On the Evaluation of Waste Management Practices at Ward Level in a Tertiary Hospital in Lagos, Nigeria

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Abstract
The management of Health Care Waste (HCW) is highly important towards reducing the risk of infections. Attention should be focused on the cradle of the generation, which is the wards. This study assessed the management of wastes from the 22 wards and a diagnostic centre of a tertiary hospital in Lagos, Nigeria. Data on waste generation, segregation, storage and collection practices were collected from the wards. The general observation from all the wards is that guidelines and standards of health care waste management according to WHO were not adhered to. The average waste generated ranged from 0.14 kg bed^{-1} day^{-1} at the private ward to 1.46 kg bed^{-1}day^{-1} at the diagnosis centre. The general waste generated was about 63.4 % of the total wastes and these were mostly from the children ward. The waste generated from the private ward was the least. The female surgical and gynaecology wards have the largest amount of infectious waste, with each generating 4.94 kg day^{-1} and 4.02 kg day^{-1} respectively. Re-orientation of the hospital workers and management of waste from source could reduce the risk of HCW to the society.

Keywords: *Hazardous, health care, Infectious, waste disposal*

1.0 INTRODUCTION

Hospitals play a vital role in the society through the provision of diagnostic, therapeutic, research and rehabilitative services. In the process of performing these activities, health care facilities generate wastes, which can be classified as general and hazardous wastes. Wastes are from hospitals, primary health-care centers, dispensaries, dialysis centers, first-aid posts and sick bays, medical and biomedical laboratories, biotechnology laboratories, medical research centers, mortuary and autopsy centers, blood banks and blood collecting centers, nursing homes for elderly, maternity homes, pharmaceutical, chemical and chemist stores (Tudor *et al.,* 2005; Mokuolu, 2009). Wastes from hospitals and other Health Care Facilities are of different types and come from different sources. The sources of the wastes are offices, clinics, diagnosis centre, theater, recreation centers, wards and other facilities that may be available in the hospital based on the peculiarity of such facility. The wastes are generated by the patients (in and out) and the staff of the hospitals. They are generally classified into two viz: general and hazardous. The general waste does not pose risk of injury or infections and are similar to household related wastes (Azage and Kumie, 2010). The hazardous waste is associated with undesired biological and chemical health damages in the course of its management (Halbwachs, 1994; Akter, 2000).

Hospital waste (HW) is potentially dangerous, as it may possess pathogenic agents which are infectious. Hazardous hospital waste management (HWM) can lead to environmental pollution and transmission of diseases like typhoid, cholera, hepatitis and AIDS through injuries from syringes and needles contaminated with human blood (Henry and Heinke, 1996). This can cause economic wastes to the nation.

The management of HW, though labeled as hazardous, because of the serious direct threat it poses to human health (WHO, 1999) is reported to have little or no attention in most developing countries. Manyele *et al*. (2003) observed that HWM in Tanzania, South Africa, Mozambique and Swaziland is poor and Da Silva *et al*. (2005) noted that HW was given only little attention in Southern Brazil. A WHO (1999) report noted that though HW constitutes a small fraction of the municipal solid wastes, the potential health hazards could be deleterious if not properly handled. In particular, Slack *et al*. (2004) singled out developing countries as being the worst affected.

Farzadkia *et al*. (2009), Longe and Williams (2006), and others studies have concentrated on the management and comparison of different types of wastes generated from different hospitals globally, in terms of types, quantity and the volume/weight per bed per day. These have contributed largely to the knowledge of the characteristics and quantity of waste generated from different types of hospitals.

There are a number of factors that determined the volume and characteristics of health care waste, such as established methods of waste management, type of healthcare establishment, degree of health facility specializations, proportion of reusable items employed in health care, patient work load and level of development of the community or country where the health care is located (Akter, 2000; WHO, 2000 and WHO 2004).

Globally, various methods have been adopted to assess and quantify HW, such as the use of physical observation, questionnaire administration and quantification (Olukanni *et al*., 2014; Abah and Ohimain, 2013; Adegbita *et al*., 2010; Olubukola, 2009; Phengxay *et al*., 2005), as well as checklists (Townend and Cheeseman, 2005) and measurement of the total waste generated in the entire health care (Sangodoyin and Coker, 2005). These could not give an insight to the quantum of wastes being generated from each waste generator sources and means of managing such waste from source.

Therefore, the aim of this study is to investigate the wastes generated from different wards of a tertiary hospital in Lagos and the management of such waste.

2.0 MATERIALS AND METHOD

The study was conducted in a tertiary hospital located in the urban center of Lagos, Lagos State, Nigeria. The hospital has 22 wards and 1 diagnostic centre. The method employed involves a cross – sectional survey of the wards in the hospital, oral interview of staff in the wards and collection of wastes from the wards and diagnostic centre for fourteen (14) days. The 22 wards comprised male surgical, female surgical, pediatric surgical, children, gynecology, post-natal, pre-natal, psychiatric, orthopedic, general and private wards. The number for each of the wards is detailed in **Table 1**.

The hospital serves as general and referral hospital and treats all types of ailments both medical and surgical. Due to services rendered, the waste generated from the hospital is complex. It is, therefore, imperative to examine the waste that emanates from each of

the wards and compare such in terms of quantity, type and composition towards having proper management from the waste source.

Table 1: Wards and bed spaces in a tertiary Hospital, Lagos, Nigeria

Ward	No. of wards	Bed space
Female Surgical (F. S)	4	116
Male Surgical (M.S)	3	89
Pediatric (PEDI)	1	14
Children (C.W)	3	51
Gynecology (GN)	2	81
Pre Natal (PRN)	1	20
Post Natal (PN)	2	44
Psychiatric (PSY)	1	14
Orthopedic (ORTH)	1	12
General (G.W)	2	24
Private (PW)	2	22
Diagnosis centre (DIAG)	1	2

The collection of the waste in the wards was carried out between May and June, 2010. The characterization of the waste was carried out in accordance with WHO guidelines as reported in Longe and Williams (2006). Different types of bags were put in each ward for the collection of different wastes. The wastes were classified into “general”, “infectious”, “sharps” and “others”.

Segregation of the wastes was done from the wards according to their nature and characteristics. The following categories were used: sharps, infectious, general and others. A process of colour coding was adopted in each of the wards prior to collection. Despite the colour coding, majority of the medical workers and patients in the wards did not follow the sorting procedure. The general waste in the black bag was not segregated.

The weighing of the waste was performed at a designated place very close to the disposal point where the city waste manager, Lagos State Waste Management Authority (LAWMA) collects the latter for disposal. The medical wastes were previously sorted in each ward before collection for transfer into the final disposal point. The survey was carried out primarily in the wards where in-patients were admitted for treatment. No consideration was given to the outpatients, the theater where surgeries take place and the offices. Thus, the results of the composition do not include the pathological wastes from those areas.

3.0 RESULTS AND DISCUSSION

3.1 Waste Segregation and Storage

Management of solid waste is best done through reduction from source most especially the hazardous one. For HCW, segregation at source reduces the volume of hazardous that eventually gets to dumping site. This will eliminate further spreading of the hazard through mixing with other waste material. Segregation also results in the reduction of cost of waste management wherever it is applied. It was observed that partial segregation of waste from ward is being done through sorting of sharps from other wastes.

The major problem noticed was the multiple uses of black plastic bags for storage of infectious and general waste without appropriate labeling. There was no colour coding in the collection of the wastes from the wards. This was due to careless attitude and

lack of knowledge on HWM as confirmed by Aukohr (2008).The study confirmed the observation of Longe and Williams (2006) that there is a complete absence of waste segregation in the wards of the hospital. The general wastes were stored in the black bag as required by LAWMA. The only problem was that some of the medical workers intentionally dropped infectious waste into the general waste bag. It is pertinent to note that, the instruction of Hagen *et al*. (2001) that, to achieve effective segregation of waste in health care facility, provision of instructive posters is very important to educate the health workers.

3.2 Health Care Waste Generation

The composition and percentage of the medical waste generated from wards in the hospital are shown in **Table 2**. The general waste from the total waste stream generated from the ward was 63.4 % while the medical infectious waste was 22 %. The sharps and other wastes were 8.0 % and 7.1 % respectively. Thus, majority of the waste generated from the wards fall into the general waste category. The only section with the lowest percentage of the general waste was the diagnosis centre.

Table 2: Average total waste generated in each ward (Kg day^{-1})

Ward	General waste %	Infectious waste, %	Sharps, %	Others, %
Female Surgical	17.06 (63.2)	4.94 (18.3)	1.88 (6.7)	3.18 (11.8)
Male Surgical	14.10 (66.1)	3.48 (16.3)	1.54 (7.2)	2.22 (10.4)
Gynecologist	12.94 (66.6)	4.02 (20.6)	1.43 (7.3)	1.06 (5.5)
Post Natal	10.21 (63.8)	2.88 (18.0)	1.32 (8.2)	1.59 (9.9)
Pre Natal	4.52 (75.2)	0.80 (13.4)	0.53 (8.8)	0.16 (2.7)
Children	18.41 (76.9)	2.84 (11.9)	2.07 (8.6)	0.63 (2.6)
Diagnosis	0.69 (23.7)	1.86 (63.5)	0.07 (2.4)	0.30 (10.4)
Psychiatric	3.61 (66.6)	0.99 (18.3)	0.43 (8.0)	0.39 (7.1)
Orthopedic	1.78 (64.2)	0.37 (13.4)	0.37 (13.3)	0.25 (9.1)
Pediatric	2.97 (70.3)	0.71 (16.7)	0.39 (9.2)	0.16 (3.8)
General	3.07 (58.9)	1.33 (25.5)	0.45 (8.5)	0.37 (7.1)
Private	4.55 (65.8)	1.53 (22.2)	0.54 (7.7)	0.30 (4.4)

The percentage of medical infectious waste in the waste stream ranged from 11.9 % to 63.5%. The children ward had the least percentage of the infectious waste. The diagnosis centre had the highest percentage of infectious wastes in the waste stream due to the presence of disposable bags. This observation agreed with Aukohr (2008). The general infectious and sharp wastes from each ward are shown in **Figures 1-3**.

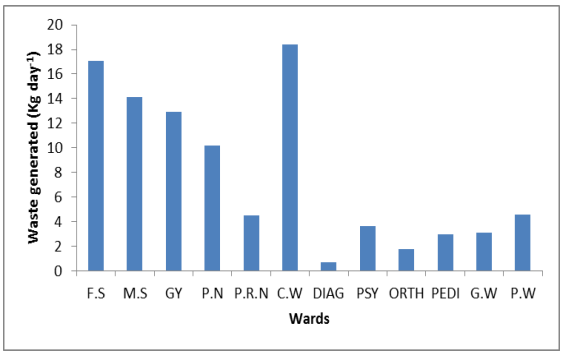

Figure 1: Average general waste generated at ward level in kg day^{-1}

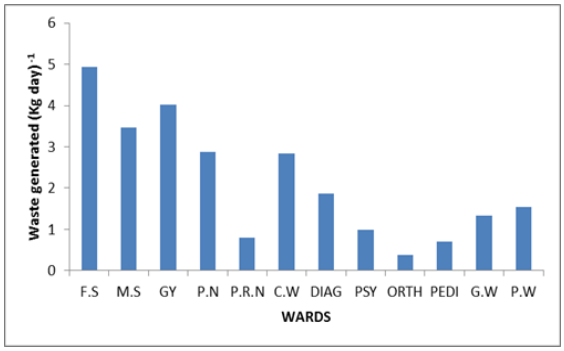

Figure 2: Average infectious waste generated by wards

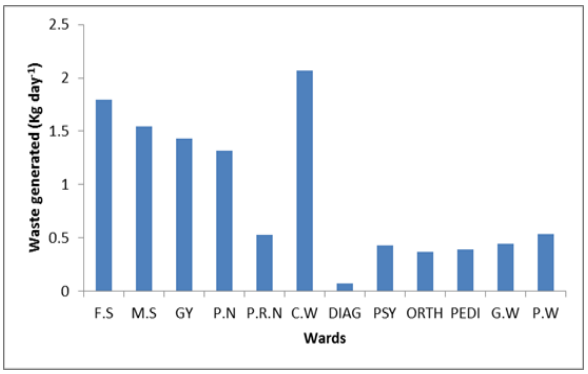

Figure 3: Average sharps waste generated by wards.

The children ward also generated the least infectious type of waste compared to wastes from other wards. In terms of the volume, the highest infectious waste originated from Female Surgical Ward followed by the Gynecology ward with 4.94 and 4.02 kg day^{-1} respectively. The least contributor of infectious waste into the waste stream was the orthopedic ward with a generation of 0.37 kg day^{-1}. The reason was that the major materials being used in this ward were bandage and plaster of Paris (PoP).

The least general waste generated within a ward or unit came from the diagnosis unit with 0.69 kg day^{-1}. This was not unconnected with the fact that only tests and diagnosis were being carried out in this unit. The diagnosis centre had the highest percentage of infectious waste (72.8 %) as compared to other wastes from the same ward. However, in terms of quantity, the two wards having the highest quantity of infectious waste were Female Surgical and Gynecology's wards with 4.94 and 4.015 kg day^{-1} respectively as shown in **Figure 2**.

From **Figure 3**, the highest contributor of sharps waste was the children ward with 2.07 kg day^{-1}. Children on admission or sick bed do not like taking drug in form of syrup or tablet; hence the hospitals prefer giving them injection. Also blood sampling and collection contributes to the volume of sharps generated in the ward.

From **Table 3** the children's ward on average generated the highest quantity of general waste on daily basis. The amount of total waste generated in a day is the highest in the Female surgical Ward with 27.0 kg day^{-1}. The ward that generated the least waste in a day was the orthopedic ward with 2.78 kg day^{-1}.

Table 3: The average solid waste generated from each ward of the hospital on daily basis (kg)

Ward	No of Beds	Waste Category				
		General	Infectious	Sharps	Others	Total
F.S	116	17.06	4.94	1.8	3.18	26.99
M.S	89	14.1	3.48	1.54	2.22	21.34
G	81	12.95	4.02	1.43	1.06	19.45
P.N	44	10.21	2.88	1.32	1.59	16.00
PRN	20	4.52	0.80	0.53	0.16	6.02
C.W	51	18.41	2.84	2.07	0.63	23.94
DIAG	2	0.69	1.86	0.07	0.30	2.93
PSY	14	3.61	0.99	0.43	0.39	5.42
ORTH	12	1.79	0.37	0.37	0.25	2.78
PEDI	14	3	0.71	0.39	0.16	4.22
GW	24	3.1	1.33	0.45	0.37	5.22
P.W	22	4.55	1.53	0.54	0.30	6.93
TOTAL	**489**	**93.94**	**25.75**	**10.92**	**10.62**	**141.23**

Table 4 shows the waste generated expressed in kg $bed^{-1}day^{-1}$. Gynecology and diagnosis wards generated the highest quantity of waste per bed per day with a value of 1.47 kg bed^{-1} day^{-1}. This value was higher than what was reported by Longe and Williams (2006) for Nigeria and about 50% higher than what Aukohr (2008) reported for King Abudullah University Hospital in Jordan for gynecology ward. The General Ward generated the least quantity of waste that was 0.218 kg $bed^{-1}day^{-1}$

The data shows that the average waste generated in kg bed^{-1} day^{-1} in all the wards was 0.289 kg $bed^{-1}day^{-1}$. This was about 50 % of the 0.573 kg $bed^{-1}day^{-1}$ reported by Longe and Williams (2006). The reason for this low value was that Longe and Williams (2006) value was based on the quantity of waste generated globally from all the units of the hospital with respect to the amount of bed spaces in the hospital. However, the value recorded in this study was based on the wastes generated in the wards alone without consideration of the offices, out – patient clinics, surgery theaters etc.

Table 4: **Summary of the average solid waste generated from each ward of the hospital per day**

Ward	No of Bed	Waste Category (kg bed^{-1} day^{-1})				
		General	Infectious	Sharps	Others	Total
F.S	116	0.147	0.30	0.016	0.027	0.232
M.S	89	0.158	0.27	0.017	0.025	0.240
G	81	0.014	0.35	0.018	0.013	1.47
P.N	44	0.232	0.46	0.030	0.036	0.364
PR	20	0.226	0.28	0.027	.008	0.303
C.W	51	0.361	0.39	0.041	0.012	0.469
DIAG	2	0.345	6.51	0.035	0.15	1.465
PSY	14	0.258	0.50	0.031	0.028	0.387
ORTH	12	0.149	0.22	0.031	0.021	0.232
PEDI	14	0.214	0.35	0.028	0.011	0.301
GW	24	0.129	0.39	0.019	0.015	0.218
P.W	22	1.45	0.49	0.025	0.014	0.315
TOTAL	**489**	**0.192**	**0.053**	**0.022**	**0.022**	**0.289**

4.0 CONCLUSION

The waste generated from each ward and section of the hospital needs to be sorted from source. This is desirable in order to identify the contribution of each ward to the waste stream with respect to quantity, and types of the waste that emanate from such ward. The rate of waste generated per bed per day from the wards is lower than the rate generated per bed per day in the entire hospital. Sorting the waste from the wards will reduce the quantity of waste to be considered or handled as special/hazardous waste since the general wastes constitute 66.5% of the entire waste generated from the wards.

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