



Hospital Wastes Handlers' Understanding of Medical Waste in Selected Hospitals in Ota, Nigeria

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Abstract: The study assessed waste handlers' understanding of hospital waste components, in order to provide information that would inform policy intervention. Data was collected through questionnaire administration. There were thirty-eight (38) hospitals distributed across five (5) political wards in Ota Township. Twenty-five per cent of the hospitals were sampled, two hospitals in each ward, making ten altogether. Questionnaires were administered to all forty-nine waste handlers in the surveyed hospitals. Data were analysed using descriptive and inferential statistics. The study established that only 8.2% and 14.3% of waste handlers were informed on colour-coded storage receptacles for pharmaceutical and sharp materials respectively. Though 46.9% of waste handlers knew that pathological, pharmaceutical, sharps and infectious wastes were harmful. However, 53.1% was not aware of the harmful nature of radioactive waste. The use of protective materials by the waste handlers was noted to be inadequate. Training of cleaners on proper management of medical waste was insufficient. It was found that there is a strong relationship between educational status and monthly income of the cleaners ($r = .67$, $p > .05$), though not significant. It could be concluded that waste handlers in the selected hospitals did not fully understand the hazardous nature of medical waste components.

Keywords: Waste handlers, hazardous materials, hospital, storage receptacle, Ota

I. Introduction

Healthcare waste comprises all the waste materials generated from the treatment, diagnosis or immunisation of humans and/or animals at hospitals, veterinary and medical centres [1]. Waste emanating from healthcare facilities is diverse. Generally, healthcare waste is classified into two major groups: general/non-hazardous and hazardous/special waste. It is noted however that between 75 to 90% of the waste generated in healthcare is non-hazardous or general that is comparable with domestic or municipal solid waste [2,3]. General waste is not potentially dangerous; therefore, it requires no special handling, treatment or disposal [4]. It should be dealt with via the

municipal waste disposal mechanism [4]. The remaining 10 – 25% of healthcare waste is considered hazardous/special [5]. According to World Health Organization definition, hazardous/special waste includes: infectious, pathological, genotoxic, pharmaceutical, chemical, waste with high metal content, pressurized containers and radioactive waste, most of which are toxic, harmful, carcinogenic and infectious in nature [6]. This category of waste could have adverse effects on the environment and human health, especially cleaners that deal directly with the waste [3].

Waste handlers' understanding of healthcare waste especially hazardous materials is a prerequisite for its sustainable management. Inadequate training for cleaners on the nature of healthcare waste components might create a problem that could mar the whole management processes. [7] noted that it is a common practice in developing countries for

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the municipal waste handler to treat healthcare and domestic waste the same way, because of inadequate understanding of hazardous nature of the formal. This unsafe healthcare waste management such as lack of segregation, unsafe collection and transportation is observed to be common in a study conducted in India [8]. It is of importance to note that improper handling of medical waste has resulted in 8 to 16 million new cases of Hepatitis B virus (HBV), 2.3 to 4.7 million cases of Hepatitis C virus (HCV) and 80,000 to 160,000 cases of Human Immunodeficiency Virus (HIV) [5]. A study conducted by [9] documented that poor management of healthcare waste is a major cause of diseases such as hepatitis B and C, HIV/AIDS, and tetanus. Others are eye infections, asthma, dysentery, sore throat and cough. Some of which are life-threatening. Furthermore, it was observed that health workers such as nurses, doctors and pharmacists including waste handlers, sweepers and other auxiliary staff as well as relations of patients are prone to diseases. [10] established that injuries and infections often occur as a result of the fact that syringe, needles or other sharps were not properly kept in safety boxes, whereas sharp materials are considered to be the most dangerous category of waste.

Paradoxically, healthcare facilities which are meant to protect the health, cure patients and save lives have been known to also generate waste that are hazardous to human health and the environment. Thus, for healthcare facilities to fulfil its primary purpose, serious attention must be given to training and re-training of waste handlers in order to be abreast of time on issues relating to healthcare waste especially hazardous materials, so as to ensure its sustainable management from generation to final disposal. Against this backdrop, the study, therefore, investigated

the knowledge of the cleaners on the nature of healthcare waste components as well as the use of colour-coded storage receptacles and personal protective equipment in the selected hospitals in Ota, Nigeria.

Literature is replete with studies on cleaners' understanding of healthcare waste components. For instance, studies conducted in Tanzania regarding medical waste management practices showed that awareness on issues related to medical waste management is lacking among cleaners [11]. [12] demonstrated that healthcare workers with access to documents about healthcare waste management reported good handling practices. Nurses had better access (91%) than doctors (15%), which tallied with the fact that nurses had significantly better knowledge of the issues than doctors and by extension cleaners.

Training is almost universally described as inadequate in reports about medical waste management. Even where awareness is good, such as in the hospital described by [12], only 32% of the study participants found out about medical waste management policies through seminars or courses. Besides, only 23% of Bangladeshi waste workers had received basic information about health and safety in medical waste management and the majority of these had received it from a local non-governmental organization, rather than their own employers. The general lack of understanding of the hazards was illustrated by both attitude and behaviour. People used containers including sharps containers to store food, and healthcare workers giving patients used hazardous waste bin liners to carry their belonging [13].

[14] in a study conducted in Iran noted that there was no training on medical waste handling or the associated hazards in a sampled of 15 hospitals. No training on waste

is given to doctors or other personnel in Serbia [15]. Medical staff members in six Nigerian hospitals were unaware of medical waste management regulations and hospital policies [16]. In Tripoli, Libya, a survey of 300 medical waste handlers, working for a local contractor, found that only 7% had received training in waste handling, and 21% were immunized against hepatitis B [17]. Another survey, across 14 hospitals in three cities, found that 85% of personnel, from managers to cleaning staff, had no training or detailed information about their duties regarding waste management, 55% of medical staff were under-informed about waste management risks and procedures and 90% of municipal waste handlers were unaware of the hazards of medical waste [18].

II. Materials and Methods

The study area, Ota, consists of eight (8) political wards [19]. Five of the wards are within Ota township. These are Wards I, II, III, Iju and Ilogbo. The remaining wards are at the outskirts, namely: Sango, Ijoko and Atan. The study focused on wards in Ota township. Data was obtained through questionnaire administration. Questionnaires were administered to all cleaners in each of the hospitals. Information obtained were socioeconomic characteristics, knowledge on colour code storage bins, nature of medical waste generated, frequency of training and usage of personal protective equipment (PPE).

There are thirty-eight (38) hospitals distributed within the five (5) political wards in Ota township (see Table 1). A total of 10 hospitals (25%) of the hospitals in Ota township) were sampled. Using a stratified sampling technique, two hospitals were selected from each ward. This translated to 10 hospitals as shown in Table 2.

Table 1: Distribution of healthcare centres in central area of Ota

Ward	Number
Ward 1	7
Ward 2	19
Ward 3	2
Iju Ward	8
Ilogbo Ward	2
Total	38

Questionnaires were administered to all cleaners in each of the selected hospitals. A total of 49 questionnaires were administered. Data collected were analyzed using descriptive and inferential statistics. Descriptive statistics used are percentage, mean, and frequency distribution. Correlation analysis was inferential statistics used. Unless otherwise stated, all the tables in the study emanated from the survey of 2018.

Table 2: Hospitals selected for survey in each ward

Ward	Hospital
Ward 1	Osi Primary Health Centre and T Ifeoluwa clinic and Maternity Home
Ward 2	General Hospital and Central Specialist
Ward 3	Faramed Clinics and the Twins Hospital & Medical Centre
Iju Ward	Krownfit Medical Clinic and Ace Medicare Clinics
Ilogbo Ward	Sure Mercy and Jesus Save clinics

III. Results and Discussion

A. Socioeconomic Characteristics of the Cleaners

Four socioeconomic attributes of the cleaners considered to be of relative importance to waste management activities were examined. These are age, gender, income and educational status of cleaners.

The study shows that the age group between 25-31 years constituted the highest (46.9%). In order of magnitude, cleaners within the age bracket of 32 -38 years (30.6%) ranked second, while cleaners above 46 years accounted for 2.0%. This finding might be as a result of the fact that young adults are presumed to work better compared to old

adults. Results of the analysis on the gender of cleaners show that majority (57.1%) were female, while the proportion of male cleaner was 42.9%. This might be attributable to the notion that waste management activities are the exclusive duty of female in the cultural setting of the study area.

The results of the analysis on the monthly income of the cleaners show that 51.0% earned less than ₦25,000, which is less than ₦30,000 minimum wage in Nigeria. The proportion of cleaners that earned between ₦25,000 and ₦38,000 was 20.4%, while the cleaners that earned above ₦38,000 as monthly income constituted 28.6%. It has been noted that poor remuneration of cleaners is a major contributing factor to inadequate management of healthcare waste particularly in a developing country such as Nigeria [13]. Furthermore, analyses on the educational status of the cleaners show that majority (69.4%) possessed secondary school certificate. Ranked next were those with tertiary education. The proportion of cleaners in this group was 22.4%. Cleaners in this category were holders of Ordinary National Diploma (OND) and Nigerian Certificate in Education (NCE). Cleaners with no formal education constituted the least (2.0%).

Further analyses show that there is a strong relationship between educational status and monthly income of the cleaners ($r = .67$, $p > .05$), however, the correlation is not significant. The coefficient of determination (R^2) established that educational attainment accounts for 67.0% of the variability in the monthly income of the cleaners.

B. Cleaners' Understanding of Medical Waste Components

i. Colour Codes for Medical Waste Components

The recommended colour coded storage bin for pathological waste is yellow. The results show that none of the cleaners had an idea of the colour-coded storage bin for a pathological storage bin. Red or brown colour coded is recommended for pharmaceutical. It could be seen that only 8.2% of the cleaners had knowledge of required colour-coded bin for pharmaceutical waste. Sharp materials are expected to be stored in yellow plastic bags marked "sharp" or safety box marked "sharp". As shown in Table 4, 14.3% of the cleaners were informed on the colour coded bin to be used for storing sharp waste. Yellow storage receptacle is recommended for infectious waste. Findings show that all the cleaners surveyed were not informed on the colour-coded bin to be used for infectious materials. Radioactive waste is to be stored in a yellow container with a radioactive symbol. Information from the table indicates that all the cleaners had no knowledge of the colour coded bin required for radioactive waste. Storage receptacle with black colour is the recommended bin for general or domestic waste.

It could be established from the table that only 75.5% of the cleaners were aware of the colour coded bin meant for general or domestic waste. It could be inferred that since information on storage bin colour coded bin to be used for different waste components is inadequate, it would be right to say waste segregation practice in the surveyed hospitals would be deficient. This might pose serious problem to the sustainable management of medical waste. Consequently, health hazards resulting from improper management of this category of waste might be rampant.

ii. Knowledge on Nature of Medical Waste

Table 3: Socioeconomic characteristics of waste handlers

Hospital	Age					Gender			Income				Educational status			
	18-24ys (%)	25-31ys (%)	32-38ys (%)	39-46ys (%)	>46ys (%)	Female (%)	Male (%)	<#18,000 (%)	18,000-24,000 (%)	25,000-32,000 (%)	32,000-38,000 (%)	>#38,000 (%)	NFE (%)	Primary (%)	Secondary (%)	Tertiary (%)
General	3 (6.1)	13 (26.5)	9 (18.4)	2 (4.1)	1 (2.0)	14 (28.6)	14 (28.6)	6 (12.2)	9 (18.4)	3 (6.1)	2 (4.1)	8 (16.3)	0 (0.0)	2 (4.1)	19 (38.8)	7 (14.3)
Farmed	0 (0.0)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)	0 (0.0)	1 (2.0)	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	0 (0.0)
Twins	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	0 (0.0)	2 (4.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	0 (0.0)
Krown	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	0 (0.0)	0 (0.0)	2 (4.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	0 (0.0)
fit	0 (0.0)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)
Sure	0 (0.0)	1 (2.0)	1 (2.0)	1 (2.0)	0 (0.0)	3 (6.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	2 (4.1)	1 (2.0)	0 (0.0)	1 (2.0)	1 (2.0)
mercy	0 (0.0)	1 (2.0)	1 (2.0)	1 (2.0)	0 (0.0)	3 (6.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	2 (4.1)	1 (2.0)	0 (0.0)	1 (2.0)	1 (2.0)
Central	0 (0.0)	1 (2.0)	1 (2.0)	1 (2.0)	0 (0.0)	3 (6.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	2 (4.1)	1 (2.0)	0 (0.0)	1 (2.0)	1 (2.0)
specialist	0 (0.0)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)	0 (0.0)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	0 (0.0)
Tifeoluwa	0 (0.0)	2 (4.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	2 (4.1)	0 (0.0)
Jesus	0 (0.0)	1 (2.0)	2 (4.1)	0 (0.0)	0 (0.0)	3 (6.1)	1 (2.0)	1 (2.0)	0 (0.0)	2 (4.1)	0 (0.0)	1 (2.0)	0 (0.0)	1 (2.0)	2 (4.1)	1 (2.0)
saves	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)
Osi	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)
PHC	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)
ACE	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.1)	1 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	1 (2.0)	1 (2.0)
Medicare	0 (0.0)	1 (2.0)	1 (2.0)	1 (2.0)	0 (0.0)	3 (6.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	2 (4.1)	1 (2.0)	0 (0.0)	1 (2.0)	1 (2.0)
Total	7 (14.3)	23 (46.9)	15 (30.6)	3 (6.1)	1 (2.0)	28 (57.1)	21 (42.9)	12 (24.5)	13 (26.5)	7 (14.3)	3 (6.1)	14 (28.6)	1 (2.0)	3 (6.1)	34 (69.4)	11 (22.4)

Note: PHC means Primary Health Centre NFE means No Formal Education

Table 4: Knowledge on colour-coded storage bin for medical waste components

Component	Colour Code							Total
	Yellow (%)	Red (%)	Blue (%)	Orange (%)	Black (%)	White (%)	Brown (%)	
Pathological	0 (.0)	24 (49.0)	2 (4.1)	0 (.0)	9 (18.4)	14 (28.6)	0 (.0)	49 (100.0)
Pharmaceutical	16 (32.7)	4 (8.2)	0 (.0)	1 (2.0)	14 (28.6)	14 (28.6)	0 (.0)	49 (100.0)
Sharps	7 (14.3)	10 (20.4)	10 (20.4)	9 (18.4)	1 (2.0)	12 (24.5)	0 (.0)	49 (100.0)
Infectious	0(0)	26 (53.1)	0 (.0)	10 (20.4)	12 (24.5)	1 (2.0)	0 (.0)	49 (100.0)
Radioactive	0 (.0)	13 (26.5)	14 (28.6)	0 (.0)	9 (18.4)	13 (26.5)	0 (.0)	49 (100.0)
General/Domestic	0 (.0)	2 (4.1)	1 (2.0)	0 (.0)	37 (75.5)	9 (18.4)	0 (.0)	49 (100.0)

Knowledge of the cleaners on the harmful nature of medical waste was evaluated. It was discovered that 85.7% of the cleaners knew that pathological waste is harmful, if not properly handle, while 14.3% was ignorant of its harmful nature. A large proportion (83.7%) of cleaners surveyed indicated that pharmaceutical waste was not harmful, while 16.3% was aware of its harmful nature. All the

cleaners were informed on the harmfulness of sharp materials. The cleaners' knowledge on the harmful nature of infectious waste was very high in the selected hospitals. As shown in the table, 95.9% of the cleaners were informed on the harmful nature of infectious materials, only 4.1% lack idea of its harmfulness. Majority (53.1%) of the cleaners had no knowledge of radioactive waste has

being harmful. The percentage of cleaners that were aware of its harmful nature was just 46.9%. General or domestic waste was not harmful if it is not mixed with other medical wastes. However, 12.2% of the cleaners still regarded the waste has been harmful. Inadequate information on the nature of medical waste components by the cleaners in the selected hospitals will in no doubt hampered environment-friendly medical waste management. This finding is in agreement with a study conducted in Tanzania by [10].

iii. Training of Cleaners on Hospital Waste Management

Table 5 shows the findings on the frequency of training received by the cleaners on medical waste management practices. In aggregate, most (57.1%) of the cleaners asserted that they underwent training once in a year.

Cleaners that received training once in every two years constituted 4.1%. Those that rarely receive training account for 38.8% of the total. The nature of medical waste required adequate information on every aspect of its management. The information would be better acquired through training, which if it is lacking or not adequate may pose serious danger to the health of the cleaners, health professionals and the general public.

iv. Personal Protective Equipment (PPE) Usage by Cleaners

The usage of personal protective equipment (PPE) by the cleaners reveals that only 42.9% made use of all the materials. As shown in the table, 18.4% of the cleaners used all the PPE except overall. Boots and nose guards were used by 4.1% of the cleaners. The cleaners that used all the gears except glove constituted 14.3%. Besides, cleaners that used

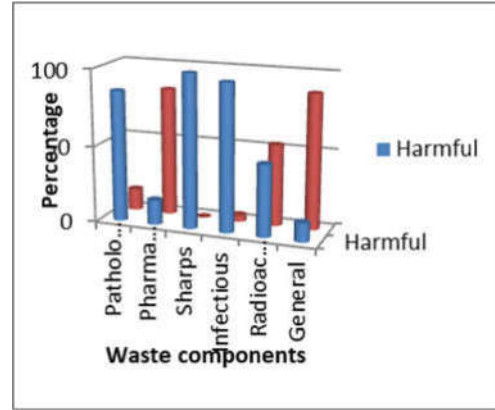


Figure 1: Knowledge of Nature of Medical Waste

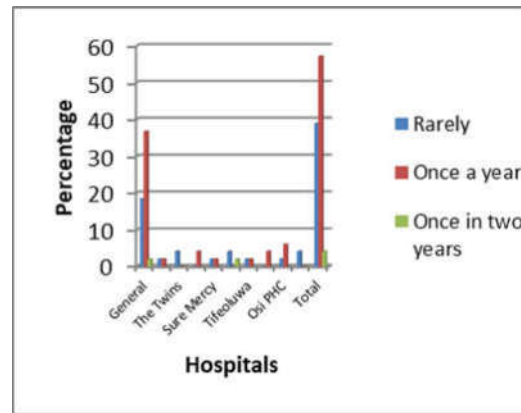


Figure 2: Training of Cleaners on Medical Waste Management

glove, nose guard and overall accounted for 8.2%. The proportion of the cleaners that used boot and overall constituted 2.0%, however, only 10.2% of the cleaners' utilized glove and nose guard during the waste management activities. In aggregate, it could be established that 57.1% of the cleaners in the selected hospitals were deficient in the use of one or two of PPE. This might have serious implications for cleaners' health and the environment due to potential risks and hazards of the category of waste involved. On the basis of each hospital, only cleaners in ACE Medicare claimed to use all protective gears provided. This might be attributed to their educational status, coupled with appropriate monitoring mechanism put in

place by the director of the hospital. Cleaners also noted that some of the cleaners cannot

Table 5: Protective gears usage

Hospital	Protective Gears Usage							Total
	All (%)	All except overall (%)	Boot & nose guard (%)	All except glove (%)	Glove, nose guard & overall (%)	Boot & overall (%)	Glove & nose guard (%)	
General	13 (26.5)	2 (4.1)	2 (4.1)	5 (10.2)	2 (4.1)	1 (2.0)	3 (6.1)	28 (57.1)
Faramed	1 (2.0)	1 (2.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	2 (4.1)
The Twins	1 (2.0)	1 (2.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	2 (4.1)
Krownfit	1 (2.0)	0 (.0)	0 (.0)	1 (2.0)	0 (.0)	0 (.0)	0 (.0)	2 (4.1)
Sure mercy	1 (2.0)	0 (.0)	0 (.0)	1 (2.0)	0 (.0)	0 (.0)	0 (.0)	2 (4.1)
Central specialist	1 (2.0)	0 (.0)	0 (.0)	0 (.0)	2 (4.1)	0 (.0)	0 (.0)	3 (6.1)
Tifeoluwa	1 (2.0)	1 (2.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	2 (4.1)
Jesus saves	0 (.0)	1 (2.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	1 (2.0)	2 (4.1)
Osi PHC	0 (.0)	3 (6.1)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	1 (2.0)	4 (8.2)
ACE Medicare	2 (4.1)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	0 (.0)	2 (4.1)
Total	21 (42.9)	9 (18.4)	2 (4.1)	7 (14.3)	4 (8.2)	1 (2.0)	5 (10.2)	49 (100.0)

of other hospitals surveyed were deficient in the use of one or two of the protective materials. None usage of complete protective gears increases the propensity of cleaners to get infected during their daily routine.

IV. Conclusion and Recommendations

The study found that the level of literacy among the cleaners in the surveyed hospitals was low. Most of the cleaners were illiterates, primary or secondary school certificate holders. Consequently, their understanding regarding medical waste components and how it should be managed was found to be inadequate. In addition, another factor noted to contributing to low-level awareness on issues relating to medical waste among the cleaners was insufficient training. It has been documented in the literature that cleaners gained an understanding of the nature of healthcare waste through training [11]. This was found to influence their perception, disposition and handling of medical waste. It was discovered that many of the cleaners cannot differentiate between medical waste that is hazardous and non-hazardous. It is

identify colour coded storage receptacle required for different medical waste components. It was found that majority of the cleaners did not use complete protective gears. This is could also be attributed to inadequate information on the importance of using protective gears.

Therefore, an improvement in training and awareness creation for cleaners' is urgently needed in order to prevent occupational health hazards and at the same time safeguard the environment. The training will among other things be focused on issues relating to the type of colour code storage receptacle to be used for different medical waste components, identification of infectious, hazardous and non-hazardous waste components and the proper use of personal protective equipment.

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References

- [1]. Mbongwe, B., Mmereki, B.T. and Magashula, A. "Healthcare Waste Management Current Practices in Selected Healthcare Facilities", *Waste Management*, vol. 28, 2008, pp. 226-233.
- [2]. Pruss, A., Giroult, E. and Rushbrook, P. "Safe Management of Waste from Healthcare Activities", Geneva, Switzerland: World Health Organization, 1999.
- [3]. Chaerul, M., Tanaka, M. and Shekdar, A. "A System Dynamics Approach for Hospital Waste Management", *Waste Management Research*, vol. 28, 2008, pp. 442-449.
- [4]. Lee, B.K. Ellenbecker, M.J. and Moure-Ersaso, R. "Alternatives for treatment and disposal cost reduction of regulated medical wastes" *Waste Management*; 24; 2004, pp. 143-151
- [5]. Khan, B.A., Cheng. L., Khan, A.A. and Ahmed, H. "Unsafe Small Clinics Practices Causing New HIV Outbreaks in Pakistan", *J. Hosp. Infect.*, doi: 10.1016/j.jhin.2019, 10.003.
- [6]. Chartier, Y. "Safe Management of Wastes from Health-Care Activities", World Health Organization; Geneva, Switzerland, 2014.
- [7]. Marinkovic, N., Vitale, K., Holcer, N.J., Dzakula, A. and Pavic, T. "Management of Hazardous Medical Waste in Croatia", *Waste Management Research*, vol. 28, 2008, pp. 1049-1056.
- [8]. Khan, B.A., Khan, A.A., Ahmed, H., Shaikh, S.S., Peng, Z. and Cheng, J. "A Study on Small Clinics Waste Management Practice, Rules, Staff Knowledge, and Motivating Factor in a Rapidly Urbanizing Area", *International Journal of Environmental Research and Public Health*, vol. 16, no. 20, 2019, pp. 40 – 44.
- [9]. Diaz, L.F., Savage, G.M. and Eggerth, L.L. "Alternatives for the Treatment and Disposal of Healthcare Wastes in Developing Countries", *Waste Manag.*, vol. 25, 2005, pp. 626–637.
- [10]. Coker, A.O. "Engineering Application in the Management of Waste from General and Specialist Hospitals in Ibadan, Nigeria", (*PhD thesis*), Department of Agricultural and Environmental Engineering, University of Ibadan, Ibadan, Nigeria, 2002.
- [11]. Manyele, S.V. and Lyasenga, T.J. "Factors Affecting Medical Waste Management in Low-level Health Facilities", *Environmental Science and Technology*, vol. 4, no. 5, 2010, pp. 304-318.
- [12]. Manyele, S.V. and Anicetus, H. "Management of Medical Waste in Tanzanian Hospitals", *Tanzania Health Res. Bull.*, vol. 8, no. 3, 2006, pp. 177-182.
- [13]. Ramokate, T. and Basu, D. "Health Care Waste Management at an Academic Hospital: Knowledge and Practices of Doctors and Nurses", *South African Medical Journal*, vol. 99, no. 6, 2009, pp. 444-445.
- [14]. Patwary, M.A., O'Hare, W.T. and Sarker "Assessment of Occupational and Environmental Safety Associated with Medical Waste Disposal in Developing Countries: A Qualitative Approach", *Safety Science*, vol. 49, 2011, pp. 1200-1207.
- [15]. Askarian, M., Vakili, M. and Kabir, G.H. "Results of a Medical Waste Survey in Private Hospitals in Fars Province, Iran", *Waste Management*, vol. 24, 2004, pp. 347-352.
- [16]. Stankovic A., Nikic D. and Nikolic M. "Report: Treatment of Medical Waste in Nisava and Toplica Districts, Serbia", *Waste Management & Research*, vol. 26, 2008, pp. 309–313.
- [17]. Ndidi, N., Ocheke, N., Odumosu, P. and John, S.A. "Waste Management in Healthcare Establishments within Jos Metropolis, Nigeria", *African Journal of Environmental Science and Technology*, vol. 3, no. 12, 2009, pp. 459 – 465.
- [18]. Franka, E., El-Zoka, A.H. and Hussein, A.H. "Hepatitis B Virus and Hepatitis C Virus in Medical Waste Handlers in Tripoli, Lybia", *The Journal of Hospital Infection*, vol. 72, 2009, pp. 258–261.
- [19]. Sawalem, M., Selic, E. and Herbell, J.D. "Hospital Waste Management in Libya: A Case Study", *Waste Management*, vol. 29, 2009, pp. 1370–1375.
- [20]. Independent National Electoral Commission 2015, www.inec.org.ng accessed on October, 25, 2020