Original

Practices on healthcare waste segregation in Bagamoyo Town Council, Tanzania

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Abstract

Background: Segregation of healthcare waste is increasingly of great concern globally. Study assessed the practice of healthcare waste segregation in Bagamoyo Town Council, Tanzania

Methods: The study employed quantitative research approaches with Cross-sectional study design. The questionnaire was employed for data collection from a sample of 80 participants. Statistical Package for the Social Sciences (SPSS) version 22 was employed to analyse the data collected.

Results: The study indicates that only 22.5% of healthcare workers had received training on proper segregation of healthcare wastes, 21.3% are aware of regulations, and >50% of healthcare workers were not aware on different bins used in segregation of healthcare wastes. These signify low level of knowledge. For institutional factors; 31.3% of health workers had clear guidelines and procedures for healthcare waste as emphasized, 37.5% of healthcare workers were emphasized on proper segregation of healthcare wastes, 31.3% of healthcare workers had proper containers for different types of healthcare wastes, 27.5% of healthcare workers supported that there are enough resources allocated to manage healthcare waste segregation, and 33.8% of healthcare workers were aware of the potential health and environmental risks on improper healthcare waste segregation.

Conclusion: The practice of healthcare waste segregation in Bagamoyo Town Council is still poor due to the low level of knowledge of health staff involved in the daily healthcare waste segregation, poor institutional factors associated with healthcare waste segregation, and low risk perceptions of the health staff toward healthcare waste segregation.

Key words: Healthcare wastes, waste segregation, colour coding, risk factors, facilities, Tanzania

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Introduction

Healthcare waste involves waste generated from healthcare facilities, research centers, medical laboratories, and veterinary centers; including infectious waste, pathological waste, sharps, pharmaceutical waste, genotoxic waste, radioactive waste, coagulated blood waste, and expired medicines, drugs, and cosmetics[1,5]. Healthcare waste is of great concern for public health authorities because it has been reported to be the second most hazardous waste in the world. Globally, over 2 million healthcare workers are exposed to infections where by level accidents caused by sharps accounted for infections amongst the personnel of HCFs[2].

HCW segregation is an important component in the waste management chain as it makes possible to realize the effective reuse, recycling and recovery (RRR). If improperly managed it contaminate soil, water and air by affecting the quality of life, it also creates nuisance to human. Unfortunately, it has received little attention and normally informally practiced and rarely adhered to among health workers mostly in developing countries' HCFs where approximately 20% to 60% of HCFs are characterized by improper HCW segregation despite of being an integral part of their national health system[3,9] Globally, it has been estimated that injections with contaminated syringes caused 21 million Hepatitis infections (32% of all new infections), 2 million Hepatitis C infections (40% of all new infections) and 260,000 HIV infections (5% of all new infections). Also, more than 2 million health-care workers are exposed to percutaneous injuries with infected sharps every year[4].

In Africa healthcare waste segregation seems to be a continent-wide problem by which a systematic review indicated that 47% of the HCF observed to have absence of waste segregation[5]. Probably, the contributing factors could be due to lack of appropriate waste segregation utilities, lack of awareness, lack of enforcing laws and regulations, Lack of accessible HCW guidelines, inadequate training, working without personal PPE and poor managerial supports. Despite different strategies to improve HCW management has been done involving policy reform, review of government structures and improving public awareness but in many HCFs waste, segregations has not received adequate attention.

A Study done in Tanzania revealed that; despite the availability of enough bins in some HCFs, colour coding practices in the two municipalities was poor. Only 11% of the surveyed facilities in Ilala municipality and 10% of the surveyed facilities in Kinondoni Municipality practice colour coding. This implies that wastes are segregated into infectious and non-infectious wastes but the process does not put into consideration colour of the containers[6]. Another study done in Tanzanian zonal referral hospitals revealed that, Muhimbili National Hospital composition of hazardous wastes was 40.6% which is higher compared to the amount given by WHO which ranges from 10% to 25%[7].

Also, it has been revealed that, resources for segregation and in- storage of Healthcare waste along with proper system for on-site transportation are very poor across all types of healthcare facilities where by more than 50% of all healthcare facilities had one or other problem of resources for segregation, sharps management and storage[8,9]. So, lack of resources for segregation, lack of color coding system, lack of record keeping and carelessness of the health staffs are observed as some of the main issues leading to poor segregation practice across staffs in developing countries[7]. These problems also have reported in Tanzania including Bagamoyo Town Council[10]. Therefore, the aim of this study was to assess the practices of healthcare waste segregation in Bagamoyo Town Council, and the specific objectives based on; exploring level of knowledge of healthcare workers involved in the daily healthcare waste segregation, examining the institutional factors associated with healthcare waste segregation, and assessing the risk perceptions of the healthcare workers towards healthcare waste segregation.

Methods

Study area

The study was conducted at Bagamoyo Town Council located in Pwani Region which has a population of 2,024,947 in which males are 998,616 and females are 1,026,331. It covers an area of 1423km^2 with population density of 144.4/km^2 (NBS, 2022). The district has 3 divisions, 21 wards and 108 villages. The data collection was done from April to early June 2024. Bagamoyo economy is largely based on Agricultural activities whereby by they grow different crops such as Rice, maize, pineapples, mangoes, cashew nuts, sweet potatoes and coconuts. Other economically reliable activities include fishing in the Indian Ocean, Ruvu River and artificial dam's industrial development, informal and artisan activities, tourism and livestock keeping.

Study design and population

The study was a descriptive cross-sectional study designed to assess the practice of healthcare waste segregation in Bagamoyo Town Council. This design was found to be most appropriate as data were collected from many individuals at a single point in time making it

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cheaper and less time-consuming, it measures the outcome and the exposure(s) in the population and their association but also it takes a short period and it is cost-effective. The target study population was all healthcare workers working in both private and government healthcare facilities in Bagamoyo Town Council.

Sample size

The sample size in this study was 80 participants from the study population of 387 (number of healthcare workers in Bagamoyo Town Council) which was obtained by adopting proportional allocation[11] by which the study population was divided into different strata according to their profession, then, simple random sampling was employed to drawn the sample from each stratum using the formula below;

$$P_x = N_x/N$$

$$\text{Then; } n_x = n.P_x$$

Where;
n= total sample size
P_x = Proportion of population in stratum x
N_X =Population in stratum x
N= Total population
n_x = sample size in stratum x

A population of 387 will be divided into the following strata
Doctors (P_1) =93, Nurses (P_2) =226, Laboratory technicians (P_3) 39, Mortuary attendants (P_4) = 8 and Pharmacists (P_5) =21.
The sample of different strata can be obtained as shown below;
$P_1=N_1/N$
$n_1= n.P_1$
P_1 =93/387
=0.24
n_1=80* 0.24
n_1=19, n_2=47, n_3=8, n_4=2 and n_5=4.
Therefore; the sample size was obtained by adding the number of respondents in all strata making a total of 80 participants.

Sampling techniques

Stratified sampling was used in the study. The study participants from each stratum were selected by using simple random sampling.

Instruments

A pre-tested structured questionnaire was used to collect information from the selected participants from different departments. Pre-testing of the questionnaire was done to 10 healthcare workers at Bagamoyo District Hospital.

Data analysis

Data were processed using Statistical Package for the Social Sciences (SPSS) version 22. The data were entered into the SPSS and cleaned before categorization and analysis. A double entry of data was made for validation. Descriptive statistics (percentage, frequency, mean) were used to describe the basic features of the data. Cross tabulation and frequency tables were used to determine the level of Knowledge, Institutional factors, and risk perception of the healthcare workers in Bagamoyo Town Council.

Ethical approval

The proposal was approved by the department of Environmental Health Sciences of Ruaha Catholic University (RUCU). Permission to collect data came from the relevant healthcare facilities authorities. Prospective study participants were informed about the objectives of the study and that their participation was voluntary as there was no kind of coercion for participation. Furthermore, participants were free to decline or withdraw at any time in the course of the study without any repercussions. It was also clarified that the information which was provided was for research purposes only. Also, the respondents were assured about the confidentiality of all information provided, and the culture of the respondents was respected.

Results

Socio-demographic characteristics of the participants

During a study, a total of 80 participants from different healthcare facilities were given a questionnaire to answer and the results showed that 35(43.8 %) of the participants were male and 45(56.3%) participants were female. The age of participants was as follows; 11(13.8%) aged 18-25 years, 17(21.3) aged 26-30 years, 38(47.5) aged36-45years 14(17.5) were above 46 years at the time of study. Among 80 respondents, 12(15.0%) were certificate holders, 48(60%) were diploma holders, 17(21.3) were degree holders and 3(3.7%) were having masters and specialty in different courses. Participants were having different professionals whereby 48(60%) were nurses, 8(10%) were Laboratory technologists, Medical Doctors 19(23.8), Pharmacists 4(5%). Working experience of participants were as follows; 14(17.5%) were below 5 years, 25(31.3%) had 6-10 years, 38(47.5%) had 11-15 years and 3(3.8%) had more than 16 years working experience.

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Table 1: Social demographic characteristics

Variable		Frequency	Percent
Sex	Male	35	43.8
	Female	45	56.3
	Total	80	100.0
Age	18-25years	11	13.8
	26-30years	17	21.3
	36-45years	38	47.5
	46 and above	14	17.5
	Total	80	100.0
Level of education	Certificate	12	15.0
	Diploma	48	60.0
	Degree	17	21.3
	Masters, Specialty in different course	3	3.8
	Total	80	100.0
Profession type	Nurse	48	60.0
	Laboratory technologist	8	10.0
	Pharmacist	4	5.0
	Doctors	19	23.8
	Others	1	1.3
	Total	80	100.0
Work experience	Below five years	14	17.5
	6-10 years	25	31.3
	11-15 years	38	47.5
	Above 16 years	3	3.8
	Total	80	100.0

Knowledge of health staff involved in the daily healthcare waste segregation

Healthcare workers are responsible for segregating healthcare waste during the provision of health services (at the source) to prevent the risks to human health and the environment as well as reducing the cost of disposal. They should separate different categories of waste into designated color-coded containers or bags. This is done to ensure proper handling, treatment, and disposal of each type of waste.

Table 2: Shows knowledge of health staff involved in the daily healthcare waste segregation

Focus		Frequency	Percent
Training on proper segregation of healthcare wastes	Yes	18	22.5
	No	62	77.5
Aware of any regulations or law related to healthcare waste segregation in your area	Yes	17	21.3
	No	63	78.7
Color coding of the container used in hospitals to segregate human anatomical wastes such as body parts	Yellow	22	27.5
	Black	24	30.0
	Red	11	13.8
	Blue	23	28.8
Food remains are placed into container	Red	7	8.8
	Green	35	43.8

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Focus		Frequency	Percent
	black/blue	32	40.0
	Yellow	6	7.5
Healthcare waste container is recommended to be filled up to.	Top of the container mouth	16	20.0
	1/2 full	34	42.5
	3/4 full	30	37.5
Blood-contaminated wastes are placed in a container	Red	37	46.3
	Black	14	17.5
	Green	10	12.5
	Yellow	19	23.8
	Total	80	100.0

In this study, the level of knowledge concerning healthcare waste segregation among healthcare workers in Bagamoyo Town Council has proved to be low as shown in the table above.

Institutional factors associated with healthcare waste segregation

The institutional factors should be well established so as to create an enabling environment that supports and incentivizes healthcare workers to consistently segregate waste correctly. This in turn leads to more effective waste segregation, reducing the risk and better environmental outcomes.

Table 3: Institutional factors associated with healthcare waste segregation

Focus		Frequency	Percent
Clear guidelines and procedures for healthcare waste emphasized in your workplace	Yes	25	31.3
	No	55	68.8
Proper segregation of healthcare waste emphasized in your workplace	Strongly agree	4	5.0
	Agree	26	32.5
	Disagree	41	51.3
	strongly disagree	9	11.3
Proper containers for different types of healthcare wastes readily daily available in your workplace	Yes	25	31.3
	No	55	68.8
Encountered any challenges while trying to properly segregate healthcare waste in your workplace	Yes	51	63.8
	No	29	36.3
Received feedback or consequences for not following proper healthcare waste segregation practices	Yes	53	66.3
	No	27	33.8
Enough resources (e.g., staff, equipment, funding) allocated to effectively manage healthcare waste segregation in your workplace	Strongly agree	22	27.5
	Disagree	48	60.0
	strongly disagree	10	12.5

Research findings showed that, the Institutional factors associated with healthcare waste segregation in many healthcare facilities in Bagamoyo Town Council are still low.

Risk perceptions of the health staff toward healthcare waste segregation

The way health staff perceive the risks associated with improper healthcare waste handling can have a significant impact on their compliance with proper segregation practices.

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Table 4: Risk perceptions of the health staffs toward healthcare waste segregation

Focus		Frequency	Percent
Awareness of the potential health and environmental risks associated with improper healthcare waste segregation	Yes	27	33.8
	No	53	66.3
Experienced or witnessed any incidents related to improper healthcare waste segregation in your workplace	Yes	66	82.5
	No	14	17.5
	Total	80	100.0
Health and safety risks associated with improper healthcare waste segregation in your workplace	Very concerned	7	8.8
	Concerned	16	20.0
	Not concerned	51	63.8
	Not at all concerned	6	7.5
Confident in ability to properly segregate healthcare waste in your workplace	Very confident	4	5.0
	Confident	7	8.8
	Uncertain	27	33.8
	Not confident	42	52.5
Satisfaction with the level of information and resources available for proper healthcare waste segregation practices	Very satisfied	3	3.8
	Satisfied	16	20.0
	Dissatisfied	48	60.0
	Very dissatisfied	13	16.3
Sufficient safety measures in place to protect healthcare workers from exposure to hazardous healthcare wastes in workplace	Strongly agree	4	5.0
	Agree	8	10.0
	Disagree	47	58.8
	Strongly disagree	21	26.3
What does poor segregation of healthcare waste can cause?	Infectious diseases	36	45.0
	Medical issues	31	38.8
	Allergies	13	16.3
Personal protective equipment is required when?	The employee suffers an injury	13	16.3
	An employee asks for it	16	20.0
	Engineering, work practice and administrative controls do not provide sufficient protection against hazards	21	26.3
		29	36.3

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Discussion

The study indicates that only 22.5% of healthcare workers had received training on proper segregation of healthcare wastes, 21.3% are aware of regulations, and >50% of healthcare workers were not aware on different bins used in segregation of healthcare wastes. These signify low level of knowledge. For institutional factors; 31.3% of health workers had clear guidelines and procedures for healthcare waste as emphasized, 37.5% of healthcare workers were emphasized on proper segregation of healthcare wastes, 31.3% of healthcare workers had proper containers for different types of healthcare wastes, 27.5% of healthcare workers supported that there are enough resources allocated to manage healthcare waste segregation, and 33.8% of healthcare workers were aware of the potential health and environmental risks on improper healthcare waste segregation.

Training on healthcare waste segregation is very important to ensure that effective protection is present for combating the spread of diseases, now, having only 22.5% of trained healthcare workers implies that more possibilities of the spread of infectious diseases. For that focus, 77.5% of healthcare workers in Bagamoyo Town Council (BTC) had not received training on proper segregation of healthcare wastes meaning they do not have appropriate knowledge. That is nearly similar to the study done in Zambia which revealed that, only 37.5% of the healthcare workers received training on healthcare waste management.

On visiting the healthcare facilities, the study reported the presence of high number of bins for healthcare waste segregation (89.5%). Unfortunately, the study revealed poor waste segregation practice as only 62% of the healthcare workers agreed that they exclusively place hazardous wastes into its respective waste colour-coded bins[12]. Another study done at tertiary hospital in South Africa showed that 35.4% of the participants agreed that they received no any training about healthcare waste segregation[14], Similar to the study conducted in Bagamoyo Town Council. Also, the study conducted in Kampala revealed that; 60.7% of the healthcare workers responded not had adequate training on healthcare waste segregation prior being transferred to the central storage point[12].

Awareness on regulations or law related to healthcare waste segregation is crucial to meet the standards recommended by the Ministry of Health. Having only 21.3% of healthcare workers who are aware of the regulations or law related to healthcare waste segregation in their area while 78.7% not having awareness raises several questions to healthcare workers. When compared with the study conducted in selected health centers and hospitals in Ethiopia which showed that only 51.9% of the healthcare workers involved in the study responded that they are not aware of any rules and regulation about healthcare waste segregation, and 51.8% of the workers who didn't know their responsibilities in healthcare waste segregation as well as their job description[5], at least Ethiopia's selected health centers and hospitals have more than 50 percentage compared with BTC (21.3%).

The study also revealed that large percent (more than 50%) of healthcare workers were not aware on different bins used in segregation of different healthcare wastes, compared to the study conducted in Ethiopia which showed that only 53.2% of the total participants had clear understanding about the healthcare waste segregation procedures. Based on categories of healthcare wastes, 47.6% of the participants agreed with the healthcare waste categories as infectious and non-infectious waste only. 56.7% of the participants were aware of the colour coding system. Also, the study revealed that only 40.6% of healthcare waste matched with their respective segregation containers[13]. For cross sectional study conducted in South Africa tertiary hospitals, the result revealed that 58.3% of the participants had knowledge on the types of containers for healthcare waste segregation[14]. Therefore, knowledge on proper segregation of waste at the point of generation is crucial, as it allows for the safe and appropriate treatment and disposal of each waste stream.

Furthermore, Institutional factors stipulate the following; only 31.3% of health workers had clear guidelines and procedures for healthcare waste emphasized in their workplace while 68.7% did not have. This percent is low compared with the study conducted in Ilala and Kinondoni municipalities-Dar es Salaam, which signifies that, 41% of the studied healthcare facilities had no healthcare waste standard operation procedures and only 17% had water proof bins[6]. The study conducted in Ethiopia shows that only 51.9% of the healthcare workers involved in the study, were unaware about the rules and regulation about healthcare waste segregation.

Also, 51.8% of the workers didn't know their responsibilities in healthcare waste segregation as well as their job description. In addition, about 37.5% of healthcare workers have been emphasized on proper segregation of healthcare wastes in their workplace at Bagamoyo TC while the remaining 62.5 % need more emphasis. This shows poor practices of healthcare waste segregation at BTC similar to the results from the study

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conducted in Bukombe District Council hospital-Geita region in Tanzania, revealed low training programs done by the government to their healthcare wastes on healthcare waste segregation as only 33.6% of the participants, responded that they have received training in medical waste management practices.

This implies that most health workers at Bukombe District Council hospital are not knowledgeable about proper practices of medical waste segregation[15]. Moreover, only 31.3% of healthcare workers had proper containers for different types of healthcare wastes in their workplace while 68.7% did not have proper containers for healthcare waste segregation in their workplaces compared to the study beyond institutional factors associated with healthcare waste segregation from Rahim Yar Khan (Pakistan), regarding availability of waste bins revealed that, from nineteenth researched public hospitals, individual bins for each bed were in 68.4% hospitals only out of 100% public researched hospitals. This means that 31.6% public hospitals observed to have no individual bin for each bed. Also, the study indicated that 100% of the healthcare worker involved in the research responded to have given no any training on healthcare waste segregation[1].

The study also found that only 27.5% of healthcare workers agreed that there are enough resources (e.g., staff, equipment, funding) allocated to effectively manage healthcare waste segregation in their workplaces while 72.5% didn't agree. This signifies that there is an inadequate resource for healthcare waste segregation which is the same as the study conducted in a tertiary care government hospital of Nepal showing that, the hospital did not allocate budget for proper healthcare waste management. The hospital did not have committee, policy, standard operating procedures and proper colour coding system for waste segregation, collection, transportation and storage as well as trained waste handlers[4]. Also, another study done in Kampala showed that, majority of the respondents asserted that there was no proper colour coding systems (88%); maternity ward lacked a proper allocated budget for proper management practices (67%); there were no proper standard operation procedures (SOPs) for waste management (54%), no proper coordinated healthcare waste management committee (25%), lacked protective gears (76%) and there were no specific trained waste handlers (56%)[12].

In the study, the risk perceptions of the health staff toward healthcare waste segregation among healthcare workers in Bagamoyo Town Council was low as only 33.8% of healthcare workers were aware of the potential health and environmental risks associated with improper healthcare waste segregation while 66.2% were not aware. The study also revealed that only 26.3% of the study population agrees on the use of personal protective equipment all the time while at workplaces while the rest didn't agree. This relates to the study conducted in Ethiopia which revealed that 75.7% of the respondents showed positive perception about healthcare waste segregation of which only 35.3% were correctly practiced colour-coded waste segregation and 40.4% were practiced waste segregation incorrectly. Personal protective equipment reported to be present but only 46.8% of the participants agreed that they used personal protective equipment during handling of infectious wastes[13].

Strengths and limitations of the study

On one hand, the study about practices on healthcare waste segregation in Bagamoyo (BTC), Tanzania was very important to add more knowledge to the healthcare workers so as to be free from hazardous infectious diseases. This also ensures proper safety and protection to the clients/patients from various infectious diseases. The findings of the study bring awareness of how the situation is in regard to the way wastes are handled at different health centers and hospitals, the presence of colour coded bins associated with the way regulations or law to the trained personnel are followed. Apart from BTC, the author has come across that the challenges on waste segregation have been present in other areas like Ilala and Kinondoni (hospitals and health centers) in Dar es Salaam. Therefore, it is expected that when the manuscript is published the hospital and health centers management will get the information and find the means to rectify the situation.

On the other hand, this study faced time and budget constraints for sometimes authors were to travel long distances during data collection. Also, the participants sometimes were too busy in their working places due to the nature of their work, leading to time consuming. Also, the study is only generalizable to the hospitals and health centres of BTC only.

Implications of the findings

Based on the findings of this study, the following measures are recommended to improve the practice of healthcare waste segregation in Bagamoyo Town Council; Implementing training and awareness programs through conducting regular training sessions for healthcare workers, sanitation staff, and waste handlers on the importance of proper waste segregation and management, establishment of clear guidelines and protocols by developing comprehensive guidelines for

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the segregation, collection, transportation, treatment, and disposal of different categories of healthcare waste and ensuring these protocols are aligned with national and state-level regulations, and provision of adequate infrastructure for healthcare waste segregation. By doing so, Bagamoyo Town Council can significantly improve healthcare waste segregation, ensuring the safety of healthcare workers, the public, and the environment.

Conclusion

The practice of healthcare waste segregation in Bagamoyo Town Council is still poor due to the low level of knowledge of health staff involved in the daily healthcare waste segregation, poor institutional factors associated with healthcare waste segregation, and low risk perceptions of the health staff toward healthcare waste segregation. This have posed many risks to public health as well as environment such as increased risk of infections, occupational hazards for healthcare workers, environmental contamination, reputational damage to healthcare facilities and increased waste disposal costs. All these are caused by inadequate training of staff on proper segregation of healthcare wastes, staff are unaware of regulations or law related to healthcare waste segregation in workplaces, inadequate emphasize on proper segregation of healthcare waste in the workplaces, unavailability of proper containers for different types of healthcare wastes in workplaces, poor allocation of resources (e.g., staff, equipment, funding) to effectively manage healthcare waste segregation in workplaces, staff are unaware of the potential health and environmental risks associated with improper healthcare waste segregation by healthcare workers and inadequate personal protective equipment for healthcare waste segregation.

Declaration

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