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Evaluation of biomedical waste in Kogi State University Teaching Hospital, Anyigba, Kogi State, Nigeria

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Adequate handling, efficient treatment and effective methods of biomedical waste play a vital role in the hospital infection control programme. Inadequate management of healthcare waste is a serious concern in many developing countries due to the risks posed to human health and environment. This study evaluates the biomedical waste generated at the Kogi State University Teaching Hospital, Anyigba. Seven wards were selected within the health facilities to determine the quantities of waste. The result showed that total waste generated in seven consecutive days was 19.89 kg/week. The average waste generated in seven wards was 2.8 kg/week and average waste generated per day was 0.4 kg/day. The quantity of waste increased as the number of patients and visitors increased. There were non-availability of bags in all the bins used for waste collection, storage and the bins were not colour coded, neither was there segregation of waste in the seven units. The study equally showed that the waste collected from the hospital are subjected to open burning which may affect the health of the workers, patients, visitors and the residents. There should be proper management of healthcare waste which can be improved through employment and retraining of staff, provision of colour coded bins and at least an incinerator for waste treatment before final disposal.

Key words: Biomedical waste, Kogi State University Teaching Hospital, Anyigba, waste generation, waste segregation, waste disposal.

INTRODUCTION

Biomedical waste originates from human or animal health care, medical research, medical teaching facilities, funeral establishments, laboratories and other facilities. A portion of that waste stream is infectious or potentially infectious and presents a potential hazard to the public health and the environment. They arise from diagnosis, monitoring and preventive, curative or palliative activities in the field of veterinary and human medicine (Bhatia,

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2009). Waste management has continually generated global concerns, where the industrialized nations are progressively solving their solid waste management problems; little progress has been recorded in most of the developing countries about biomedical waste management (Afon, 2005). There has always been the need for man to dispose the waste generated in the course of his daily activities, and biomedical waste is part of the total waste streams generated in the built environment. Although, biomedical waste represent a relatively small portion of the total waste generated in a community, its management is considered an important issue world-wide (Cheng et al., 2009). Biomedical or hospital waste represents a high risk to doctors, technicians, nurses, sweepers, hospital visitors and patients due to arbitrary management (Becher and Lichtnecker, 2002).

Wastes generated in the process of health care consists of variety of wastes including hypodermic needles, scalpels, blades, surgical cottons, gloves, bandages, clothes, discarded medicine and body fluids, human tissues and organs, chemicals and others. The concern regarding medical waste is mainly due to the presence of pathogenic organisms and organic substances in hospital solid wastes in significantly high concentrations. Improper handling of solid waste in the hospital may increase the airborne pathogenic bacteria, which could adversely affect the hospital environment and community at large (Toyobo et al., 2012).

Medical waste management is the prime step taken towards the regulation of the generation, handling, storage, treatment and disposal of medical waste with the overall objective of protecting the care seekers, care givers, the general public and the environment from potentially infectious diseases causing agents. Effective health management should start from effective management of the waste generated from the sector for safety of the patients, the workers and the community. Waste produced in the course of healthcare activities carries a higher potential for infection and injury than any other type of waste. It is therefore a necessity to make medical waste management an integral feature of healthcare services as inadequate and inappropriate handling of it may have serious impact on the environment (Chitnis et al., 2004). Although, medical waste constitutes a small fraction of the municipal solid waste, the potential environmental and health hazards could be dangerous if not properly handled, with its disposal posing more difficulties with the appearance of disposable needles, syringes and other similar items (Askarian et al., 2006).

Biomedical waste management has received little attention in waste management process in Nigeria. Neither the hospital authorities nor government pay proper attention to its management. Unwholesome waste disposal by healthcare institutions pose serious health hazard to the city residents in general and people living within their vicinity. Medical wastes are disposed into municipal dumpsites without pre-treatment, leading to an unhealthy and hazardous environment around the health institutions, affecting patients and staff. Scavengers who collect waste from dustbins or the dumpsites are at risk of injury from sharp instruments and direct contact with infectious materials. Liquid medical wastes are disposed directly into the municipal sewer system without paying proper attention to its effect on the environment and the health. Direct disposal of faces and urine of infectious patients in municipal sewer system may cause outbreak of epidemic diseases (Chitnis et al., 2000; Coker et al., 2009).

In Nigeria, the international policy that the generator of waste is responsible for the proper management, treatment and disposal of waste is yet to be implemented. The notion that waste management is the sole responsibility of the government authorities has not enabled waste generators to appreciate the negative impact of improper waste disposal especially to its hazardous nature and disease transmission characteristics of some of the wastes (WHO, 1999). Health care establishment generates waste by-products which can be classified into infectious and non-infectious waste, most of which are not properly handled but rather, get mixed with other municipal wastes. This encourages the propensity for the growth of various pathogens and vectors and its ability to contaminate other non-hazardous/toxic wastes (Akter et al., 1999; Patil and Shekdar, 2001).

The rate at which population is increasing in Anyigba metropolis in Kogi State, Nigeria calls for an increase in health care facilities to meet the health challenges, then the paramount reason for the establishment of the teaching hospital in Anyigba. This has led to increase in volume and types of medical waste generated. It is upon this platform that this study sought to investigate the obstacles to adequate and efficient medical waste management in Kogi State University Teaching Hospital, Anyigba with respect to sources of biomedical waste, composition and quantity of waste generated per day, current management practice, and to assess the level of environmental pollution.

METHODOLOGY

The study employed a cross-sectional design to assess the hospital for waste generation, segregation, disposal and management practices conducted in the Kogi State University Teaching Hospital, Anyigba, Kogi State, Nigeria, which lies between latitudes 7°29' and 7° 21' and longitudes 7° 11' and 7° 55'. Kogi State University Teaching Hospital, Anyigba, envisaged as a premier referral and research hospital with the latest cutting edge technology, a 250-bed hospital comprising the major clinical areas of medicine, surgery, pediatrics, outpatient department (OPD), obstetrics and gynecology. Others are orthopedic, accident and emergency (A&E), dentistry, pathology, bulk store and administration. Other units are intensive care unit, special baby care unit and a central medical gas plant

Table 1. Quantity of waste generated in each ward of the hospital (kg/day).

Wards / Days	Medical	Orthopedic	Maternity	OPD	A&E	Surgery	Pediatrics	Total	Average
Day 1	0.71	0.42	0.84	0.10	0.45	0.32	0.39	3.22	0.46
Day 2	0.67	0.40	0.80	0.09	0.43	0.31	0.37	3.06	0.44
Day 3	0.78	0.46	0.92	0.11	0.49	0.35	0.42	3.53	0.50
Day 4	0.65	0.38	0.77	0.09	0.41	0.30	0.36	2.96	0.42
Day 5	0.62	0.37	0.73	0.08	0.39	0.28	0.34	2.82	0.40
Day 6	0.48	0.29	0.57	0.07	0.31	0.22	0.26	2.2	0.31
Day 7	0.46	0.27	0.55	0.06	0.29	0.21	0.25	2.10	0.30
Waste generated in kg/week	4.38	2.59	5.17	0.60	2.78	1.99	2.39	19.89	2.84
Average waste generated/kg/day	0.63 (22)*	0.37 (13)	0.74 (26)	0.09 (3)	0.39 (14)	0.28(10)	0.34 (12)	2.84	0.41

* = Values in parenthesis are the percentages of waste generation.

with oxygen manifold and medical gas piping to all central areas.

Using a random sampling technique, seven wards were selected within the hospital for weighing and estimation of waste. The waste generated were collected, weighed and recorded on a special data sheet for seven consecutive days. A validated weighing scale was used to measure and generate data on the waste generated in the hospital. Data were compiled so as to enable the estimated of the generated quantity. The quantities of hospital waste were presented in terms of kg/day of dry weight. Questionnaire was designed and used to elicit information on the waste generation rates, as well as waste handling and disposal practices and the physical observation. Out of the 80 staff in seven selected wards/units in the health facility, only 65 consented to participate in the study and were administered with questionnaires during the survey stage of the study. The questionnaire (structured) was pretested in another state hospital which have similar characteristics with selected hospital but not in the study group and the reliability was found to be 0.78 using Cronbach alpha. The data were analyzed using Statistical Package for Social Sciences (SPSS) version 20 and presented in tables and figures.

RESULTS AND DISCUSSION

The waste generation rate of each ward of the hospital was determined and results are given in Table 1. The average rate of waste generated in the hospital ranges from 0.06 to 0.92 kg/day. The categories of waste generated were hypodermic needles, scalpels, blades, surgical cottons, gloves, bandages, clothes, discarded medicine and body fluids, human tissues and organs, chemicals and others. The waste generation rate of each ward of the hospital was different. The variation was because of the characteristics of each unit, which requires a different kind of diagnosis and treatment. It should be noted that the nature of treatment determines the types of material needed, which invariably dictates the amount of waste to be generated.

Also, the highest percentage (26%) of waste generation occurred in maternity ward. This was due to frequent use of general wastes, pharmaceuticals, sharps, cotton wools and sanitary pad by women that just delivered babies. The least percentage (3%) of waste generation occurred at the out-patient department (OPD). The considerable smaller quantities of solid wastes generated at the OPD is not surprising given the fact that the kind of therapy usually prescribed here does not lead to generation of much wastes within the hospital but are rather prescribed and taken away for subsequent use at homes. The variation in the waste generation rate from wards is expected, since this depends on the nature of activities in a specific ward (Bassey et al., 2006). In this study, the quantities of medical wastes generated in these wards are relatively small. Conversely, Etusim et al. (2013) in his study on the solid waste generation and characterization in some selected hospitals in Okigwe, Imo State-Nigeria generate very high (total of 95.5 kg) waste from the selected hospitals. The relative abundance of waste from the three hospitals followed the same pattern of relative composition.

Fifty-two (80%) of the respondents disclosed that waste bins were available, which shows that there were waste bins in the facility which enhance proper storage of the wastes generated before disposal (Table 2). The waste bins provided were not colour coded which gave no room for segregated waste to be collected differently. The collection, storage and transportation of these wastes reflected the good intention of management, much improvement is still required to segregate wastes; to train waste handlers regularly and provide them with suitable and adequate personal protective equipment such as clothing and other covers for body, mouth and nose.

These findings were similar to that of Toyobo et al. (2012) on the appraisal of University Teaching Hospital Medical Waste management in Nigeria using University College Hospital (UCH), Ibadan and Obafemi Awolowo University Teaching Hospital (OAUTH), Ile-Ife. He observed that as a result of a lack of waste segregation practices in most hospitals, many of these hazardous

Table 2. Waste handling and disposal practices of the biomedical waste in the hospital.

Variables	Male workers	Female workers
Collection of waste through the bin		
Yes	22 (73.3)*	30 (85.7)
No	8 (14.7)	5 (14.3)
Segregation of waste before disposal		
Yes	9 (30)	10 (28.6)
No	21 (70)	25 (71.4)
Treatment of the waste within the hospital		
Yes	3 (10)	2 (5.7)
No	27 (90)	33 (94.3)
Open dumping and burning as a means of disposal		
Yes	28 (93.3)	34 (97.1)
No	2 (6.7)	1(2.9)

* = Values in parenthesis are the percentages of respondents

Figure 1. Openly dumped waste for treatment.

materials are flushed down as waste water drain that flows directly to an open sewer or river, are mixed into general solid waste for disposal in municipal bins or are mixed into wastes which are incinerated as potentially infectious waste. It is generally acceptable that when non-hazardous waste is mixed with hazardous ones, the mixture becomes hazardous (Fadipe et al., 2011; Ngwuluka et al., 2009; Rao et al., 2004). It has been observed that barriers to the segregation in developing countries include inadequate budgetary provision for waste management activities, limited space for multiple receptacles at service areas and non-continuous training opportunities for healthcare workers in their various cadres (Tudor et al., 2009; Adeolu et al., 2014).

Nearly all (95%) of the respondents agreed to open dumping and burning as means of treatment and disposal of waste within the hospital (Table 2). This was in line with Marshal (1995) study on the impacts of biomedical waste on the environment and that open dumpsites are a major problem to the environment, especially on air that we breathe. Also, Wrensh (1990) reported that biomedical waste dumpsites should be far from human habitat since the releasing smokes and gases are mobile and could travel a long distance to avoid air contamination diseases which could be both airborne and waterborne in nature. Also, Dolk (1997) observed that dumpsite closer to residential area are always feeding places for pets together with rodents, they can both carry diseases with them to the nearby home stands.

There were no incinerators or properly designed landfills. The hospital practiced open dump method of waste treatment, which create an eye sore to the inhabitants and workers of the fairly-densely populated hospital; thereby exposing them to its adverse effect (Figures 1 to 2). The cleaners collect wastes produced in each ward in plastic buckets and dump them at designated pit, where the wastes are burnt here without regards to the effect of the action on the environment. The open burning enhances the release of smoke and dangerous gases into the atmosphere with very serious health implications, one of which is encouraging proliferation of multidrug resistant microbes in the environment (Chitnis et al., 2000). Burning of wastes has also been linked to severe public health threat and environmental pollution resulting in the release of dioxin, mercury and other toxic substances into the environment. These substances produce a remarkable variety of

Figure 2. Dumped waste without segregation.

Figure 4. Partially burnt waste for the facility.

Figure 3. Ashes of burnt wastes before burying.

adverse effects in humans at extremely low doses (Peele et al., 1981). Partially burnt wastes were buried within the pit (Figures 3 to 4). This has the potential to pollute ground water, which may therefore expose the population to health hazards. Putrefaction occurs in portions of refuse, which have not been fully burnt and add to air pollution through foul smells (Bassey et al., 2006).

Conclusion

It was found that conditions of biomedical waste management were not better because the administrators and other hospital staff were not concerned with the damage done to the environment and society due to inappropriate handling and disposal of biomedical waste. Lesser amount of biomedical waste means lesser burden on waste workers and the environment. Hence, hospital care provider should always try to reduce waste generation in day to day activities in hospitals. The liquid waste management needs more attention and effluent treatment facilities need to be installed and viewed seriously for hospitals in general. The segregation of waste at source is the key step and reduction, re-use, recycling should be considered in proper perspectives. Therefore, the ministries of Environment and Health must put in place a legislation that will regulate medical waste generation and management and also adopt a multidisciplinary approach to medical waste management in Nigeria.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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