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Original Research Article

Investigating healthcare waste management practices among healthcare workers at Samfya District Hospital of Luapula Province

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ABSTRACT

Background: Healthcare waste management is a critical component of infection prevention and control within health facilities, however, it still remains a global public health challenge. The purpose of this paper was to assess the healthcare waste management practices among health workers at Samfya District Hospital.
Methods: A descriptive cross-sectional study design and quantitative approach was employed. Simple random sampling was used, 65 healthcare workers participated in the study. Data was collected through structured questionnaire and analyzed using STATA version 14.2. Descriptive statistics were used to summarize socio-demographic characteristics and Healthcare waste management practices, while Fishers exact and chi square tests were applied to determine associations between variables. At 95% confidence Interval, a p value <0.05 was considered statistically significant.
Results: The study findings revealed that healthcare waste management practices were significantly associated with the presence of properly labelled waste bins (p<0.05, 95% CI), indicating that the availability and proper labelling of bins greatly influenced correct waste segregation and disposal. Furthermore, the profession of healthcare workers showed a statistically significant relationship with healthcare waste management practices (p<0.05, 95% CI), suggesting that knowledge and adherence to waste management protocols varied across professional categories.
Conclusions: The study concluded that while awareness of healthcare waste management practices among healthcare workers was high, actual compliance was influenced by structural factors such as the availability of properly labelled bins and professional background.

Keywords: Healthcare facilities/Hospital, Healthcare waste management, Healthcare workers, Practices, Samfya district hospital

INTRODUCTION

Healthcare waste is all the waste generated by healthcare facilities. This waste is comprised of 85% non-hazardous, while 15% is hazardous waste, which poses serious risks including exposure of about 3 million healthcare workers annually to blood-borne infections through injuries such as needle pricks resulting in HIV new infections of about 33800, 1.7 million hepatitis B infections and 315000 hepatitis C.[1,2] In addition, environmental degradation, land, water and air pollution come result from poor healthcare waste management practices.[2]

The increase in health facilities fueled by population growth and the primary healthcare approach has made healthcare waste management practices a persistent global public health challenge.[3,4] This can be attributed to the increased use of disposable equipment and poor healthcare waste management practices, which includes indiscriminate dumping of untreated hospital waste. Such practices increase the chances of survival, and mutation

of pathogenic microorganisms and promotes antimicrobial resistance.[5] Furthermore, poor waste management contributes to climate change through greenhouse gas emissions, promoting the rise and increased incidence of communicable disease within communities and threatening global health.[5] The prevalence of nosocomial infectious diseases such as tuberculosis, hepatitis B, C, measles, acquired immunodeficiency syndrome (AIDS), and cholera among healthcare workers has been traced to the inappropriate segregation and disposal of hospital waste.[2]

In sub-Saharan Africa, healthcare waste management (HCWM) systems remain below international standards, characterized by poor segregation, transport, and disposal.[6] Additionally, there is often no policy and plan in place to incorporate occupational health and safety matters such as training staff as part of induction and also in-service refresher course, health risk assessments, and clear employee, and employer responsibilities in waste management, also having waste management guides to refer to.[5-7] In Zambia, waste generation has increased alongside expansion of health services, but segregation and use of color-coded containers remain unsatisfactory.[8,9] At Samfya District Hospital, which generates about 206kg of waste monthly, mixing of waste at disposal sites creates risks for handlers and the community. In 2024, 13 needle prick incidents were reported, two linked to poor waste practices. This study therefore investigated the healthcare waste management practices among healthcare workers at Samfya District Hospital of Luapula Province. And answered the research question; what factors are associated with healthcare waste management practices among healthcare workers at Samfya District Hospital of Luapula Province.

Healthcare waste management (HCWM) is a critical global public health issue due to its risks to human health, occupational safety, and the environment. Healthcare waste contributes approximately 4.4% of global greenhouse gas emissions, positioning healthcare sector as the fifth largest emitter.[3] The costs associated with HCWM are projected to increase from $11.77 billion in 2018 to $17.89 billion in 2026, at a 5.3% annual growth rate.[10] Healthcare waste includes hazardous materials contaminated with blood, body fluids, or chemicals, which, if poorly managed, can spread infectious diseases and increase occupational injuries.[11] Institutions are key to implementing standards, providing training, and ensuring compliance, yet gaps remain in practice and documentation persist.[12]

Studies across countries highlight variations in knowledge, and practices. In Pakistan and Thailand, high compliance and good practices were associated with training and work experience.[4,11] Similarly, in India and Sri Lanka, training and awareness were strongly linked to safe waste segregation and positive practice.[5,13] In contrast, research in Sweden revealed low knowledge levels (34.4%) and insufficient training despite the presence of proper segregation systems, underscoring persistent gaps even in high-income contexts.[14] These findings show that HCWM challenges are not limited to developing countries but are global in scope.

In sub-Saharan Africa, HCWM faces structural barriers, including limited financial resources, inadequate training, poor supervision, and weak regulatory enforcement.[13] In South Africa, hospitals lacked occupational health policies and training programs for safe waste management.[7] Similarly, in Nigeria, 98.1% of health workers demonstrated poor knowledge and non-compliance with standards, coupled with limited training and weak regulation.[15,16] Ethiopian studies further revealed poor segregation, weak waste collection, and inadequate treatment systems, with gaps linked to training, hospital ownership, absence of guidelines, and lack of color-coded bins.[17-19] Heavy workloads and poor supervision were also cited as significant barriers.[18]

In Zambia, HCWM remains below both national and international standards. A multi-province study found that only 62% of health workers properly segregated infectious waste into color-coded bins, with poor disposal practices leading to increased needle-stick injuries among staff.[8] Further assessments showed that many facilities failed to take responsibility for safe waste management, lacking proper infrastructure for segregation, transport, and disposal.[8] These findings highlight ongoing risks of disease transmission and environmental hazards.[19,20]

Healthcare workers' practices play a pivotal role in HCWM. Evidence shows that knowledge does not always translate into good practice.[17] For example, studies in Nigeria and Zambia reported that despite adequate knowledge, poor practices persisted due to limited training and inconsistent supply of commodities.[2,319,20] In Ethiopia, over 60% of facilities demonstrated poor practices in segregation, collection, transportation, and disposal.[2] Conversely, in Uganda, India, and Sri Lanka, positive practices were observed where training, supervision, and provision of resources were available.[5,19] Profession and work experience also influenced HCWM practices, with nurses often demonstrating higher knowledge levels than other cadres, while in some context's physicians scored higher.[1,15,20] The study aim was to assess the factors associated with healthcare waste management practices among healthcare workers at Samfya District Hospital of Luapula Province.

METHODS

Research approach

This study employed a quantitative research approach to investigate healthcare waste management practices among healthcare workers at Samfya District Hospital. The study period was from January 2024-September, 2024. The quantitative approach enabled the systematic collection of numerical data to measure knowledge and

practices, as well as to assess relationships between key variables.

Research design

A descriptive cross-sectional study design was adopted. This design facilitated the collection of data at a single point in time, providing a snapshot of healthcare workers' knowledge and practices regarding healthcare waste management. The design was appropriate for identifying patterns, levels of knowledge, and factors associated with proper or improper waste management practices.

Research setting

The study was conducted at Samfya District Hospital, a referral hospital in Luapula Province, Zambia. The hospital serves over 30 health facilities and has six inpatient wards, including maternity, pediatric, malnutrition, and general medical/surgical wards, with approximately 2,000-2,300 annual deliveries. Samfya District covers 24,800 km^2 with a population of 159,200 (CSO, 2022). The hospital was selected due to accessibility, size, workforce diversity, and availability of data.

Study population and sampling

The study population comprised 78 healthcare workers. A simple random sampling technique was used to select a representative sample of 65 participants (Slovin's formula, 95% confidence level). Healthcare workers not employed at Samfya District Hospital were excluded.

Data collection techniques

Quantitative data was collected using self-administered structured and semi-structured questionnaires covering all professions, including medical officers, nurses, laboratory staff, and general workers. Completed questionnaires were securely stored for analysis.

Data analysis

Questionnaires were uniquely numbered and coded. Practice scores ranged 0-32 (low ≤16, medium 16-23, high ≥24). Key healthcare waste management practices were recorded as binary variables (yes/no). Data were entered into Microsoft Excel, cleaned, and analyzed using STATA 14.2. Inferential statistics was applied with Chi-square and Fisher's exact tests used to assess relationships.

Validity and reliability

Validity was ensured by covering all study variables and pre-testing instruments for clarity and logical flow. Reliability was confirmed through consistent measurement in a pre-test conducted in a comparable setting outside the study area.

Participant confidentiality

To protect participant confidentiality the researcher implemented anonymity, codes were used instead of participant names, questionnaires that were responded to were kept in a bag that was kept locked hence limiting access.

Ethical considerations

Ethical approval was obtained from the University of Lusaka, with permission from the Samfya District Health Office and National Health Research Authority. Informed consent was secured, ensuring participants understood the study, risks, benefits, and confidentiality.

RESULTS

The results of this study conducted among healthcare workers at Samfya District Hospital regarding healthcare waste practices are presented in this chapter (chapter four).

Descriptive characteristics of study participants

65 participants participated in the study as shown in Table 1.

The study showed that majority of the study participants were females (63.1%) while male was only (36.9%) with frequencies of 41 and 24 respectively. In addition, the study established that most of the respondents were aged between 30-34 years, this had a percentage of 40 while 19-24 were the least represented by 3%. Professionally, most of the respondents were Nurses (29), followed by general workers (7), and then Clinical Officers (6). The rest of the professionals who participated were 6 and less. Furthermore, the study revealed that most of the respondents had more than five years work experience represented by a percentage of 44.6, while, those with more than 10 years of work experience were 20% of the total participants.

Factors associated with healthcare waste management practice among healthcare workers at Samfya District Hospital

Fisher's exact and chi-square tests were performed to analyze factors associated with the practice of healthcare waste management.

The results of these tests showed that there was a statistically significant association between Samfya district hospital having bin identifiers and healthcare waste management practices at 95% confidence interval, with a p value of <0.001. Additionally, there was also a Statistically significant association between workers' profession and healthcare waste management practices with a p value of 0.019 at 95% confidence interval.

Table 1: Descriptive characteristics.

Characteristics	Frequency	Percentage	Total
Sex			
Female	41	63.1	65
Male	24	36.9	
Age group (in years)			65
19-24	2	3.10	
25-29	17	26.2	
30-34	26	40.0	
40-44	5	7.7	
45-49	13	20.0	
50-54	2	3.1	
Profession			65
Clinical officer	6	9.2	
Counsellor	2	3.1	
Dental staff	1	1.5	
Doctor	3	4.6	
Environmental health staff	2	3.1	
General worker	7	10.8	
Laboratory staff	3	4.6	
Mortuary attendant	1	1.5	
Nurse	29	44.6	
Pharmacy	3	4.6	
Physiotherapy staff	4	6.2	
Radiography staff	4	6.2	
Years of experience			65
<five year	23	35.4	
>five year	29	44.6	
>ten year	13	20.0	

Table 2: Factors associated with healthcare waste management practices among healthcare workers at Samfya District hospital.

	Waste management practice (%)			
	Medium n=10	High n=55	Total n=65	P value
Knowledge level				
Medium	1 (50)	1 (50)	2 (100)	0.17[c]
High	9 (14)	54 (86)	63 (100)	
Age group (in years)				
19-24	1 (50)	1 (50)	2 (100)	0.27[c]
25-29	1 (6)	16 (94)	17 (100)	
30-34	4 (15)	22 (85)	26 (100)	
40-44	2 (40)	3 (60)	5 (100)	
45-49	2 (15)	11 (85)	13 (100)	
50-54	0 (0)	2 (100)	2 (100)	
Years of experience				
<Five year	3 (13)	20 (87)	23 (100)	0.92[c]
>Five year	5 (17)	24 (83)	29 (100)	
>Ten year	2 (15)	11 (85)	13 (100)	
Sex				
Female	7 (17)	34 (83)	41 (100)	0.62[c]
Male	3 (13)	21 (88)	24 (100)	
Waste Container ID				
No	3 (100)	0 (0)	3 (100)	<0.001[c]*
Yes	7 (11)	55 (89)	62 (100)	

Continued.

	Waste management practice (%)			
	Medium n=10	High n=55	Total n=65	P value
Who segregates				
Cleaning worker	4 (25)	12 (75)	16 (100)	0.42[e]
Health worker	4 (14)	24 (86)	28 (100)	
Cleaning worker and Medical Staff	2 (10)	19 (90)	21 (100)	
Segregation place				
Don't know	1 (14.3)	6 (85.7)	7 (100.0)	0.99[c]
At the source	6 (14.6)	35 (85.4)	41 (100.0)	
Waste storage place in hospital	2 (16.7)	10 (83.3)	12 (100.0)	
After waste is collected	1 (20.0)	4 (80.0)	5 (100.0)	
Tear container				
No	4 (10)	36 (90)	40 (100)	0.17[c]
Yes	6 (24)	19 (76)	25 (100)	
Fastened bins				
No	1 (10)	9 (90)	10 (100)	1.00[c]
Yes	9 (16)	46 (84)	55 (100)	
Profession				
Clinical officer	3 (50)	3 (50)	6 (100)	0.019[c]*
Counsellor	0 (0)	2 (100)	2 (100)	
Dental staff	0 (0)	1 (100)	1 (100)	
Doctor	0 (0)	3 (100)	3 (100)	
Environmental health Staff	1 (50)	1 (50)	2 (100)	
General worker	1 (14)	6 (86)	7 (100)	
Laboratory staff	0 (0)	3 (100)	3 (100)	
Mortuary attendant	0 (0)	1 (100)	1 (100)	
Nurse	1 (3)	28 (97)	29 (100)	
Pharmacy	0 (0)	3 (100)	3 (100)	
Physiotherapy staff	2 (50)	2 (50)	4 (100)	
Radiography staff	2 (50)	2 (50)	4 (100)	
Prohibit liquids				
No	0 (0)	7 (100)	7 (100)	0.58[e]
Yes	10 (17)	48 (83)	58 (100)	

e = Fisher's exact test, c = Chi square test, * = statistically significant p value at 5% significance level.

However, knowledge level was not statistically significant with healthcare waste practices at 95% confidence interval having a p value of 0.17. It was further revealed that there was no statistically significant relationship between healthcare waste management practices and age, sex, and years of work experience of healthcare workers which were at 95% Confidence Interval, with p values 0.27, 0.62, and 0.92 respectively at Samfya District Hospital.

Furthermore, segregation done by, segregation place, fastened bin, and bin prohibiting liquid waste from running out had no statically significant relationship with healthcare waste management practices at a 95% confidence interval in this study as shown in Table 2.

DISCUSSION

The study was conducted to assess the healthcare waste management practices among healthcare workers at Samfya District Hospital. The study revealed that 63.1% of respondents were female and 36.9% male, these study results are similar to a study conducted in Nigeria and Lesotho which revealed that 64.3% and 53.8% respectively and this can be attributed to workforce composition or greater willingness of females to participate.[11,22,23] Nurses were the most represented profession (88.18%), these findings are similar to a study conducted in Nigeria which revealed nurses contributing 49.1% and 45.2% respectively.[3,23]

The study revealed that labelled waste bins were significantly associated with better practices, as respondents with access to labelled containers indicated that good healthcare waste management practices were enhanced when workers knew where to deposit each type of waste. This was statistically significant at $p<0.05$. These findings are consistent with results of a study conducted in Amhara region, Ethiopia which showed that bins having identifiers by having color codes was statistically significant at 95% significant level.[5] Similarly, a study conducted in Addis Ababa, Ethiopia

and another comparative study revealed that the availability of labels on bins and guidelines positively influences the healthcare waste management practices among healthcare workers, while proper practices reduce exposure to infections and protect the environment.[18,3] Another study, also reported that having bins with identifiers increased the likelihood of healthcare workers disposing off waste correctly.[11] This result could be attributed to availability of guidelines and sport checks by the environmental health officers. However, the implications when this is not done is that there is increased chance of having commingled waste and thereby increasing the chances of having nosocomial infections

A study conducted in Ghana on healthcare waste management practices similarly revealed that waste generated at the source was not segregated, with some type being dumped together in the various coded bins which can potentially causing infections, injuries, and diseases such as HIV, hepatitis B and C and tuberculosis.[23,26] This was attributed to poor identification or labels on the bins. Likewise, a study conducted in southwest Ethiopia found that properly labelled provide bins provide clarity and guidance on how to segregate and dispose off waste correctly, aiding in compliance, accountability, safety, and risk reduction.[27] Proper segregation and disposal minimize the risk of exposure to hazardous materials, thereby protecting both healthcare workers and patients from potential harm.[28,29]

Secondly the study results revealed that profession was also statistically significant with healthcare waste management practices with a p value of 0.019. These findings are similar to a study conducted in Ghana which found that healthcare waste practices were significantly associated with profession with a $p<0.0001$.[27,28] Comparable results were recorded in Ethiopia where a statistically significant relationship between with profession and healthcare waste practice was reported.[9] Environmental health staff and pharmacists demonstrated higher compliance, reflecting differences in formal training and awareness.[30-32] Similarly, another study conducted in Sri Lanka revealed similar results that profession was statistically significant with a $p<0.05$.[29] In Nigeria, a study conducted in Maiduguri Metropolis also reported that professional background was noted to shape healthcare waste management practice.[1] This could be attributed to variations in prior knowledge about healthcare waste management, with certain professions receiving closer supervision and frequent reminders compared to others.

However, the study revealed that, the majority (86%) of healthcare workers at Samfya District Hospital demonstrated high levels of healthcare waste management practices. This finding aligns with studies conducted in southwest Ethiopia and India which reported that 67.4% respondents practiced proper healthcare waste management.[18,25] Similarly, studies conducted in Ghana, Lesotho and Nigeria revealed that participants exhibited high knowledge level regarding healthcare waste management.[10,11,21,24,30] The high healthcare waste management practice reported in this study may be explained by the presence of waste management trained professionals within the hospital like environmental health officers who routinely conduct routine spot checks. Additionally, the hospital staff utilize available resources effectively, such as labelled bins (though not always colour-coded) to distinguish waste types and guide appropriate disposal practice.

The cross-sectional design limited the ability to establish casual relationships regarding healthcare waste management practices, as data was collected at a single point in time. Additionally, the study was conducted at one district hospital, which may limit the generalization of the findings to other healthcare settings.

CONCLUSION

The study aimed to assess healthcare waste management practices among health care workers at Samfya district hospital by establishing associations between various factors and practices.

This objective was successfully achieved, as the study found that the presence of bin identifiers and the health care workers profession were significantly associated with waste management practices. It is therefore recommended that regular training and refresher sessions be organized for all healthcare workers to enhance knowledge, skills, and adherence to proper healthcare waste management practices. Additionally, the hospital should ensure that all waste bins are adequately colour-coded or clearly labelled for proper segregation and disposal. Furthermore, future research should consider employing a qualitative approach to provide deeper insight and richer understanding of healthcare waste management practices, which could not be fully explored in this quantitative study.

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