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AWARENESS AND PRACTICE ON BIOMEDICAL WASTE MANAGEMENT AMONG HEALTH CARE PERSONNEL IN KENYATTA NATIONAL HOSPITAL

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M. W. NJIRU, C. MUTAI and J. GIKUNJU

ABSTRACT

Background: The proper handling and disposal of Bio-medical waste (BMW) is very imperative. There are well defined set rules for handling BMW worldwide. Unfortunately, laxity and lack of adequate training and awareness in execution of these rules leads to staid health and environment apprehension.

Objective: To assess the awareness and practice regarding biomedical waste management among health care personnel in Kenyatta National Hospital (KNH)

Design: A cross sectional study design.

Setting: Kenyatta National Hospital

Subjects: Doctors, Nurses and support staff who have worked in the institution for more than six months and consented were evaluated.

Results: The total level of awareness on biomedical waste management among health care personnel was found to be 60%. The doctors scored 51% which was the lowest score the nurses scored 65% which was the highest score while the support staff scored 55%. As for the practices, the results showed that most of the healthcare personnel were aware of the biomedical waste management practices in the hospital with the lowest scores emerging from doctors and this shows no association between knowledge on biomedical waste management and education. When asked how they would describe the control of waste management in the institution 59% said good and 40% said fair while 1% said poor.

Conclusion: The present study therefore outlines the gap between biomedical waste management rules and inadequate state of execution and awareness in practice. It is recommended that enhancement be done to the already existing Hospital Infection Control Committee to supervise all the aspects of biomedical waste management. Periodical training programmes for biomedical waste handling and disposal to the staff with focus on doctors is highlighted.

INTRODUCTION

Health care facilities are an integral part of our society with an endeavor to reduce health problems and to eliminate imminent jeopardy to people's health. It is therefore the duty of hospitals and healthcare centers to take care of public health. This may directly be through patient care or indirectly by ensuring a clean, healthy environment for their employees and the community Patil *et al* (1).

In the process of healthcare delivery, waste is generated which includes sharps, human tissues or body parts and other infectious materials Baveja

et al (2). All these require specific treatment and management prior to its final disposal. Of the total amount of waste generated by healthcare activities, about 80% is general waste. The remaining 20% is considered hazardous material that may be infectious, toxic or radioactive WHO (3) However, such residues are disposed indiscriminately and can potentially transmit diseases such as hepatitis B to the staff of the healthcare facilities handling the wastes - and the community Health care workers have an important opportunity to manage the environmental effects of their practice. Their effort may seem small, but each step builds a base of sound behavior and thinking that

is necessary for the success of the whole Mc Veigh P (4).

Throughout the world, the health sector is one area that has witnessed significant improvement. However, it seems that the fraction of waste generated at healthcare institutions has not attracted the same level of attention as other types of wastes, particularly in developing countries, despite the fact that medical waste is labeled as hazardous waste because it poses serious and direct threat to human health in the process of healthcare delivery. Coad, (5) WHO (6) Oweis *et al* (7).

Johannessen *et al* (8) stated that proper management of medical waste can minimise the risk both within and outside healthcare facilities. The first priority is to segregate wastes, preferable at the point of generation into reusable and non-reusable, hazardous and non-hazardous components. They identified other important steps as, the institution of a sharps management system, waste reduction, avoidance of hazardous substances wherever possible, ensuring worker safety, providing secure methods of waste collection and transportation, and installing safe treatment and disposal mechanisms. According to Johannessen *et al* (8), there are generally four key steps to medical waste management: (1) segregation into various components, including reusable and safe storage in appropriate containers; (2) transportation to waste treatment and disposal sites, (3) treatment and (4) final disposal.

Acharya *et al* (9) also identified the medical waste management process to include, handling, segregation, mutilation, disinfection, storage, transportation and final disposal. He suggests that these are vital steps for safe and scientific management of medical waste in any establishment. According to Rao *et al* (10), the key to minimisation and effective management of medical waste is segregation (separation) and identification of the waste. They recommend that the most appropriate way of identifying the categories of medical waste is by sorting the waste into colour coded plastic bags or containers. Medical waste should be segregated into containers/ bags at the point of generation. The WHO suggests that hospitals should provide plastic bags and strong plastic containers for infectious waste such as empty containers of antiseptics used in the hospital. Pruss *et al* (11).

General waste such as garbage and garden refuse should join the stream of domestic refuse. Sharps should be collected in puncture proof containers. Bags and containers for infectious waste should be marked with Biohazard symbol. Highly infectious waste should be sterilised by autoclaving. Cytotoxic wastes are to be collected in leak proof containers clearly labeled as cytotoxic waste Acharya (9). Needles and syringes should be destroyed with the help of needle destroyer and syringe cutters provided at the

point of generation. Infusion sets, bottles and gloves should be cut with curved scissors. Disinfection of sharps, soiled linen, plastic and rubber goods is to be achieved at point of generation by usage of sodium hypochlorite with minimum contact of an hour. Fresh solution should be made in each shift. On site collection requires staff to close the waste bags when they are three quarters full either by tying the neck or by sealing the bag. The storage area needs to be impermeable and hard standing with good drainage. It should provide an easy access to waste collection vehicle. Srivastava (12) According to scientific standards, the infectious wastes in the tropical area can be kept in a temporary storage area for 24 hour during the hot season and up to 48 hour in cooler seasons Pruss *et al* (11). Medical waste should be transported within the hospital by means of wheeled trolleys, containers or carts that are not used for any other purpose. The trolleys have to be cleaned daily and designated to particular wards at the hospital. Off site transportation vehicle should be marked with the name and address of carrier. Biohazard symbol should be painted and suitable system for securing the load during transport should be ensured. Such a vehicle should be easily cleanable with rounded corners. Johannessen *et al* (8) recommend that transportation of medical waste on public roads must be carried out by trained staff in a dedicated vehicle with closed containers. All disposable plastic should be subjected to shredding before disposing off to vendor. Final treatment of medical waste can be done by technologies like incineration, autoclave, hydroclave or microwave (Rao *et al* (10).

All persons exposed to hazardous medical waste are potentially at risk, including those within the healthcare institutions that generate the hazardous waste, and those outside these sources who either handle such waste or are exposed to it as a consequence of careless management. The main groups mostly at risk of hazardous medical waste include: medical doctors, nurses, healthcare auxiliaries, and hospital maintenance personnel, patients in healthcare establishments or receiving home care, visitors to healthcare establishments, workers in support services allied to healthcare. Establishments, such as laundries, waste handling, and transportation workers in waste disposal facilities (such as landfills or incinerators), including scavengers

WHO has estimated the amount of infectious waste and sharp objects in developing countries to be about 15% and 1%, respectively. Pruss *et al*, (1). For serious virus infections such as HIV/ AIDS and hepatitis B and C, healthcare workers – particularly nurses - are at greatest risk of infection through injuries from contaminated sharps (largely hypodermic needles). Other hospital workers and waste-management operators outside healthcare establishments are also at significant risk, as are

individuals who scavenge on waste disposal sites (although these risks are not well documented). The risk of this type of infection among patients and the public is much lower. Certain infections, however, spread through other media or caused by more resilient agents, may pose a significant risk to the general public and to hospital patients. For instance, uncontrolled discharges of sewage from field hospitals treating cholera patients have been strongly implicated in cholera epidemics in some Latin American countries.

Lack of awareness about the health hazards related to health-care waste, inadequate training in proper waste management, absence of waste management and disposal systems, insufficient financial and human resources and the low priority given to the topic are the most common problems connected with health-care waste. Many countries either do not have appropriate regulations, or do not enforce them. In Kenya there exists a five year strategic plan (2008-2012) that was developed to provide viable technical options as well as a roadmap for the management of health-care waste. The National Environmental Management Authority (NEMA) Regulations made under the the Environmental and Coordination Act EMCA (13) imposes duty of care on the occupier of premises where health care waste are handled to take measures to ensure that such waste is handled without adverse effects on human health and to the environment and natural resources. A waste generator is expected to minimize the waste generated by adopting cleaner production methods that focuses on; reclamation and recycling and elimination of use of toxic raw materials, and reducing toxic emissions and wastes among others. These provisions also impose segregation as a means of waste minimization in order to make the choice of waste treatment easy. The EMCA, 1999 also provides that NEMA may appoint inspectors who may enter any premises to determine compliance with environmental management requirements and demand for an Environmental Audit (EA) of a premises, plant or project. Though these plans exist to mitigate the impact of hazardous and infectious hospital waste on the community, there are still provisions to be fully implemented.

Biomedical waste management has been entrusted with waste segregation at the source of generation into labeled colour coded container bags that have been assigned for the different categories of wastes. Across all specialties, doctors, nurses and support staff need to have exemplary professional practice in this regard. As an occupier of a workplace and Employer, you have an obligation under the Occupational Safety and Health Act OSHA 2007(14), laws of Kenya, to carry out appropriate risk assessments in relation to the safety and health of persons employed and, on the basis of these results, adopt preventive and protective measures to ensure that under all conditions of their intended use, all chemicals, machinery, equipment, tools and process under the control of the occupier are safe and without risk to health to employees. And at the same time, you have an obligation to carry out a thorough safety and health audit annually to ensure compliance with OSHA, 2007.

Hence, the present study was carried out with the objective to assess the professional awareness and practice on biomedical waste management among healthcare personnel in KNH.

MATERIALS AND METHODS

A total of 244 healthcare personnel were sampled for the study. Seventeen of them being doctors, 129 nurses and 98 being support staff. The staffs were from three departments, 40 were from the casualty, 36 from orthopedic department and 70 from the general surgery department. A predesigned questionnaire containing a set of 49 questions was administered from the 12th to 19th February 2013 to evaluate the knowhow, outlook and practices of employees towards biomedical waste management. Assessment was done based on their awareness and practice on various aspects of biomedical waste management such as collection, segregation, treatment transport and disposal. It also covered on training on biomedical waste management. A total of 6 research assistants were involved in collecting of the data and this was after intense questionnaire briefing instructions to ensure that they understood the questions correctly.

RESULTS

Table 1
Generation of waste by department

Variables	Total	Infectious	Anatomical	Sharp	Chemical	Pharmaceutical	Radioactive and genotoxic	Papers/ Food stuff
Total	244	98%	86%	91%	76%	70%	59%	84%
Accident & Emergency	40	100%	75%	90%	75%	70%	63%	78%
Orthopedic	36	100%	86%	94%	72%	75%	47%	86%
Gen. Surgery	70	97%	89%	93%	76%	69%	59%	87%

The Table 1 above shows that the highest amount of wastes produced in the above mentioned departments is the infectious wastes. Important to note also is that all the amount of wastes produced exceed 70% apart from the radioactive and genotoxic wastes. There is need therefore to ensure that the right measures are taken to ensure these high amounts of biomedical wastes are well handled.

Table 2
Use of right colour code for disposal

	Infectious		Anatomical		Chemical		Pharmaceutical		Radioactive		Paper		Mean score						
	Tota	Yellow	Tota	Red	Tota	Yellow	Tota	Yellow	Tota	Yellow	Tota	Black							
Total	239	54	23%	210	121	58%	185	104	56%	170	53	31%	145	40	28%	204	133	65%	43%
Doctor	17	3	18%	14	9	64%	15	9	60%	12	7	58%	7	3	43%	13	7	54%	49%
Nurse	127	27	21%	109	59	54%	94	56	60%	91	19	21%	76	16	21%	110	73	66%	41%
Sanitary Staff	95	24	25%	87	53	61%	76	39	51%	67	27	40%	62	21	34%	81	53	65%	46%

Table 3
Overall level of awareness on biomedical waste management

	Right color code	Policy awareness	Dispose when 3/4 full	don't recap needles	Mean Score
Total		43%	84%	49%	63%
Doctor		49%	71%	35%	51%
Nurse		41%	88%	58%	65%
Sanitary Staff		46%	80%	39%	55%
1-2 years		43%	88%	47%	56%
3-4 years	44%	82%	41%	63%	58%
>5 years	43%	84%	53%	68%	62%
Trained	40%	84%	55%	63%	61%
Not trained	52%	83%	27%	63%	56%

Table 4
Waste segregation practice

	Color coding rate		Why not use color code always					
	Total	All the time	Sometime	Rarely	No material	Inadequacy	Not Accessible	Any other
Total	244	61%	38%	1%	12%	82%	11%	1%
Doctor	17	76%	24%	0%	25%	75%	50%	0%
Nurse	129	57%	42%	1%	11%	87%	5%	0%
Sanitary Staff	98	63%	36%	1%	11%	75%	14%	3%

DISCUSSION

From the study, it is evident that most of the generated waste recorded figures that are above average. The top four wastes that were mentioned highly as being generated in the hospital were: Infectious wastes (Blood and body fluids) 98% with accident and emergency and orthopedic departments recording 100% each, Sharp wastes 91% with all the departments recording over 90%, Anatomical wastes (human tissues, body parts, fetus etc) 86% with general surgery, orthopedic and accident and emergency departments recording 89%, 86% and 75% respectively, Papers / Food Stuff 84% with general surgery, orthopedic and accident and emergency departments recording 87%, 86% and 78% respectively. Important to note also is that all the amount of wastes produced exceed 70% apart from the radioactive and genotoxic wastes. The low levels of radioactive and genotoxic waste can be attributed to the fact that such kind of wastes are more specific to some departments such as X-ray department hence their low levels in this particular study that focused on general surgery, orthopedic and casualty departments. There is need therefore to ensure that the right measures are taken to ensure these high amounts of biomedical wastes are well handled especially by the healthcare personnel. The highest amount of wastes produced as from the results was the infectious wastes yet it was the type of waste that most staff recorded the lowest awareness score on in terms of its segregation with 23% as compared to the scores for the segregation of the other types of wastes. The highest score in terms of proper segregation of biomedical wastes was the paper (65%) followed by the anatomical (58%) chemical (56%) pharmaceutical (31%) and radioactive wastes (28%). A lot of emphasis therefore needs to be done on segregation with emphasis on the infectious wastes.

The study showed that the level of awareness on biomedical waste management for the doctors was 51%, the support staff followed with 55% and the nurses had the highest score of 65%. The healthcare personnel, both the professionals (doctors and nurses) and the support staff were aware of the different

categories of wastes but they were not able to tell about the methods / guidelines of segregation and collection of wastes into colour coded bins and especially the segregation of infectious wastes. Segregation was noted to have the lowest level of awareness with 43%, awareness on policies on biomedical waste management scored the highest with 84%, the score on correct sharps segregation was 49% while the score on awareness on recapping used needles was 63% bringing the total awareness on biomedical waste to 60% which we would say is above average although a lot more can be done improve the situation. It was also noted that training in this case was a factor that seemed to influence the awareness on biomedical waste management. For example in the policy awareness 84% of them had received training on biomedical waste management and so translated to 84% being aware of the policies. Another example is the category of disposal of sharps when ¾ full, 55% had been trained on biomedical waste management and so it translated to 49% as the level of awareness on the sharps disposal. This can also be seen in the overall awareness 56% had been trained on biomedical waste management and this translated to 60% being the overall level of awareness on biomedical waste management.

In terms of the practices, most of the healthcare personnel were aware of the status of the storage facility for biomedical wastes. Ninety three percent knew it is large enough to handle waste, 82% knew it was fenced, 89% knew it was big enough, 85% were aware that it was well ventilated and 84% were aware that it is only accessible to the authorised personnel only.

Results also showed that there is a temporary waste storage facility for waste handling. Ninety one percent were aware of it and that further action was taken after one day 76% were aware that further action was taken in a day's time to handle the already stored waste. Forty one percent knew that the waste is weighed and a record of the same kept. There is indeed a hand washing facility in the institution in every department as found out and 99% were aware

of it. The colour coding scheme was used 61% of the time while it was used 38% sometimes. The nurses were the majority of those who used the colour code system sometimes and this could be because most of them are found in the wards where there are a lot of patients and so sometimes due to their busy schedule might not take notice of when wrongly segregating the wastes. mix the waste. Inadequacy of colour coded containers came out as the top reason as to why the colour coding scheme was used sometimes and not all the time hence forced to use one or two containers for all the waste which is dangerous to the support staff who has to separate them in such a case. Plastic containers are the ones mainly used as disposal containers in the hospital. The wastes is emptied while $\frac{3}{4}$ full according to 51% of the staff which is slightly above average and so there is still more that needs to be done to the remaining 49% since the wastes are to be handled while they are $\frac{3}{4}$ full and not completely full to give space to be able to carry them comfortably for disposal. From the findings, there was an average of 11 containers at least in each department. Incineration was the method of treatment that came out as the most common by most of the healthcare personnel. Eighty eight percent of the healthcare personnel were aware that there is a routine schedule for biomedical waste collection and it is done so daily. The means of transport mentioned was the wheeled trolley and the transportation is also done daily. It was also noted that there is a specific area for biomedical waste disposal. Incineration in the hospital is done everyday according to 81% of the healthcare personnel while 15% of them did not know. The hospital has one major incinerator which is in good condition all the time at least according to 64% of the staff while 22% did not know majority being the doctors at 71%. The incinerator can hold up to greater than 500kgs /hr. Fifty two percent of the staff did not know of the capacity of the incinerator.

The top three limitations faced by healthcare personnel during their interaction with biomedical waste handling are: inadequate facilities followed by risk of infections and thirdly risk of injuries. This simply means that the equipments for handling biomedical wastes are not enough such as the waste segregation papers that result into mixing the wastes and this is what makes the limitations that follow to be the risk of injuries and risk of infections. This is because they know the dangers that come with biomedical waste handling and hence ought to be very careful. It was also noted that 61% of the healthcare personnel said that having a continuous supply of equipments would act as the top most motivating factor for better biomedical waste management, this was followed by getting more human resources at 60%, this means that they feel if the hospital employs more people to help in biomedical waste management then it would be a motivating factor in good biomedical waste

management.

Having more trainings on biomedical waste management came in as the third motivating factor at 57% while the last point was getting more funds for biomedical waste management. Seventy five percent of the healthcare personnel have been trained on biomedical waste management and that is above average which is good but most of them have only been trained 2 times and most of them being 18 months ago, which translates to more than a year ago. Seventy seven percent of the nurses have been trained on biomedical waste management and 82% of the support staff has been trained on the same. This kind of training should be continuous so as to ensure a deeper understanding into the subject matter. Important to note also is that the doctors have the least figure of 29% for those who have been trained on this area which is really something worth noting. According to WHO (15) to be effective, a Health Care Waste Management (HCWM) policy has to be applied carefully, consistently and universally. Training is a crucial aspect to successfully upgrade HCWM practices. The overall aim of training is to develop awareness of the health, safety, and environmental issues relating to HCWM. It should highlight the roles and responsibilities of each actor involved in the management process of the HCW (duty of care). Employees should be trained Separately but equally important training programs should be designed for the following categories of personnel:

1. hospital managers and administrative staff responsible for implementing regulations on HCWM,
2. medical doctors; nurses and assistant nurses,
3. cleaners, porters, ancillary staff, and waste handlers,
4. municipal solid waste laborers' and waste pickers.

The content should cover: Information on, and justification for, all aspects of the HCWM policy; Information on the role and responsibilities of each hospital staff member in implementing the policy; Technical instructions, relevant for the target group, on the application of waste management practices; Information on monitoring techniques. There are several observed problems in this process like lack of awareness especially on segregation practices & training, lack of supply of colour code papers resulting in indiscriminate use of only one or two coloured bins for all purposes and lack of proper supervision. Above all the attitude of the professionals especially the doctors for whom it is "not part of their job" is an important finding. This is because most doctors were not aware of how or where the waste from the hospital is ultimately treated and disposed and also some of the biomedical waste practices in the hospital which suggests no association between education and waste management, which is in contrast to the finding reported by Mohammad *et al* (16) This could

be because they feel they do not really need training on this since it should be done by other health workers and not them. This is an attitude that needs to be dealt with since it is the responsibility of all the healthcare workers, whether doctors, nurses' or support staff to ensure biomedical wastes is handled as it should.

CONCLUSION

The present study therefore outlines the gap between biomedical waste management rules and inadequate state of execution and awareness in practice. To improve the existing conditions it is recommended to enhance the already existing Hospital Infection Control Committee to supervise all the aspects of biomedical waste management. Periodical and timely trainings programmes credited to good management of biomedical waste by healthcare workers which should include training explicitly for biomedical waste handling and disposal to the staff with focus on doctors, interns & postgraduates for segregation and collection and support staff for collection and disposal is highlighted.

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