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Knowledge, Attitude and Practices of Medical Laboratory Staff Toward Waste Management and Decontamination in Medical Laboratories: FUTA-TH as a Case Study

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ABSTRACT

Biomedical waste generated in medical laboratories poses significant occupational and environmental risks if not properly managed. Medical laboratory staff play a crucial role in ensuring safe waste handling and effective decontamination, yet gaps in knowledge, attitude, and practice (KAP) can compromise safety. This study assessed the knowledge, attitude, and practice of medical laboratory staff regarding waste management and decontamination at FUTA Teaching Hospital, Nigeria. A cross-sectional descriptive study was conducted among 62 laboratory staff using a structured, self-administered questionnaire covering demographics, knowledge, attitude, and practice. Data were analyzed using IBM SPSS. Descriptive statistics summarized KAP scores, while chi-square tests evaluated associations between demographic variables and KAP outcomes. Significance was set at $p < 0.05$. The majority of respondents were female (71%) with a mean age of 32.5 ± 6.8 years. Most participants demonstrated adequate knowledge (59.7%) of waste management and decontamination procedures, particularly regarding infectious and sharps waste. Knowledge gaps were observed in waste segregation and decontamination protocols. Positive attitudes were reported by 75% of staff, with strong recognition of the importance of proper waste handling. Practice adherence was poor; 48% followed standard waste segregation procedures routinely, 55% adhered to decontamination protocols. Cadre was significantly associated with knowledge ($p = 0.02$), while years used in the department predicted better practice adherence ($p = 0.01$). Laboratory staff at FUTA Teaching Hospital generally possess adequate knowledge and positive attitudes toward waste management; however, gaps in technical knowledge and practice adherence exist. Structured training and institutional monitoring are recommended to enhance compliance, improve occupational safety, and ensure environmental protection.

Keywords: Medical laboratory staff, Waste management, Decontamination, Knowledge, Attitude, Practice

INTRODUCTION

Biomedical waste generated in medical laboratories represents a critical public health concern worldwide. Laboratory waste includes infectious materials, sharps, chemicals, and other hazardous substances that, if improperly handled, can lead to the spread of infectious diseases, chemical injuries, and environmental contamination[19]. Globally, healthcare-associated infections are often linked to inadequate waste management practices, highlighting the need for strict adherence to safety and decontamination protocols in laboratory settings.

Medical laboratory staff are frontline personnel in the handling and disposal of biomedical waste. Their knowledge, attitudes, and practices (KAP) directly influence the effectiveness of infection control measures, occupational safety, and environmental protection. Proper knowledge ensures staff understand the risks associated with improper disposal; a positive attitude motivates adherence to safety protocols, while effective practice ensures correct implementation of waste management procedures[1, 13].

Despite international guidelines and local policies on biomedical waste management, studies in Nigeria and other developing countries have consistently reported suboptimal KAP levels among laboratory staff. For instance, research by Oladele and Adebayo (2019) highlighted that while many laboratory personnel are aware of waste segregation rules, compliance with decontamination procedures remains low. Similarly, studies in other regions have shown that gaps in knowledge often contribute to unsafe practices, increasing occupational exposure to infectious agents[5, 10].

FUTA Teaching Hospital serves as a tertiary healthcare and teaching facility with diverse laboratory services, including clinical chemistry, hematology, microbiology, and histopathology. The hospital provides an ideal setting to evaluate the current status of KAP among laboratory staff because of its varied workforce, range of laboratory procedures, and significant volume of biomedical waste generated daily. Understanding staff KAP in this setting is crucial for designing targeted interventions, improving compliance with standard operating procedures, enhancing occupational safety, and minimizing the environmental impact of laboratory waste.

Study Objective:

This study aimed to assess the knowledge, attitude, and practice of medical laboratory staff in waste management and decontamination at FUTA Teaching Hospital. Specifically, it sought to:

1. Determine the level of knowledge regarding biomedical waste categories, handling, and decontamination.
2. Evaluate attitudes toward the importance of proper waste management and adherence to safety guidelines.
3. Assess actual practices related to waste segregation, disposal, and laboratory decontamination procedures.

METHODS

Study Design and Setting

A cross-sectional descriptive study design was employed to provide a snapshot of the current knowledge, attitude, and practice of medical laboratory staff regarding waste management and decontamination. The study was conducted at the medical laboratories of FUTA Teaching Hospital, a tertiary healthcare institution that serves as a major referral and teaching facility in Nigeria. The laboratories include specialized units such as clinical chemistry, microbiology, hematology, parasitology, and histopathology, each generating various types of biomedical and chemical waste daily.

Study Population and Eligibility Criteria

The study population comprised all medical laboratory staff directly involved in sample collection, processing, analysis, and waste disposal.

Inclusion criteria were:

- Permanent and temporary laboratory staff with a minimum of six months of work experience at FUTA Teaching Hospital.
- Staff willing to participate and provide informed consent.

Exclusion criteria included staff on prolonged leave during the data collection period and those who declined participation.

Sample Size Determination and Sampling Technique

The sample size for this study was determined using the formula $n= Z^2pq/d^2$ n = minimum sample size for estimation of a meaningful event; Z = standard normal deviate; p = proportion of the factor; q = (1 − p); d = desired level of precision. Hence, Z = standard normal deviate (which is usually 1.96) and corresponds to a 95% confidence interval. p = proportion of practice of skin bleaching is 96.3% which is 0.963. Desired level of precision = 5 per cent (5/100) considering an estimated prevalence of adequate waste

management practices from previous studies, a confidence level of 95%, and a margin of error of 5%. Based on these parameters, a total of 62 participants were targeted[2].

Data Collection Instrument

Data were collected using a structured, self-administered questionnaire adapted from previously validated KAP surveys on biomedical waste management (Akhtar et al., 2020; Chukwuma et al., 2021). The questionnaire consisted of four sections:

1. Demographics: Age, gender, years of work experience, cadre, and current unit.
2. Knowledge: Questions on waste categories, segregation methods, decontamination procedures, and potential hazards.
3. Attitude: Statements measuring perceptions and beliefs about the importance of proper waste handling, scored on a 5-point Likert scale from strongly agree to strongly disagree.
4. Practice: Questions assessing the frequency and correctness of waste segregation, decontamination, and disposal methods.

A scoring system was made to measure the level of knowledge of waste segregation and decontamination. Six questions were used to assess knowledge. One mark was awarded for the correct answer and zero for the incorrect answer. The total score was converted to a percentage. The scores were graded as good or poor. Scores of 65% and less defined inadequate knowledge, while scores above 65% defined adequate knowledge. The same system was applied for the scoring of practice.

Attitude grading responses to questions on the likert scale were scored 1-5 marks. Strongly- disagreed response was given 1 mark, while disagreed response was assigned 2 marks. Responses that were neutral to the questions asked were given 3 marks, while those that agreed were assigned with 4 marks. Maximum 5 marks were given for all responses that strongly agreed to the questions asked. Overall scores were placed on percentage to determine the level of malaria knowledge. Respondents who scored above 70% were categorized as those with positive attitude towards waste management and decontamination, while those who scored below 70% were categorized as those with negative attitude towards waste management and decontamination.

Data Analysis

Data were entered and analyzed using SPSS IBM version. Descriptive statistics (frequencies, percentages, means, and standard deviations) summarized demographic characteristics and KAP scores. Knowledge scores were categorized as "adequate" or "inadequate". Attitude scores were categorized as positive or negative, and practice scores as good or poor based on established thresholds. Inferential statistics were carried out, and the Chi-Squared test was used to test for the association between categorical variables. The level of statistical significance was set at $p < 0.05$.

RESULTS

Demographic Characteristics of Respondents

A total of 62 medical laboratory staff participated in the study. The majority were female (71%), while males accounted for 29%. The mean age of respondents was 32.5 ± 6.8 years, with most staff falling within the 30–39 years age group (64.5%). Regarding cadres, 51.6% are Medical Laboratory Scientists (MLS), 29% Medical Laboratory Technicians (MLT), and 12.9% Health Attendants (HA), and others are 6.5%. Years used in the department varied, with 48.4% having 5–10 years, 41.9% having less than 5 years, and others are more than 10 years. Majority of the respondents were in Reception/Phlebotomy (33.9%), clinical chemistry 17.7%, microbiology 17.7%, histopathology 8.1%, while blood transfusion service accounted for 9.7% (Table 1).

Table I: Sociodemographic characteristics of the participants

Sociodemographic characteristics	***Frequency***	***Percentage %***
Age group (years)	**n= 62**	
20-29	10	16.1
30-39	40	64.5
40-49	10	16.1
>50	2	3.2
Gender	**n= 62**	
Male	18	29
Female	44	71
Cadre	**n= 62**	
MLS	32	51.6
MLT	18	29
HA	8	12.9
Others	4	6.5
Years used in the department (Years)	**n= 62**	
<5	26	41.9
5-10	30	48.4
11-15	3	4.8
>15	3	4.8
Current Unit	**n= 62**	
Reception/Phlebotomy	21	33.9
Blood Transfusion service	6	9.7
Clinical Chemistry	11	17.7
Haematology	2	3.2
Histopathology	5	8.1
Mirobiology	11	17.7
Others	6	9.7

Knowledge of Waste Management and Decontamination

Overall, 59.7% of respondents demonstrated adequate knowledge regarding biomedical waste categories and handling procedures. Most participants correctly agreed that sharps should always be disposed of in puncture-proof containers (96.8%). However, knowledge gaps were observed in the areas of most effective method of decontamination of infectious wastes with only 56.5% correctly identifying autoclaving as the most effective method. Awareness of what decontamination means was moderate, with 61% correctly agreeing with complete destruction of all microbial life, while only 59.7% were aware of the right place for waste segregation (point of generation), Table 2.

Table 2: Knowledge of Waste Management and Decontamination

Knowledge	***Frequency***	***Percentage %***
Site of Waste Segregation?	**n= 62**	
Point of generation	37	59.7
Collection area	15	24.2
Disposal site	10	16.1
Color code for infectious waste?	**n= 62**	
Black	9	14.5
Yellow/Red	53	85.5
Most effective decontamination method?	**n= 62**	
Autoclaving	35	56.5
Burning	17	27.4
Flushing in sinks	1	1.6
Burying underground	9	14.5
Dispose sharps in puncture-proof containers	**n= 62**	
Yes	60	96.8
No	2	3.2
Decontamination means?	**n= 62**	
Complete destruction of microbial life	38	61.3
Reduction of microbial load	24	38.7

Attitude Towards Waste Management

A majority of respondents (75%) demonstrated a positive attitude towards biomedical waste management and decontamination. Most strongly agreed that proper waste segregation reduces infection risk (88.7%) and that adherence to decontamination protocols is critical for laboratory safety (93.5%). Despite this, a small proportion (17.7%) perceived waste segregation as a time-consuming and strenuous task, indicating potential barriers to consistent compliance (Table 3).

Table 3: Attitude of participants towards Waste management and decontamination

Attitude	***Strongly agree frequency (%)***	***Agree frequency (%)***	***Undecided frequency (%)***	***Disagree frequency (%)***	***Strongly disagree frequency (%)***
Waste management is important in laboratory safety	58 (93.5)	1 (1.6)	1 (1.6)	0	2 (3.2)
Waste segregation is stressing and time-consuming	11 (17.7)	2 (3.2)	8 (12.9)	7 (11.3)	34 (54.8)
Decontamination reduces infection risks	55 (88.7)	6 (9.7)	0	0	1 (1.6)
Laboratory management support is necessary	54 (87.1)	5 (8.1)	0	1 (1.6)	2 (3.2)

Practice of Waste Management and Decontamination

In terms of practice, 58.1% of respondents adhered consistently to standard waste segregation procedures, while only 48.4% routinely segregated waste and followed proper decontamination protocols for laboratory instruments and surfaces. Notably, compliance with proper sharps disposal was high (71%). However, only small proportion of laboratory staff had received training on waste management and decontamination in the facility (37.1), while 66.1% felt the laboratory doesn't have facilities for proper waste management, as seen in Table 4.

Table 4: Practice of Waste Management among participants

Practice	*Frequency*	*Percentage (%)*
Use color-coded container for waste disposal?	**n= 62**	
Yes	36	58.1
No	26	41.9
Routinely segregate waste?	**n= 62**	
Always	30	48.4
Sometimes	19	30.6
Rarely	8	12.9
Never	5	8.1
Discard sharps into puncture-proof containers?	**n= 62**	
Always	44	71
Sometimes	12	19.4
Rarely	6	9.7
Received training on waste management in your facility?	**n= 62**	
Yes	23	37.1
No	39	62.9
Does your laboratory have adequate facilities for proper waste management?	**n= 62**	
Yes	21	33.9
No	41	66.1

Association Between Demographics and Knowledge

Chi-square analysis revealed significant associations between cadre and knowledge scores ($p = 0.02$), with high-cadre staff demonstrating greater awareness of proper waste handling. Years spent in the department was significantly associated with practice scores ($p = 0.01$), indicating that more experienced staff were more likely to consistently follow decontamination protocols. No significant association was observed between gender and Knowledge outcomes (Table 5).

Table 5: **Association Between demographic characteristics and knowledge of participants on waste management**

Sociodemographic characteristics				
	Good Freq (%)	**Poor Freq (%)**	**Total Freq (%)**	**p-value**
Age group (years)				0.50
20-29	9 (90.0)	1 (10.0)	10 (100.0)	
30-39	34 (85.0)	6 (15.0)	40 (100.0)	
40-49	8 (80.0)	2 (20.0)	10 (100.0)	
>50	0 (0)	2 (100.0)	2 (100.0)	
Gender				0.14
Male	17 (94.4)	1 (5.6)	18 (100.0)	
Female	35 (79.5)	9 (20.5)	44 (100.0)	
Cadre				0.02
MLS	31 (96.9)	1 (3.1)	32 (100.0)	
MLT	18 (100.0)	0 (0)	18 (100.0)	
HA	3 (37.5)	5 (62.5)	8 (100.0)	
Others	0 (0)	4 (100.0)	4 (100.0)	
Years used in the department (Years)				0.01
<5	19 (73.1)	7 (26.9)	26 (100.0)	
5-10	29 (96.7)	1 (3.3)	30 (100.0)	
11-15	1 (33.3)	2 (66.7)	3 (100.0)	
>15	3 (100.0)	0 (0)	3 (100.0)	
Current Unit				0.11
Reception/Phlebotomy	18 (85.7)	3 (14.3)	21 (100.0)	
Blood Transfusion	6 (100.0)	0 (0)	6 (100.0)	
Clinical Chemistry	10 (90.9)	1 (9.1)	11 (100.0)	
Haematology	2 (100.0)	0 (0)	2 (100.0)	
Histopathology	3 (60.0)	2 (40.0)	5 (100.0)	
Mirobiology	10 (90.9)	1 (9.1)	11 (100.0)	
Others	3 (50.0)	3 (50.0)	6 (100.0)	

Summary of Key Findings

Knowledge levels were generally adequate but gaps existed in specific technical areas such as point of segregation and methods of decontamination.

Attitudes were largely positive, reflecting awareness of the importance of waste management and decontamination.

Practices were poor in areas of routine segregation and adherence to decontamination protocols, with strong compliance in sharps disposal use.

Cadre and experience (years used in the department) were important predictors of knowledge and practice, respectively.

DISCUSSION

This study assessed the knowledge, attitude, and practice (KAP) of medical laboratory staff regarding waste management and decontamination at FUTA Teaching Hospital. The findings provide insight into areas of strength and gaps that may influence laboratory safety and compliance with established protocols.

Knowledge of Waste Management and Decontamination

Overall, the majority of laboratory staff demonstrated adequate knowledge of biomedical waste categories and general handling procedures, consistent with findings from previous studies in Nigeria and other developing countries (Oladele & Adebayo, 2019; Chukwuma et al., 2021). High awareness of infectious and sharps waste indicates that staff recognize the immediate risks associated with these waste types. However, gaps were noted in knowledge point of segregation and methods of decontamination, suggesting the need for more focused training on technical aspects of laboratory waste management. Similar gaps have been reported by Akhtar et al. (2020), who emphasized that knowledge deficiencies often translate into unsafe practices, particularly in areas requiring specialized handling.

Attitude Towards Waste Management

The positive attitude observed among the majority of respondents is encouraging, as attitude strongly influences adherence to safety practices[19]. Most staff recognized the importance of proper waste segregation and decontamination for occupational safety. Nonetheless, a minority perceived waste management as a low-priority task due to workload pressures, reflecting a potential barrier to consistent compliance. This finding aligns with previous research demonstrating that organizational and workload factors can negatively influence laboratory safety practices[2]

Practice of Waste Management and Decontamination

Practice scores were in areas of routine segregation and adherence to decontamination protocols, with strong compliance in sharps disposal use. This discrepancy between knowledge and practice is a common observation in KAP studies, indicating that awareness alone may not guarantee consistent application of safety protocols[5]. Factors such as availability of resources, workload, and institutional enforcement of protocols likely contribute to these variations. The finding that more experienced staff demonstrated better practice underscores the value of on-the-job training and mentorship in reinforcing safe laboratory behavior

Associations Between Demographics and KAP

Cadre was significantly associated with knowledge, suggesting that higher qualifications equip staff with a better understanding of waste management principles. Work experience (years used in the department) was linked to practice, indicating that practical exposure enhances adherence to protocols. Interestingly, gender did not significantly influence KAP outcomes, consistent with studies suggesting that professional training and experience are more predictive of safe laboratory behavior than demographic factors[1]

Implications for Practice and Policy

The findings highlight the need for ongoing professional development and structured training programs focusing on technical aspects of waste management, particularly chemical disinfection and proper segregation procedures. Institutional policies should emphasize periodic refresher courses, mentorship programs, and routine monitoring of adherence to standard operating procedures. Improving waste

management practices not only protects laboratory staff from occupational hazards but also minimizes environmental contamination and enhances overall patient safety.

Limitations

This study has some limitations. First, it was conducted in a single teaching hospital, which may limit the generalizability of the findings. Second, the use of self-reported questionnaires may introduce response bias, as participants could overreport compliance with safety protocols. Finally, the cross-sectional design precludes causal inferences between demographic factors and KAP outcomes.

RECOMMENDATIONS

- Implement targeted training workshops focusing on areas with knowledge gaps, particularly color-coded waste segregation and chemical decontamination.
- Introduce regular monitoring and evaluation of laboratory practices to ensure adherence to protocols.
- Encourage mentorship programs that leverage experienced staff to guide less experienced personnel in safe waste handling.
- Equip facilities with modern waste management and decontamination gears for easy and smooth adherence of laboratory staff to waste segregation and decontamination
- Expand future research to multiple centers to assess KAP across diverse laboratory settings in Nigeria.

CONCLUSION

This study revealed that medical laboratory staff at FUTA Teaching Hospital generally possess adequate knowledge and positive attitudes toward biomedical waste management and decontamination. However, gaps exist in technical knowledge, particularly segregation and decontamination protocols, and practice adherence was low, with lower compliance in some decontamination procedures. Educational level and work experience were significant predictors of knowledge and practice, respectively. These findings underscore the need for continuous training, structured mentorship, and institutional policies that reinforce safe laboratory practices. Improving KAP among laboratory staff is essential for occupational safety, patient protection, and environmental sustainability in medical laboratories.

CONFLICT OF INTEREST

There is no conflict of interest regarding the publication of this research. All contributions were made solely for academic and scientific purposes without any financial, personal, or institutional influence that could have affected the outcome or interpretation of the study.

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