

# Factors Influencing Waste Segregation Among Staff in Chuka Level Four Hospital

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**Abstract:** Proper segregation, handling and disposal of medical waste is an imperative component on preventing potential risk for injury, infection, and environmental pollution. Globally there are well defined set of rules for handling medical waste but unfortunately, laxity and lack of adequate training and awareness in the execution of these rules can lead to serious health implications. Thus, the main objective for this study was to investigate the factors affecting segregation of waste in Chuka hospital. Specifically the study aimed at identifying the health care waste generated in the hospital, determining the knowledge level of health workers on waste segregation, assessing the attitude of staff on waste segregation and establishing the structural support towards waste segregation in the hospital. The study applied the descriptive research design and the target population was 330 comprising of doctors, nurses, other health workers and support staff drawn from Chuka level four hospital. The study employed the simple random sampling technique to get the study sample size. Simple random sampling technique was used to select 66 participant respondents as the study sample size. The research instrument for data collection was a questionnaire consisting both open-ended and closed-ended questions as per study variables. Reliability of the research instruments was tested and improved by use of test-retest method. Quantitative data was coded and analyzed using the SPSS (Statistical Package for social Scientists) version 22 program. The descriptive statistics indices such as tables, frequencies distribution and percentages, pie charts and graphs were used to represent the data. The most common waste was the highly infectious waste infectious waste, sharps and the non-infectious waste which included food items, empty bottles for drinks, paper, and packaging material. Correct knowledge and safe practices of health care workers was very important when managing the health care waste. Few health care workers were trained on health care waste management and majority did not differentiate the different coded containers for disposing waste. The attitude of workers was aggravated by poor working condition, shortage of health care workers, overcrowded wards, poor communication and uncooperative behavior among some health care workers. There was a shortage of dust bins and bin liners in the hospital for waste segregation. In conclusion the hospital waste management practices should be improved at Chuka general hospital through training and provision of relevant equipment.

**Keywords:** Waste Management, Waste Segregation, Infection Prevention, Hospital Infection

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## 1. Introduction

The world health organization (WHO) classifies medical or healthcare waste into communal waste or general waste and special waste. Kenya's major health facilities are today fighting to clear heaps of solid waste from their environments [1]. These strategic centers of health security are being gradually overtaken by the messy nature of unattended heaps of solid wastes emanating from wards, clinics, theatre and other sectors of the hospital [2].

About 75-90% of waste produced in healthcare establishments is general waste. This includes papers, packaging materials, dust and the like. The remaining 10-25% of waste is hazardous and could be composed of sharps (needles, lancets etc.), syringes, blood or body fluid, contaminated surgical instruments, delivery bowls, used gauzes and gloves, plasters, etc. It may also contain expired drugs, laboratory reagents and other chemicals [3]. In hospitals, different kinds of therapeutic procedures (i.e. chemotherapy, dialysis, surgery, delivery, autopsy, biopsy, etc.) are carried out and result in the production of infectious

wastes, sharp objects, radioactive wastes and chemical materials [4].

### **1.1. Types of Wastes**

Medical waste contains highly toxic metals, toxic chemicals, pathogenic viruses and bacteria which can lead to pathological dysfunction of the human body [5, 6]. Medical waste presents a high risk to doctors, nurses, technicians, sweepers, hospital visitors and patients due to arbitrary management. These wastes consist of several different subcategories:

Infectious waste contains pathogens (bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. This category includes cultures and stock of infectious agents from laboratory work, waste from surgery and autopsies on patients with infectious diseases, waste from infected patients in isolation wards, waste that has been in contact with infected patients undergoing hemodialysis (e.g. Dialysis equipment such as tubing and filters, disposable towels, gowns and aprons, gloves and laboratory coats) and waste that has been in contact with animals inoculated with an infectious agent or suffering from an infectious disease. [7]

Pathological wastes consist of tissues, organs, body parts, human fetuses and animal carcasses, most blood and body fluids. Within this category, recognizable human or animal body parts are also called anatomical waste. Anatomical waste is also considered as an infectious waste, even though it may also include healthy body parts. [8]

Sharps are items that could cause cuts or puncture wounds, including needles, syringes, scalpels, saws, blades, broken glass and nails. Whether or not they are infected, such items are usually considered as highly hazardous healthcare waste. [8]

Pharmaceutical wastes include pharmaceutical products, drugs, and chemicals that have been returned from wards, have been spilled, are outdated or contaminated, or are to be discarded because they are no longer required. These also include discarded items used in the handling of pharmaceuticals, such as bottles or boxes with residues, gloves, masks, connecting tubing, and drug vials. [8]

Genotoxic waste is highly hazardous and may have mutagenic, teratogenic, or carcinogenic properties. It raises serious safety problems, both inside hospitals and after disposal, and should be given special attention. Genotoxic waste may include certain cytostatic drugs, vomit, urine, or feces from patients treated with cytostatic drugs, chemicals, and radioactive material. Cytotoxic (or antineoplastic) drugs, the principal substances in this category, have the ability to kill or stop the growth of certain living cells and are used in chemotherapy of cancer. [8]

These wastes consist of discarded solid, liquid, and gaseous chemicals, for example from diagnostic and experimental work and from cleaning, housekeeping, and disinfecting procedures. Chemical waste from healthcare may be hazardous or nonhazardous; in the context of protecting health, it is considered to be hazardous if it has at

least one of the following properties:

1. Toxic
2. Corrosive (e.g. acids of pH < 2 and bases of pH > 12)
3. Flammable
4. Reactive (explosive, water-reactive, shock-sensitive)
5. Genotoxic (e.g. cytostatic drugs).

Nonhazardous chemical waste consists of chemicals with none of the above properties, such as sugars, amino acids, and certain organic and inorganic salts [8] The above definitions will inform this study by providing a sound basis upon which the level of knowledge of waste segregation will be assessed.

### **1.2. Waste Segregation Knowledge and Practice**

Waste segregation is a proper manner of disposing of wastes in the hospitals according to its type; for example biological waste and is separated according to the color coded plastic bags, to protect oneself and those who are around from infections, diseases and injuries [9] Waste segregation is the essence of waste management and should be done at the source of generation of biomedical waste, for example all patient care activity areas, diagnostic services areas, dressing rooms and treatment rooms [10].

According to [11, 12] the responsibility of segregation should start with the people concerned with waste generation such as doctors, nurses and paramedical personnel. This is possible, once health care workers possessed correct knowledge and safe practices on waste segregation. Cleaners who carry the responsibility of removing generated wastes from the wards also need to know and be trained in waste segregation [13]. The process of health care waste management (HCWM) involves challenging issues like collection and segregation, timely removal and safe disposal, illegal scavenging, patient safety, occupational safety and environmental safety [14] Various steps in the process are mainly engineering functions, yet initial segregation and storage of HC-waste are the responsibilities of health care workers [15]. During the recent past, effective and efficient stepwise HCWM has emerged as a critical component in control of healthcare associated infections (HAIs). In high income countries, a combination of stringent application of legal provisions with other inputs has been effective in mitigating the menace of health-care waste [16].

Correct knowledge and safe practices of health care workers are imperative while managing the infectious waste [17]. Hence, proper waste segregation reduces the amount of waste that needs to be sent for incineration and to landfills. Therefore, it is very important for health care workers to master these domains on waste segregation so that they can be able to segregate infectious from non-infectious wastes. Namibia is among the top ten cleanest and safest countries in Africa as it has adopted innovative way of utilizing local communities and private contractors for solid waste collection and disposal from hospitals and individual businesses after waste segregation at the sites [18]. However, lack of knowledge, attitude and practice of health care workers in hospitals is a problem.

According to a study by [19] the knowledge level of medical care waste was significantly satisfactory among doctors and nurses in Niger State hospital in Nigeria, whereas there was lack of knowledge and awareness among laboratory personnel and other members of the paramedical staff, which needs effective teaching and training to prevent adverse outcome on human health. It was concluded that the effective means of waste management involves effective knowledge of the medical and paramedical staff, which needs to educate them through proper educational programme, and provision of resources involving political intervention was vital for the better outcome in future [19]. However, regarding practices related to waste management, sanitary staff was ignorant on all the counts. Finally it was concluded that the importance of training regarding waste management needs emphasis; lack of proper and complete knowledge about waste management impacts practices of appropriate waste disposal in the hospital [19].

According to a study by [20] regarding awareness, the doctors working in the hospitals in India, majority were fully aware of the importance of hospital waste generation and its management, together with their responsibilities, while the lower staff including the janitors only possessed hearsay information. They lacked proper training though they were given some basic training in of hospital. They were also unaware of the potential hazards to the environment. In most of the health care facilities, staff members were briefed about their duties and the hazards of their negligence only verbally [20]. Lack of awareness and knowledge among the staff about hospital waste management has consequences to human health and the environment. Before taking responsibility of waste management, awareness of the potential hazards caused by improper disposal is important. This creates a gap and motivates the need to establish the factors affecting segregation of waste in Chuka hospital.

Attitude of health care workers could influence the way segregation of waste is done. Health care workers' negative attitude in hospitals might be triggered by poor working conditions such as poor leadership and management, shortage of HCWs, overcrowded wards, poor communication and uncooperative behavior among some HCWs [21]. Throughout the world, healthcare is one sector 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 due to varying attitude of personnel, despite its serious health implications [21].

Hospital waste management involves range of activities, which are mainly engineering functions, such as collection, transportation, operation/treatment of processing systems, and disposal of waste [21]. However, in most cases, initial segregation and storage activities are the direct responsibility of the personnel. If the infectious component gets mixed with the general non-infectious waste, the entire mass becomes potentially infectious. It is the responsibility of hospitals to ensure that there are no adverse health and environmental consequences as a result of their waste handling, treatment

and disposal activities [21].

Knowledge, attitude and practice of health care workers have a greater impact on proper waste segregation globally. A study conducted in Egypt and in South Africa indicated that attitude and knowledge among health care workers such as housekeepers, physicians and nurses could also play a vital role in management of wastes [22]. A similar case happened in Namibia. Namibian guidelines on Infection Prevention Control and Integrated Health Care Waste Management Plan of 2010 and 2011 respectively made provision for proper waste segregation procedure to be done according to different color coded plastic bags. However, despite these guidelines that clearly stipulate waste segregation procedure in hospitals, it was noticed that waste segregation was not properly done [23].

The findings of the two studies in India suggest that the Bio-medical waste (BMW) management program cannot successfully be implemented without the willingness and cooperation of the health professionals [24]. It was concurred that for health care workers to have correct attitude and practice regarding hospital waste management, there should be a continuing training program along with monitoring those practices, so that it leads to a safe protected biohazard free environment [25]. This was followed by studies [26]. who have also demonstrated that the incomplete segregation of domestic and medical waste has generated a higher quantity of medical waste due to insufficient training programmes and the NIMBY (not in my back yard) syndrome. A study done in Pakistan has revealed that poor safety, insufficient budget, lack of trainings, weak monitoring and supervision, and poor coordination has eventually resulted in improper waste management [26]. Regarding the attitude of health care workers towards waste segregation and disposal high percentage of HCWs that strongly agreed that safe disposal is of utmost importance for preventing infection transmission.

The findings of the study by [27] are in agreement with those of another study conducted in Egypt that researched on some of the above statements such as safe waste disposal should be a priority, waste disposal is teamwork not a hospital responsibility, and that disposal of waste is a financial burden on the hospital. However, In this case, the hospital waste generation was affected by various factors which include the number of beds in the hospitals and the so called NIMBY (Not in My Back Yard) syndrome.

In order to minimize the risk to public health, the authors found that waste segregation and infectious waste treatment before its disposal should be properly conducted by the hospital management, and mostly when scavenging in landfill sites is done in developing countries. Therefore, it was essential to explore the knowledge, attitude and practice of HCWs on waste segregation. This paper therefore informs of how useful waste segregation could be in reducing the risk to public health.

### **1.3. Waste Management in Kenya**

In Kenya, the Environmental Management and Coordination Act (EMCA) of 1999 was developed to provide

a legal framework for health care waste management practices in the country (GOK, 2012). National Health Care waste management standard practices; Kenya Quality Model to regulate standards and a training programme known as "DO NO HARM" for all health workers in both public and private facilities in Health Care Facilities were also launched in 2008 to compliment the framework [28]. The EMCA law of 1999 insists that medical waste should either be packaged in clearly labeled bags or sterilized before disposal into any of the licensed incinerators. It further stipulates that the waste separation and packaging should be done at the health facility and that it is the responsibility of facilities to properly manage their hospital waste [29]. Despite these guidelines, mixing of different categories of waste, crude dumping and poor handling of waste are still common in public health [30].

In spite of the increased expansion of the health facilities very little focus has been diverted towards medical waste management hence contributing greatly to the deplorable state of biomedical waste management [31]. The problem of medical waste disposal lies in the community especially estate clinics that are difficult to follow up when it comes to waste management. Healthcare waste is a challenge in the country due to increased amounts of waste produced and a lack of proper capacity to manage. The main mode of medical waste management is incineration, open pit burning and burying. Waste handlers risk infections such as HIV and hepatitis from needle pricks while open burning produces harmful gases resulting in respiratory problems, cancer and reproductive health problems.

An assessment of the status of healthcare waste management in Nyanza Province in 2008 showed that there was inadequate or lack of segregation of HCW; there were lack of HCWM strategies, inadequate HCW receptacles, inappropriate internal HCW storage facilities, inappropriate internal transport facilities, delay in HCW collection, lack of budgetary allocations for HCW, tedious procurement approval process, lack of Personal Protective Equipment (PPE), lack of pre-treatment of HCW before final disposal [32]. However in all HCFs sampled, the waste that was properly segregated was sharps, which were placed in sharp boxes. At the HCW treatment plants, most of the HCFs had broken dilapidated "incinerators", there was lack of backup incinerators in cases of failure, broken down autoclave equipment, small capacity of incinerator and low incinerator stacks. The study findings revealed that the status of health care waste management in Nyanza province was low and contributed to environmental, social and health impacts [33].

An assessment of HCW in non-government HCFs in Nairobi Province in 2009 by [36] found that no facility had a HCWM plan and only (12.5%) of HCFs had a waste management team headed by a waste management officer. Waste segregation was found to be inadequate as no facility had a general waste category hence all the waste produced within these facilities were considered hazardous and had to be treated prior to disposal. Waste storage facilities were not adequate as they were easily accessible and not secure. Waste

was transported manually in (88%) of the facilities, putting the waste handlers at risk of injuries and infections [37].

The only treatment method found to be in use within the facilities was incineration and only (54%) of the facilities were found to have functioning incinerators. The incinerators were the De Montfort type and there were no measures for emission control in place and could therefore be source of air pollution putting community at risk of disease [38]. Private collectors were used by 2/3 of the facilities to dispose their waste while the rest disposed them within their premises by means of a landfill or open pit. There was no specific budget allocation of HCWM except in the cases where the services of private waste collectors were used. The knowledge of health workers on HCWM was found to be inadequate, but their attitude was found to be positive.

A report by Government of Kenya on assessment of the situation of waste management in Kenyan 2012 [38] revealed that good segregation practice was at only 27%, with most hospital departments mixing their waste. The wanting segregation practices coupled with lack of color coded bags, poor labeling practices and inadequately provided bins for waste containment encouraged the mixing of waste. Poor transport facilities (mainly wheelbarrows) used also encouraged the spillage (in 63% of hospitals visited) of waste and only helped to make the situation deplorable and an obvious potential for injury and infection. It was clear that most waste disposal and storage areas were not secured from unauthorized entry. This meant that risks existed especially to people who eked their living from salvaging items for resale and who even retrieved food waste to eat. It was apparent therefore that health and safety at the workplace and environmental awareness is a crucial responsibility for all in the interest of all.

## 2. Methodology

The researcher used the descriptive design. Descriptive design was used by researchers to gather information, summarize and interpret for the purpose of classification.

The study was conducted at Chuka District hospital in Chuka-Igambang'ombe Sub-County of Tharaka Nithi County. Chuka District hospital is located in the outskirts of Chuka town along Embu-Meru highway. It serves as a referral hospital for the health facilities within the county. Chuka town is located approximately 200 kilometers northeast of Nairobi towards Mount Kenya. The hospital offers preventive and promotive health services to the residents of the county.

Population refers to the entire group of individuals, events or subjects having common observable characteristics [39]. Target population also refers to the population to which the findings of the study can be generalized for the purpose of the study objectives. The target population for the study was health care workers including doctors, nurses, support staff and other paramedics within Chuka level four hospital at the time of study. The information retrieved from the hospital records

indicated that there a total number of 330 health care workers in the hospital by the year 2015-2016.

According to [39] sampling is the process of selecting few cases in order to provide information that can be used to make judgment about a much larger number of cases. The sample for the study was chosen using simple random sampling techniques. The simple random sampling method was considered appropriate since it gives the representativeness of the whole population. [40] recommends that when the target population is small (less than 1000 members), a minimum sample of 20% is adequate for educational research and when the population is large (over 1000 members) a sample size of 30% is adequate as a sample size. The Kothari formula was used to get the sample size of 66 respondents.

According to [40] a researcher can select a small sample due to various limitations that may not allow researching the whole population drawn. The sample size was obtained from the whole population scientifically using the population size as the bases. The simple random sampling methods were used. Out of the target population of 330 personnel, the research covered the 20% of the population. Thus, the sample size for the study was 66 respondents who were selected randomly.

The study used a Questionnaire as a data collection tool. [41] maintains that questionnaires give respondents freedom to express their views or opinion and also to make suggestions. It is also anonymous. Anonymity helps to produce more candid answers than is possible in an interview. A questionnaire is a research tool through which respondents are asked to respond to similar questions in a predetermined order [42] Questionnaires, "make it possible to measure what a person knows (knowledge or information), what a person likes and dislikes (values and preferences), and what a person thinks (attitudes and beliefs)" [42] The questionnaire was developed for health care workers at Chuka level four Hospital. The questionnaire consisted of mainly close-ended items and a few open-ended items. The questionnaire comprised of sections, 1 collecting the background information, and other sections collected data related to the study variable or objective of the study.

The researcher obtained an introduction letter from the department of nursing, Chuka University. The researcher later traveled to the Chuka level four Hospital to inform the offices the intention to carry out the study. After getting authority letters the researcher delivered the questionnaire to each respondent to fill and in case of any explanation the researcher took time to explain for clarity purposes. The whole process took about two weeks.

The raw data was collected, examined and checked for completeness and clarity. The numerical data collected using questionnaires was coded and entered and analyzed using a computer Statistical Package for Social Scientists (SPSS) version 22. The outcome of descriptive statistics was presented in frequency tables with varying percentages.

### 3. Results and Discussion

A total of 66 questionnaires were distributed to participants in the hospital but only 61 were well filled by the respondents representing 93% and the response rate was regarded adequate in line with [43] who recommends that 70% response rate is an adequate response in descriptive studies. [44] On other hand observes that a response rate of 50% is adequate for descriptive analysis and reporting, while a response rate of 60% is good and a response rate of 70% and over is excellent. Distribution by gender, female employees were majority at (60%) and male counterparts constituted (40%). Nurses were the majority at 46% and clinical officers at 16%. The medical officers were 13% and laboratory technicians represented 11%, finally Physiotherapist and Orthopedic represented 5% and 8% respectfully. The study revealed that 87% of the respondent had worked for over 1 year, which puts them in a good position to know the factors affecting segregation of waste in the hospital. Majority of the health care workers at 32% were working in the Out patients Services department, while another 19% were in the medical surgical wards. Those in obstetrics and gynecology were 13% and those in anesthesia theatres and rehabilitative services represented 8% each respectfully. This indicated that all the departments were covered by the study and According to [45] the responsibility of segregation should start with the people concerned with waste generation such as doctors, nurses and paramedical personnel.

The highly infectious waste was very common at 70% and the highly infectious waste included amputated limbs, placenta, extracted teeth, used test tubes and test kits and used blood bags. Infectious waste was common at 80% and it included used gauze, used cotton, pad and cloths, and contaminated bottles for infusion fluids. Sharps was also common at 80% and it included used syringes, needle, used scalpels, broken glass, ampoules, and cannulas was also very common. Non-infectious waste was also common at 90% and this kind of wastes included food items, empty bottles for drinks, paper, and packaging material. According to [46] about 75-90% of waste produced in health care establishments is general waste. This includes papers, packaging materials, dust and the like. The remaining 10-25% of waste is hazardous and could be composed of sharps (needles, lancets etc.), syringes, blood or body fluid, contaminated surgical instruments, delivery bowls, used gauzes and gloves, plasters, etc. According to a WHO report 80% of the waste generated by the hospitals is of general type and 20% is considered hazardous material that may be infectious, toxic and radioactive [47]. The findings also concurs with the findings by [48], which showed that in Kenya there is an estimated 0.33 million tons of waste is generated in hospital annually and majority of this wastes include.

On correct knowledge and safe practices of health care workers was imperative and 40% health care workers had been trained on health care waste management, another 60%

of health care workers were not trained. Those trained took their trainings one year ago 30%, while 60% were trained two years ago. It was concluded that for health care workers should have correct attitude and practice regarding hospital waste management, there should be a continuing training program along with monitoring those practices, so that it leads to a safe protected biohazard free environment. The findings concurs with [49] study of India hospital, which concluded that the importance of training regarding waste management needs emphasis and lack of proper and complete knowledge about waste management impacts practices of appropriate waste disposal in the hospital.

On mode of disposal, 62% of health care workers in the hospital disposed Infectious wastes in red coded containers, while 33% used yellow coded containers. Sharps were disposed in yellow coded container and another 34% used black coded containers. Anatomical wastes were disposed using red coded container. Offensive or non infectious waste (including nappy, incontinence, sanitary waste and other waste produced from human hygiene) was disposed using yellow and black coded containers. Chemical wastes (e.g. reagents, solvents etc.) were disposed using yellow coded container by 42%, while another 41% of health care workers used the black coded containers. Pharmaceutical wastes were disposed using yellow coded container by 37% and another 40% used the black coded containers. Food Stuff and Papers were disposed in yellow coded containers. [50] observed that in many hospitals proper health care waste segregation procedure was not done according to different color coded plastic bags. However, despite these guidelines, the health care workers were not clearly using the color coded containers as stipulated.

Segregating waste at the point of generation was considered critical to the safe management of healthcare wastes. Health workers at 22% took the sharps containers for incineration when  $\frac{1}{4}$  full and another 30% took the sharp containers when  $\frac{1}{2}$  full. The health workers at 47% stated that the temporary storage premise was not large enough to handle the waste generated in the hospital. The study aligns with the Infection Prevention and Control (IPC) Policy and Guide-lines (2011) which recommends that wastes should not be allowed to accumulate at the point of production. The waste generated in the hospital was transported using wheelbarrow by 40% while others used containers. Medical care waste was transported on daily bases by 40% and others transported the waste in weekly basis. According to National Injection Safety and Medical Waste Management Policy 2007, and Infection Prevention and Control (IPC) Policy and Guide-lines (2011), poor transportation facilities (mainly wheelbarrows) encourages the spillage of waste and only helped to make the situation deplorable and an obvious potential for injury and infection. However, according to [51] Health-care waste should be transported within the hospital or other facility by means of wheeled trolleys, containers, or carts that are not used for any other purpose and meets the specifications.

On the attitude of health workers on waste segregation in a

hospital setup, identification of the waste was the responsibility of the waste producer and it took place as close as possible to where the waste was generated as indicated by 70% of respondents. The finding is supported by [52] who stated that the responsibility of segregation should start with the people concerned with waste generation such as doctors, nurses and paramedical personnel. This is possible, once health care workers possessed correct knowledge and safe practices on waste segregation. Poor working condition by the health care workers in a hospital such as poor leadership and management, shortage of health care workers, overcrowded wards, poor communication and uncooperative behavior among health care workers triggered negative attitude on health care waste management by as indicated by 85% of respondents. The finding of this study is supported by [53] study of Pakistan which revealed that poor safety, insufficient budget, lack of trainings, weak monitoring and supervision, and poor coordination has eventually resulted in improper waste management.

Majority of the health care workers at 75% all the time put on personal protective equipment when handling medical wastes. The type of protective clothing used was Helmets, with or without visors depending on the operation, face masks, eye protectors (safety goggles), overalls (coveralls), industrial aprons, leg protectors and disposable gloves (medical staff) or heavy-duty gloves (waste workers). According to Prevention and Control (IPC) Policy and Guide-lines (IPC, 2011) protective equipments should be used by all personnel who collect or handle health-care waste.

There was a shortage of dust bins and bin liners in the hospital for waste segregation, also noted was none factional color coded bins in the hospital setting. Majority of respondents 80% highlighted lack of training and ignorance by health workers on health care waste handling and management, poor ways of segregation at the point of production. Also noted by respondents was the delay in disposing the waste, and majority of new staff were not trained on waste segregation. Some 70% of health workers stated that the institution waste control was poor. The study findings concurs with that of [54] which found the main problem of waste management in Ethiopia included the absence of proper waste disposal, insufficient training of health care workers, inadequate personal protective equipment and overall improper management strategies in the handling and disposal activities of waste.

A major challenge for the establishment of an effective waste management system and structural support for the hospital is the legal framework. There was no comprehensive Medical Waste Management Policy guideline in the hospital at 85%. Health-care waste management policies or plans was not provided in hospital and there was no provision for the continuous monitoring of workers' health and safety to ensure that correct handling, treatment, storage, and disposal procedures are being followed. [55] observed that Even after the formulation of policies and laws on health care waste management, many health care in Kenya still lack

enforcement of legislation for segregation, handling, and disposal of health care waste. Also observed in the study was that majority of health care workers 70% had never hand of the findings of the previous environmental audits and regulations for medical waste management in the hospital. Majority of health care workers 61% disagreed that the hospital kept and maintained waste management records which one can ascertain the quantities of waste generated and whether it has been disposed of in the recommended way. There was an occupational health risk exposure policy in the hospital with 48% in agreement, and another 45% of health care workers were not aware of its existence in the hospital. However, in Kenya, the Environmental Management and Coordination Act (EMCA) of 1999 provides legal framework for health care waste management practices in the country [56]. It stipulates that the waste separation and packaging should be done at the health facility and that it is the responsibility of facilities to properly manage their hospital waste.

Supervisory in-house training for staff on occupational health and safety was not done in the hospital with 70% stating that it was not done. The waste handlers do not keep record of the waste generated and plastic containers are used for disposal. There was also a routine schedule for the collection of medical care waste and it is done daily. Incineration is also done daily and incineration was the most common method of medical waste treatment, and then burning waste in open air without any specific treatment. The study findings goes opposite of Kenya National Injection Safety and Medical Waste Management Policy 2007, and Infection Prevention and Control (IPC) Policy and Guidelines 2011 policy documents which giving's policy direction to the health sector to manage waste [57]. This policy gives the guidelines on segregation, collection, disposal, processing, treatment, and recycling wastes.

In case medications are expired they are returned to drug store before expiry date by at least one month, except for emergency and life-saving drugs or those with no new expiry date replacement, to be monitored by the pharmacist in the drug store. In case of presence of expired medication the pharmacist make the proper documentation and dispose of the expired medication in a yellow bag (bag for disposal of hazardous material). In case of expired drugs within the store, the pharmacy department forms a committee that decides on proper disposal of the expired medications. The committee waits for approval to dispose of the drugs from the necessary authorities. The waste treatment/disposal facility in the hospital does not allows for waste recycling by 80% of the respondents. The EMCA law of 1999 insists that medical waste should either be packaged in clearly labeled bags or sterilized before disposal into any of the licensed incinerators. It further stipulates that the waste separation and packaging should be done at the health facility and that it is the responsibility of facilities to properly manage their hospital waste [58].

Researcher came to know that empty glass/plastic bottles, containers and tins were mainly re-used by some health

workers and support staff. Despite the guidelines of disposal, mixing of different categories of waste, crude dumping and poor handling of waste are still common in public health facilities as observed by [59]. The only treatment method found within the facility was incineration while the rest was disposed within the premises by means of a landfill or open pit. Waste is collected at a central open dumpsite and burnt periodically or either disposed with the general waste. Occasionally, the wastes are buried by covering with a layer of earth. Used swabs and dressings as well as pharmaceutical wastes are disposed with general waste. Sharps are collected separately in sharp proof containers and disposed by incineration.

The hospital had enough color coded bins and they were appropriately placed where 61% of health care workers strongly agreed, 21% disagreed and 18% were not sure. The respondents who had no color coded containers in the working department were 21% less likely to be correctly practicing health care waste segregation than who do have color coded container in the working department. The finding also concurs with a report by Government of Kenya on assessment of the situation of waste management [60] which revealed that good segregation practice was at only 27%, with most hospital departments mixing their waste. The wanting segregation practices coupled with lack of color coded bags, poor labeling practices and inadequately provided bins for waste containment encouraged the mixing of waste.

The study established that the health care wastes that required segregation in Chuka level four hospitals was highly infectious waste which was very common, which included amputated limbs, placenta, extracted teeth, used test tubes and test kits and used blood bags. Infectious waste was also very common which included used gauze, used cotton, pad, and contaminated bottles for infusion fluids. Health care workers stated that sharps which includes used syringes, needles' cut-off infusion sets, used scalpels, broken glass, ampoules, and cannulas was also very common. On the other hand, non-infectious waste was also very common and this kind of waste included food items, empty bottles for drinks, paper, and packaging material.

Correct knowledge and safe practices of health care workers are imperative while managing the health care waste. However, many health care workers were not trained on health care waste management and those trained took their trainings more than one year. Health care workers disposed highly Infectious wastes in red coded containers, while infectious waste was disposed in yellow coded container. Chemical wastes were disposed using yellow and black coded containers. Pharmaceutical wastes (e.g. outdated meds) were disposed using red and yellow coded container, while Food Stuff and Papers were disposed in yellow coded containers, while other used black coded containers.

Segregating clinical waste at the point of generation is critical to the safe management of healthcare wastes, which not only aids in the management costs of these wastes, but ensures that the waste is stored, transported and ultimately

disposed of correctly. Health workers took the sharps containers for incineration when  $\frac{1}{4}$  full, when  $\frac{1}{2}$  full,  $\frac{3}{4}$  full and completely full. The temporary storage premise was not large enough to handle the waste generated in the hospital. The waste generated in the hospital was transported using wheelbarrow and others used containers. The hospital health workers transported the medical care waste on daily bases and others transported the waste in weekly basis.

Waste segregation in a hospital setup was important to health workers and segregation (separation) and identification of the waste was the responsibility of the waste producer and it took place as close as possible to where the waste was generated. Poor working condition by the health care workers in a hospital such as shortage of health care workers, overcrowded wards, poor communication and uncooperative behavior among some health care workers was established to trigger negative attitude on health care waste management. Regarding the attitude of health care workers towards waste segregation and disposal high percentage of health care workers strongly agreed that working condition is of utmost importance for preventing infection transmission. The finding was supported by [61] study of Pakistan which revealed that poor safety, insufficient budget, lack of trainings, weak monitoring and supervision, and poor coordination has eventually resulted in improper waste management. The health care workers had protective gears for handling health care waste in the hospital, while others posed that they don't have protective gears. This showed that the hospital does not have adequate protective gears which pose a risk to health care worker when handling the waste.

Majority of the health care workers at all the time put on personal protective equipment when handling medical wastes, while others sometimes put on personal protective equipment. The workers were not always using protective equipment which is dangerous to their health. The type of protective clothing used was Helmets, with or without visors depending on the operation, face masks, eye protectors (safety goggles), overalls (coveralls), aprons, leg protectors and disposable gloves (medical staff) or heavy-duty gloves (waste workers).

There was a shortage of dust bins and bin liners in the hospital for waste segregation, also noted was none factional coded bins in the hospital setting. Majority of respondents highlighted lack of training and ignorance by health workers on waste handling and management, poor ways of segregation at the point of production. Also noted by respondents was the delay in disposing the waste (transportation to the incineration), and majority of new staff not trained on waste segregation. Some of health workers stated that the institution waste control was poor and only 30% of health workers agreed that waste control system was good. Poor control includes knowledge in segregation, improper practices, and high incidence of sharp injury at work.

A major challenge for the establishment of an effective waste management system and structural support for the hospital was the legal framework. There wasn't a

comprehensive Medical Waste Management Policy guideline in the hospital. Health-care waste management policies or plans were not provided in hospital. The health care documented internal medical waste control system in the hospital in general aim to reduce health problems and to prevent potential health risks for patients, the broader public, and workers within the system. Majority of health care workers had never hand of the findings of the previous environmental audits and regulations for medical waste management in the hospital.

The hospital did not keep waste management records which one can ascertain the quantities of waste generated and whether it has been disposed of in the recommended way. There was an occupational health risk exposure policy in the hospital, occupational safety and health in hospital setting is concerned with protecting the safety, health and welfare of people engaged in work or employment. Supervisory in-house training for staff on occupational health and safety was not done adequately in the hospital. There should be proper training and management regarding awareness and practices on Occupational Health and Safety and waste disposal. The waste handlers do not keep record of the waste generated and plastic containers are used for disposal. There is also a routine schedule for the collection of medical care waste and it is done daily. Incineration is also done daily and incineration was the most common method of medical waste treatment, then burning waste in open air without any specific treatment and landfills.

In case medications are expired they are returned to drug store before expiry date by at least one (1) month, except for emergency and life-saving drugs or those with no new expiry date replacement, to be monitored by the pharmacist in the drug store. In case of expired drugs within the store, the pharmacy department forms a committee that decides on proper disposal of the expired medications. The committee then waits for approval to dispose from the necessary authorities.

The waste treatment/disposal facility in the hospital does not allow for waste recycling. Researcher came to know that empty glass/plastic bottles, containers were being reused by some staff. Occasionally, the wastes are buried by covering with a layer of earth. Used swabs and dressings as well as pharmaceutical wastes are disposed with general waste. Sharps are collected separately in sharp proof containers and disposed by burying.

#### 4. Conclusion

This study showed that health care workers practice towards segregation of health care waste in Chuka hospital is poor. The most common waste was the highly infectious waste, sharps and the non-infectious waste which included food items, empty bottles for drinks, paper, and packaging material. Correct knowledge and safe practices of health care workers was very important when managing the health care waste. However, many health care workers were not trained on health care waste management and majority did not

differentiate the different coded containers for disposing waste. Segregating clinical waste at the point of generation was minimally applied by health care workers. The temporary storage premise was not large enough to handle the waste generated in the hospital. The waste generated in the hospital was transported using wheelbarrow and others used containers as a means of transportation.

On attitude of workers, poor working condition by the health care workers in a hospital such as shortage of health care workers, overcrowded wards, poor communication and uncooperative behavior among some health care workers triggered negative attitude on health care waste management. The hospital does not have adequate protective gears for workers which pose a risk to health care worker when handling the waste. The workers were not always using protective equipment which is dangerous to their health. There was a shortage of dust bins and bin liners in the hospital for waste segregation, also noted was none factional coded bins in the hospital setting. There is also delay in disposing the waste (transportation to the incineration), and majority of new staff not trained on waste segregation.

The hospital also lacked a comprehensive Medical Waste Management Policy guideline. Health-care waste management policies or plans were not provided in hospital. Majority of health care workers had never hand of the findings of the previous environmental audits and regulations for medical waste management in the hospital. The hospital also did not keep and maintain waste management records which one can ascertain the quantities of waste generated and whether it has been disposed of in the recommended way. There was an occupational health risk exposure policy in the hospital. Supervisory and in-house training for staff on occupational health and safety was not done adequately in the hospital. Incineration is also done daily and incineration was the most common method of medical waste treatment, then burning waste in open air without any specific treatment and landfills.

In case all medications are expired they are returned to drug store before expiry date by at least one (1) month, except for emergency and life-saving drugs or those with no new expiry date replacement, to be monitored by the pharmacist in the drug store. The waste treatment/disposal facility in the hospital does not allow for waste recycling. Occasionally, the wastes are buried by covering with a layer of earth. Used swabs and dressings as well as pharmaceutical wastes are disposed with general waste. Sharps are collected separately in sharp proof containers and disposed by incineration.

## Recommendations

- i. The hospital should embrace awareness on proper handling of medical waste and the safety of environment. The hospital should provide gloves, gowns, footwear and glasses to people handling medical care wastes.
- ii. The hospital should designate special areas for storage

of their clinical wastes rather than putting all waste in common dust bins or throwing the wastes in open pits. They should also be labeling containers with medical care waste.

- iii. The hospital should not burn their medical care wastes due to the health hazard to both staff and the general environment. Open burning of medical waste seem to be widely practiced which needed to be strictly avoided.
- iv. On the risks of improper handling of medical waste proper safety measures should be upheld to the safety of environment. This should include responsible planning of collecting, transporting, processing and disposing of hazardous and non-hazardous medical waste.
- v. To minimize the occupational health risks associated with the handling and disposal of medical waste, a regular assessment of waste management procedures is needed to assure there is compliance with applicable standards, regulations and legislation.

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