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Research article

Health Care Waste Management in Uganda -A Case Study of Soroti Regional Referral Hospital

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Abstract

It has been recognized world over that Health Care Waste (HCW) if not properly managed is a potential of disease transmission and puts health care workers, patients and the general public at a risk. This study investigated the problems of waste management in Soroti Regional Referral Hospital (SRRH) and proposed solutions to mitigate them. This was done through observation, interviews, studying the available policies, guidelines and legislature. Data on waste generation rate and patient attendance was also collected and analysed. The study identified the causes of poor waste management as poor segregation of waste, lack of waste management plan, inadequate waste management and coordination structure, ineffective and inefficient incineration equipment and lack of comprehensive waste management policies and guidelines. The current average waste generation rate at SRRH was determined to be 107.79Kg/day. There is need to have a good and comprehensive waste management policy, guidelines and plan which will provide a proper waste management structure to alleviate the problem. Some of the proposed recommendations may be implemented at the facility level as short term while others at the national level may require significant funding and time. It is hoped that there will be improved efficiency in health care waste management, improved working and living environment at the hospital, reduced risk of infection and will create a good image of the hospital.

Keywords: Health care waste, management, segregation, hospital.

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Introduction

Improper HCW waste management can jeopardize care staff, employees who handle Healthcare waste, patients and their families and the neighbouring population. In addition, the inappropriate treatment or disposal of such waste can lead to environmental contamination or pollution. Improper disposal of medical waste may lead to damage to humans by sharp instruments, diseases transmitted to humans by infectious agents and contamination of the environment by toxic and hazardous chemicals [1], [2] and [3]. Due to its content of hazardous substances, healthcare waste poses serious threats to environmental health [4] and [5]. The hazardous substances include pathological and infectious material, sharps and chemical wastes **[**6], [7] and [8]. Health care waste, medical waste, biomedical waste and hospital waste are terms which are used interchangeably. The terms cover all wastes produced in health care or diagnostic activities [9]. It is also defined as all the waste generated by health care establishments, research facilities and laboratories [10]. Improper medical waste management is alarming in Uganda and it poses a serious threat to public health.

In developing countries, medical waste has not received much attention and it is disposed of together with domestic waste [11] and [12]. Medical waste can be infectious or non-infectious. It acts as an agent in the transmission of infections. This is because it contains micro-organisms which can be communicated by invasion followed by multiplication in body tissues. These so transmitted pathogens can cause disease or diverse health impacts to humans [13].

Improper healthcare waste management puts the patients, healthcare workers, waste handlers and community at risk both in terms of risks from inadequate storage, transportation and disposal of infectious waste and from the environmental risks arising from burning hazardous wastes in open pits or badly maintained incineration equipment. In Uganda, a study conducted in July 2003 it was established that more than 45% of the health care providers interviewed reported at least one needle stick injury in 12 months. The study further established that 38% of the health facilities visited had sharps and other wastes on ground or in other un-supervised areas, exposing the community to needle stick injuries [14]. Although the study falls short of giving the number and type of infections that could have been acquired from these injuries and exposures, the possibilities of infections arising from such injuries and exposure cannot be ignored.

The current status of Hepatitis B infections in Teso region which is served by Soroti Regional Referral Hospital confirms why health care waste management should be given more attention. According to the Ministry of Health weekly summary of epidemiological reports published weekly in the New Vision newspaper, out of 4 cases reported for the whole country for the week ending 10th February 2013, 3 cases were within Teso region (1 in Kaberamaido district and 2 in Katakwi district). Also out of 4 cases reported for the whole country for the week ending 17th February 2013, all the 4 cases were from Katakwi district in Teso region.

Globally, it is estimated that accidents caused by sharps accounts for 66,000 cases of infection with the hepatitis B virus, 16,000 cases of infection with hepatitis C virus and 200 to 5,000 cases of HIV infection amongst the personnel of health-care facilities [9]. In France in 1992, eight cases of HIV infection were recognized as occupational infections; two of these cases, involving transmission through wounds occurred in waste handlers [10]. Due to infections which can arise from improper HCW management, it was pertinent to undertake this study.

One of the problems Uganda faces today is the improper handling and disposal of solid wastes. During the evaluation of injection safety and health care waste management (HCWM) in Uganda, it was found that 92 percent of waste handlers have poor waste disposal methods, 3.4 percent have acceptable waste disposal methods and 4.6 percent have good waste disposal methods [15]. Hospital waste management is one of the biggest challenges SRRH is facing in addressing the growing quantity of waste generated.

In Uganda, waste generation in hospitals averages 92 Kg of general and HCW per day, 40 percent of which is hazardous. According to [16], a level IV health center (HC) generates average of 42 Kg per day while level III and level II HC generate 25 Kg and 20 Kg per day respectively. This report agrees with a study conducted in 23 heath facilities in October 2007 by Ministry of Heath – Kenya. It was found that 39% of wastes generated were infectious and 61% non-infectious waste. The study further found that sharps waste averaged 0.031Kg/day, infectious waste 0.175Kg/day, non-infectious waste 0.135Kg/day and food waste 0.184Kg/day giving a total of 0.525Kg/day.

Another research conducted on management and generation of HCW in two hospitals in Kampala found that infectious waste from Nsambya hospital was 0.23Kg per patient per day and 0.25Kg per patient per day in Mulago hospital [17]. Thus,

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there is a need to initiate a concentrated effort to improve the medical waste management practices to reduce the negative impact of waste on environment, public health and safety of health workers at health care facilities. Therefore, proper management of medical waste is a subject of major concerns for a healthy environment in Ugandan Health Care facilities.

The objective of this research was to study the medical waste management practices in Soroti Regional Referral Hospital and to propose solutions for its improvement. The current Health care waste management practices in the hospital were investigated, waste characterization and quantification was determined, the causes of poor waste management and the possible solutions to achieve proper waste management in Soroti Regional Referral Hospital are proposed.

Materials and Methods

The research design employed the use of interviews, observation and participatory methods. The data or information which was collected from the study included: Waste management practices from waste generation, collection, storage, transportation and treatment to disposal; waste composition; attendance trend of patients in the hospital and the available policies, regulations and guidelines on healthcare waste management.

A number of interviews were conducted with some of the relevant persons in the hospital to gain a deeper understanding of the current practices in healthcare waste management. Some of the staff interviewed included: administrators, nurses, waste handlers/cleaners and nursing assistants. Further, the information/data obtained in observation and interview was used to determine whether the available policies, regulations, guidelines and manuals are being followed. The available manuals were also reviewed for their adequacy by comparing with other internationally prescribed procedures for proper health care waste management.

Waste generation rates were obtained by physical measurements of wastes from the different receptacles and noting frequencies of emptying these containers. Different categories of wastes were collected daily from the refuse receptacles and weighed using a weighing scale. The information obtained was analysed using simple descriptive and narrative analysis and a statistical method using E-View Software was used to predict the number of patients per year for the next 10 years.

Results and Discussion

Waste generation

Wastes were weighed as they were delivered at the incinerator and temporal storage site. It was established that 42.5% of the waste was highly infectious (RED). 27.8% was infectious (YELLOW) and 18.2% was non-infectious (BLACK) waste while the sharps were 11.5%. Figures 1 to 3 indicate the result of waste data collected for a period of seven consecutive days. This result disagrees with the average world estimates of infectious waste put between 10% - 25% but agrees with a study in Uganda by [16] which found that 40% of health care waste is hazardous. Ministry of health – Kenya found that the proportion of infectious waste was 39%. This high figure could be attributed to poor segregation practices where a lot of non- infectious waste is mixed with infectious waste. For example, a number of red containers were observed to contain medicine containers and packaging and food waste. ICRC recommends that such waste once put in a container with infectious waste should also be considered infectious and such a mistake does not need to be corrected.

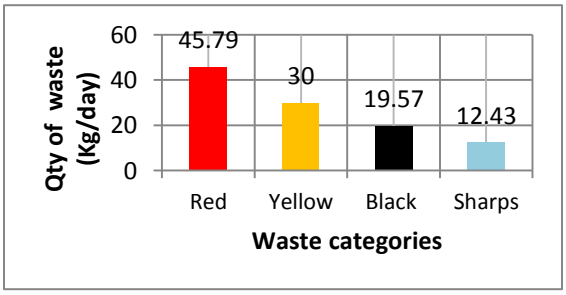

Figure 2: Daily waste generation in SRRH

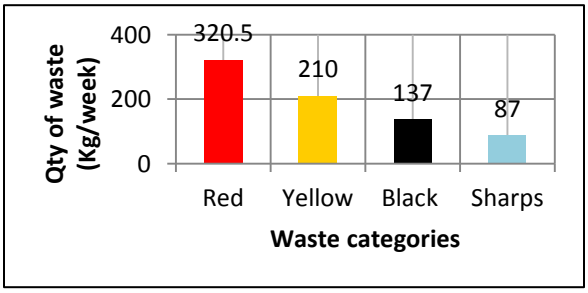

Figure 3: Weekly waste generation in SRRH

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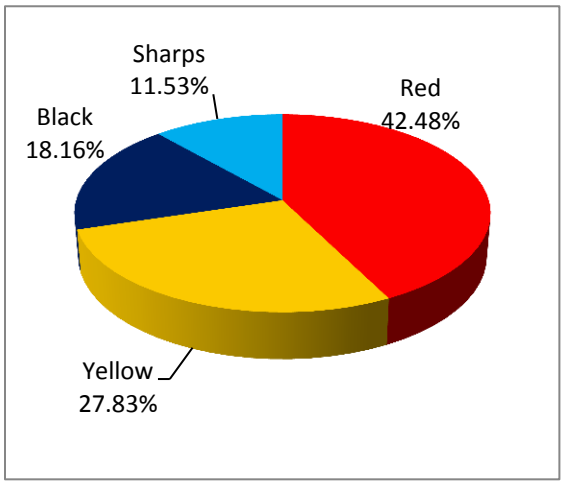

Figure 1: Percentage of waste generated in SRRH by category

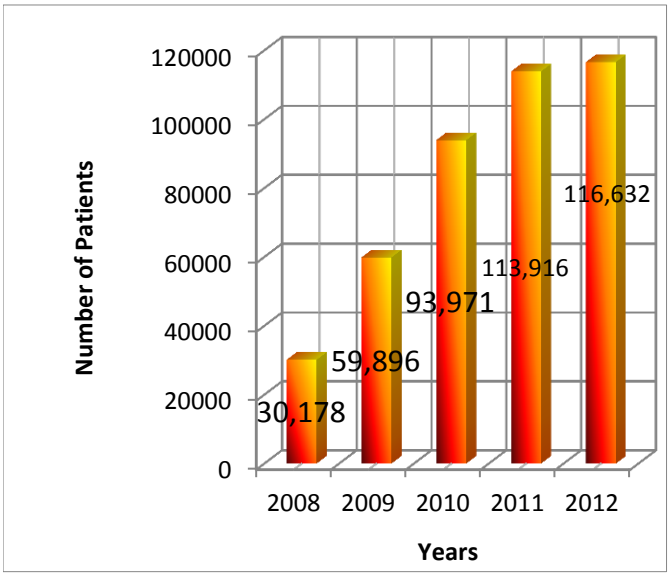

Figure 4: SRRH OPD Patients Attendance (2008 – 2012)
Source: SRRH Records Department

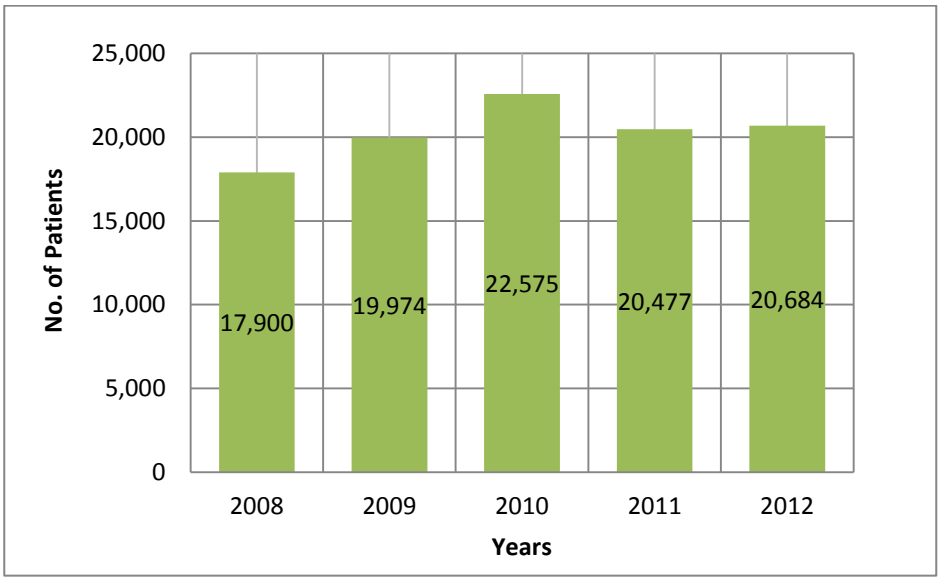

Figure 5: SRRH admissions from 2008 – 2012 (SRRH Records Department)

Out and In Patient attendance trend

Patient attendance trends were obtained from the hospital records for the last 60 months (5years) and are presented in Figures 4 and 5while the projected yearly attendance for the next 10years is given in Figure 6.

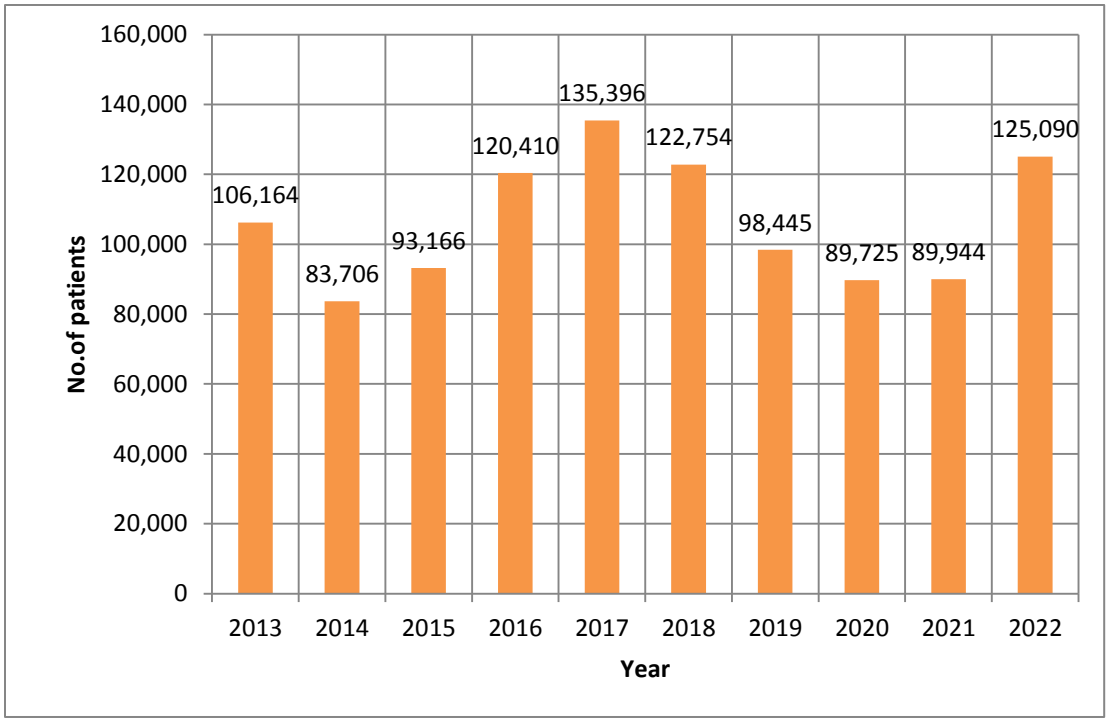

Figure 6: Projected attendance of In and Out-patients of SRRH (2013-2022)

Waste generation

It was observed that the major medical waste generating activities were from treatment and diagnostic activities in Out Patient Department (OPD) and all wards. It was also observed that some of the waste was brought from other units outside the hospital like "The AIDS Support Organization" (TASO) Soroti branch and other private clinics. The contribution of waste from these other units was 9.28% of the total waste generated per day.

Sorting/segregation or separation of waste

Waste segregation and identification is a key element in waste minimization. It allows for appropriate handling, treatment and disposal of waste by type and also reduces costs and enhances protection of public health [10]. The best way of identifying waste is by use of appropriate color coded plastic bags or containers. Different countries use their given color codes for different types of wastes although there is some similarity in most of them. In Uganda, the color codes specified in Infection Control Policies and Procedures by the department of quality assurance – Ministry of Health are: RED for infectious waste, YELLOW for sharps and BLUE for non-infectious waste. However, for Soroti Regional Referral Hospital, the color codes used were RED for highly infectious waste, YELLOW for infectious waste, BROWN for pharmaceutical waste, BLACK for other non-infectious waste and safety boxes for sharps.

Wastes were segregated and categorized as highly infectious, infectious and non-medical waste and collected in RED, YELLOW and BLACK receptacles respectively. It was also observed that brown containers were being used in some wards to supplement black containers. Further, observations of waste in the containers showed that some non-infectious waste or non-medical waste were being mixed up with the infectious waste in the red container and some of the black containers were observed to contain waste which are considered infectious. Also some of the red containers had black linings other than red linings. Such mistakes can make the waste handlers fail to take extra care when handling highly infectious wastes.

Waste storage

The first point of waste storage was observed to be within the point of generation. The waste was placed in plastic containers with polyethylene linings which were kept within a suitable location within the premises. These containers also act as a temporary storage at the point of generation of waste and should therefore be as close to the point of generation of waste as possible [10]. In some wards, the storage area was found to be exclusive enough not to pose any risk, while in some wards, the verandas were used as a storage area without any marking, warning or exclusion to the public as recommended by WHO and ICRC. The healthcare wastes were not stored for more than 24 hours, a period after which wheelbarrows were used to transport them to the incinerator site. This period of storage is within the recommendation of WHO which stipulates a storage period of 78 hours in winter, 48 hours in summer and temperate climate and 24 hours in hot or warm climate.

Collection

A daily collection programme of waste from the generation point was put in place. In order to ensure that waste was collected regularly and never allowed to accumulate at point of generation, wastes were collected twice daily i.e.in the morning at 8.00am and at 5.00pm. Before waste bags were collected, they were tightly closed or sealed and at least three quarters full as recommended by WHO.

Waste transportation

The transportation equipment should be easy to load and unload, should not have any sharp corners or edges that can tear the bags or damage the containers, easy to clean and must be clearly marked [9]. From waste generation points within the hospital waste transportation was done by wheeled trolleys or carts. Waste from TASO and clinics were brought in open wheelbarrows but it was also observed that sometimes waste from the clinics to town was brought wrapped in hand held polythene bags as shown in Figure 9. This practice contravenes WHO which recommends that for transportation of waste over a longer distance wastes should be carried in closed rigid well labelled containers.

Onsite Storage and transportation

Before waste can be transported for offsite treatment and disposal or while waiting for onsite treatment and final disposal, proper storage of health care waste must be arranged. The first point of waste storage was observed to be within the point of generation. The waste was placed in rigid plastic containers with polyethylene linings which were kept within a suitable location within the hospital. In some wards, the storage area was found to be exclusive enough not to pose any risk, while in some wards, the verandas were used as a storage area without any marking, warning or exclusion to the public contrary to recommendations by WHO and ICRC.

Off site transportation of waste

If offsite treatment and disposal is the method of choice, packaging and labelling of waste is the responsibility of the waste producing entity [9]. The national regulations should be followed when packaging and labelling the containers including the transportation requirements. Where there are no national regulations, reference should be made to the United Nations regulations [10]. In Uganda however, according to the survey on evaluation of injection safety and health care waste management in Uganda report of 2009, it was found that offsite transportation of waste was not being practiced in any health facility surveyed. Figure 7 shows how wastes are irresponsibly littered around incineration point.

Figure 7: Improper disposal of blood tubes and sharps

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Figure 9: Some of the transportation methods of waste

Treatment and disposal of HCW

Management of health care waste cannot be considered successful if there is no appropriate safe treatment and final disposal technique in place. A number of methods for health care waste treatment and disposal exist. However, whatever method is chosen, it should be done with a view of minimizing negative impacts on health and the environment. It should also be noted that there is no universal solution to waste treatment but the option chosen can only be a compromise that depends on the local circumstances [9].

The National Health Care Waste Management Plan, 2008-2012, of the republic of Kenya, recommends that, the choice of the sustainable management and disposal options for waste should be done according to: affordability, environmental friendliness, efficiency of operation cost, worker safety and prevention of the reuse of disposable medical equipment (e.g. syringes), social acceptability, monitoring, evaluation, safety and efficiency.

People were seen crossing through the heaps of waste (Figure 8). Scavengers were equally seen spreading and feeding at the waste site. The incineration site was approximately 20m from the maternity ward and the cooking area. The observation was that the incinerator site was not enclosed and all types of waste seen littered around. Sharps which posed a high risk of injuries to the incinerator operator, workers delivering waste and other people who cross over through the incinerator area were seen littered around the incinerator site.

Figure 8: People and scavengers walking through waste heaps

The incinerator

Tor being used is the De Montfort type (Figure 10). This type of incinerator uses a single chamber to burn waste. The overall external measurements on the incinerator were taken and found to be 1.8m x 1.1m x 1.4m (Length x width x height). This design was not based on any data on waste generation in the hospital. The design based on the data collected gives the internal dimensions of the primary chamber as 2.2m x 1.10m x 1.33m (Length x width x height). Comparing the two, it can be deduced that, the whole of the external dimensions of the current incinerator are even smaller than the internal dimensions of the primary chamber (without other compartments) of the proposed incinerator based on the current waste generation rate. The current incinerator is small and inefficient considering the present waste generation rate at the hospital.

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Figure 10: The current incinerator

Waste management plan

It was established that there was no waste management plan for the hospital in place to guide the management of waste as evidenced by lack of data on waste being generated at the hospital. A waste management plan is recommended by both WHO and ICRC at both the national and facility level to guide the management of waste. Further on policies or guidelines on medical waste management, 6 out of the 8 staffs interviewed had no knowledge of such documents other than posters regarding infection control procedures. The two staffs who reported the presence of some documents were at top management level. When the interviewer asked to see the documents, they were not readily available but were later provided. It was found that the hospital has documents titled "Infection Control Policies and Procedures", "Uganda National Guidelines on Tuberculosis Infection Control in Health Care Facilities", Congregate Settings and Households" and "Auditing of Infection Prevention Practices in Hospitals, Health Center IV's and III's".

Cross examination of these documents revealed that, one document on TB control had nothing to do with waste management. The other documents provided more of infection control but lacked comprehensive guidance in waste management. One of the documents indicated the following colour codes to be used for waste;

- Yellow bin for sharps
- Red bin for infectious waste
- Blue bin for non-infectious

However, this colour coding conflicts with what is in practice. Though government in the year 2004 developed the National Policy on Injection Safety and Health Care Waste Management and Standards for Injection safety and Health Care Waste Management Practices, all the staff interviewed had no knowledge of such documents even when they were shown by the interviewer. However even these very documents does not comprehensively guide on waste management. For example, the documents guide that the wastes should be sorted in colour coded containers but does not guide which colour should be used for which type of waste.

Interview Results

A total of 13 workers were interviewed, 8 (61.5%) of which are permanent hospital workers and 5 (38.5%) being contract workers. Out of the 8 permanent workers 1 was at senior administrative level, 4 were heads of units and 3 were junior staff. Out of the five contract staffs who are also waste handlers, 1 was at a supervisory level, 3 were porters and 1 incinerator operator. For the permanent hospital staff, the interviews were seeking to find out the following aspects of waste management;

- Presence of waste management team/structure with a well-defined roles;
- Knowledge of good waste management practices;
- Availability and adequacy of waste management tools and equipment and;
- Waste management trainings attended.

For waste handlers, the interviews aimed at assessing the following;

- Knowledge on the operation of the incinerator;
- The effectiveness of the incinerator;
- Knowledge of handling medical waste
- Presence of waste management plan for the hospital and;

- Safety measures in place;
- Presence of waste management policies and Regulations.

Waste management structure

The infection control committee of the hospital doubles as the waste management committee. It is headed by the director and the members are all heads of wards and units. One of the members is chosen as the secretary to the committee.
All members interviewed say they did not receive any specific appointment and written down duties or roles as members of the committee. As the members have other primary duties, they have little concentration on waste management activities outside the areas in which WHO, ICRC and the government of Kenya recommends the establishment of Waste Management Committee (WMC) with clear responsibilities and coordinated by the Waste Management Officer (WMO) for effective waste management. The waste management officer would also be responsible for the implementation of the waste management plan. It was also found that much of the waste management is done by the staff of a contracted firm from collection from the ward, transportation to the incinerator, incineration and other cleaning services. The firm is offered contract on a yearly basis and employs a foreman who supervises all the waste management work.

Good waste management practices

On knowledge of good management practices especially the segregation and colour coding, all staffs interviewed showed good knowledge of which type of waste should be put in which container. However when the containers were observed, it was found that this was not being followed strictly as some of the red containers were found to contain non- infectious waste like drug containers or boxes or even food remains.

Waste management tools and equipment

On the waste management tools and equipment; all the staff interviewed admitted that some of the materials are not adequate or does not match the requirements. For example some of the red containers had yellow linings instead of matching red liners. Also in most wards safety boxes for sharps were lacking thus the nurses had to improvise with ordinary boxes and other plastic containers. The problem with some of the containers is that they have to be changed over at the incinerator and this leads to some of the sharps pouring on the floor of the incinerator. The incinerator has in the interview revealed that he has in the period from August 2012 to February 2013 received 3 needle stitches of used needles at the incinerator site while another one worker revealed at least one needle stitch while changing needles from the container during the same period.

Staff training and Safety measures

On staff trainings in waste management, all the staff interviewed revealed that they have only received trainings related to infection control as part of the nursing course and also nurses continuous education seminars or trainings organized within the hospital which in most times last for one day or a few hours. None of the staff interviewed received a comprehensive training on health care waste management. On safety measures, all workers reported being provided with boots and gloves. A few were provided with uniforms and masks where applicable. However it was observed that the gloves used were examination gloves which cannot handle heavy duty work. The boots were also soft and could be penetrated by needles. The three injuries reported by the incinerator operator resulted from needles penetrating the boots.

Interviews with contract staff

The incinerator operator was interviewed on his knowledge of the incineration and the findings were that his education level is primary six. He is also an employee of the contractor and has never received any training on operation of incinerator apart from the induction of about 3 hours he received during the first days of his recruitment.

Effectiveness of incinerator

On the effectiveness of the incinerator it was found that the incinerator is loaded 3 times in a day and not all wastes produced can be burnt in one day therefore leading to some waste remaining and get either is bunt on the surface or gets scattered by scavengers and sometimes lunatics as the site is not fenced. An interview was also conducted with the

implementer of the incinerator project. It was found that the incinerator was not designed based on any data of waste generated by the hospital. Equally the design life is not known and no operator's manual was provided.

Knowledge of workers in waste handling

It was established that waste handlers had little knowledge in handling medical waste because their education level were found to be generally low. The education level of the foreman was senior three with a certificate in mechanics, driving license, certificate in stores management and certificate of attendance for a 3 weeks training in infection control organized by Ministry of Health – Uganda. The education level for all other workers interviewed was primary level and one who did not attend school at all. It was therefore evident that the workers could not comprehend and understand well issues of waste management as evidenced by dropping waste without properly reaching the incinerator site. When also asked if they knew what to do and the dangers of injury, only one person knew that he had to report immediately and also clean the injury with a disinfectant like 'Jik' while the rest did not know what to do.

Analysis of data for design of incinerator

From the patients' attendance trend, the annual attendance of patients was obtained by adding the out and inpatient attendance from Figures 4 and 5. The results are presented in Figure 11. For the design period of 10 years, this attendance trend therefore is projected for the next 10 years assuming there will be no change in factors that can influence the hospital attendance trend. The 10 year projection has been done by a statistical method based on the analysis of the attendance trend for the previous 60 months (five years). The projected attendance for the years up to 2022 is given in Figure 6. According to the analysis, the highest attendance of 135,396 will occur in the year 2017. It is this attendance figure that shall be used for the design of the new incinerator as recommended by this study.

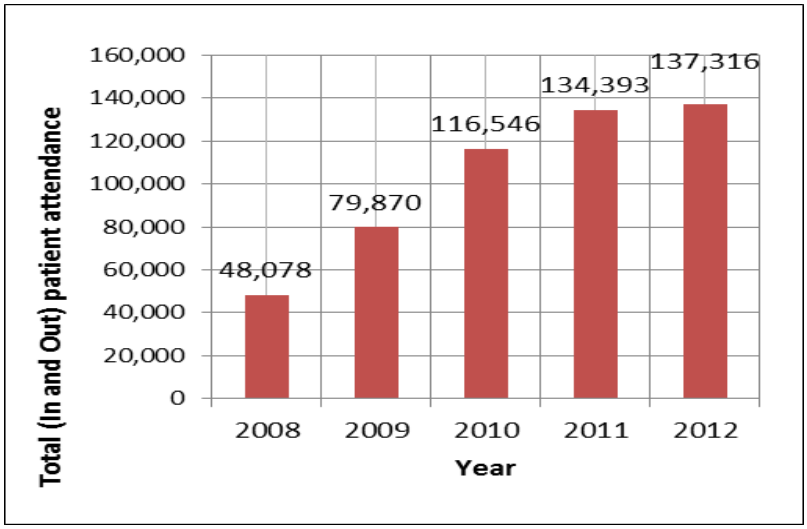

Figure 11: Annual In and Out Patient Attendance of SRRH (2008-2012)

The current average waste generation is 107.79Kg/day and the total attendance as at the end of the year 2012 is 137,316 patients per year. Therefore, average waste generation can be estimated as:
(107.79×365)/137,316 = 0.29 per patient per day. Up to the year 2023, the highest yearly projected attendance will be 135,396 patients, the expected waste generation shall be; (0.29×135,396)/365 = 107.575 Kg/day. It is also assumed that up to 20% of waste will continue coming from outside the hospital. The total waste will therefore be 107.575 x 1.2 = 129.1Kg/day.

Conclusions and Recommendations

This study investigated the current waste management practices in Soroti Regional Referral Hospital. The study proved that the problem of waste management exists and possible solutions have been suggested to alleviate the problems. The current average waste generation rate was determined to be 107.79Kg/day.

Based on the findings of this study, the following recommendations have been proposed which once implemented will improve the current situation of medical waste management in the hospital. Some of the proposals can be easily implemented at the institutional level in a short term with very limited costs involved while others at the national level and require significant funding and time.

- The management structure proposed by World Health Organization needs to be adopted and implemented.
- Strict segregation of wastes and labelling of waste bins should be encouraged.
- A well trained permanent employee incinerator operator should be deployed for effective and efficient incineration.
- Proper use of colour codes needs to be observed. The linings need to match the color of the containers to avoid confusion when waste is finally delivered at the incinerator.
- Design and construction of a new incinerator whose design should be based on the established data from the hospital should be considered urgently.
- Improvement of storage area at the incinerator site by concreting the floor for easy cleaning and partitioned for safe and proper storage of different types of waste.
- Proper waste management policies and guidelines that conform to the internationally recommended standards and practices should be developed by the central government to guide health care waste handlers.
- Appropriate short term trainings for staff to improve their skills in medical waste management practices and safety measures in waste handling.

Acknowledgement

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