

Color Coding of Solid Health Care Waste in Lagos, Southwestern Nigeria

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ABSTRACT

Color coding ensures identification of the hazards associated with the type of health care waste that is handled or treated. The objective of this study was to investigate the compliance of health care facilities in Lagos, Southwestern Nigeria to the color coding system of waste segregation. A harmonized checklist and a well-structured questionnaire were used to obtain data from the health care facilities and their workers. A total of 507 workers in 16 health care facilities were interviewed in this study. Results showed that for the color identification of sharps, 472 (93.10%) respondents said black; brown was 26 (5.13%); yellow, 10 (1.97%). For pathological wastes, black was 470 (92.70%); brown, 28 (5.52%); yellow, 6 (1.18%). For radioactive wastes, black was 475 (93.69%); brown, 5 (0.99%); yellow, 35 (6.90%). For chemical wastes, black was 483 (95.27%); brown, 20 (3.94%); yellow, 5 (0.99%). For infectious wastes, black was 461 (90.93%); brown, 32 (6.31%); yellow, 15 (2.96%). For pharmaceutical wastes, black was 467 (92.11%); brown, 36 (7.10%); yellow, 10 (1.97%). In conclusion, the health care facilities in Lagos did not adhere to the proper color coding for segregation of solid health care waste. It was recommended that awareness programs be organized for health care workers so that they will be familiar with the color coding system and abide by it.

Keywords: Color coding, Health care waste, Hazards, Health care facilities, Segregation

INTRODUCTION

Health care waste is a very sensitive, delicate and special waste that requires special attention and care due to its infectious, hazardous and toxic nature. Health care wastes are therefore, expected to be handled differently from the normal solid waste (domestic and industrial). All the wastes generated by medical activities come under healthcare waste. Health care waste is all the waste produced by a medical institution (public or private), a medical research facility or a laboratory. [1] According to World Health Organization, [2] around 80% of health care waste is nonhazardous and 15% is infectious. The remaining 5% is made up of sharps, toxic

chemicals, pharmaceuticals, genotoxic, and radioactive waste. These traditional estimates, however do not apply to many developing countries. For instance, 25% of health care waste produced in Pakistan is hazardous, 26.5% in Nigeria, and 2%–10% in other sub-Saharan Africa countries. In Kenya, due to poor segregation practices, it is common to find that up to 50% of waste in some facilities is infectious. [3] Increasing population and technology advancement have facilitated appreciable growth of health care and research institutions and resulted in increasing amounts of waste which, in turn, lead to opportunities and challenges in the management of health care wastes across the globe. [4]

Non-risk health care waste includes all the waste that has not been infected like general office waste, packaging or leftover food. They are similar to normal household or municipal waste and can be managed by the municipal waste services. They represent between 75% and 90% of the total amount of health care waste generated by medical institutions. [5] They include recyclable waste such as paper, cardboard, non-contaminated plastic or metal, cans or glass that can be recycled if any recycling industry exists in the country; and biodegradable waste comprising of leftover food or garden waste that can be composted. [6] Biomedical and health care wastes requiring special attention include:

Human anatomical waste: This category of waste comprises non-infectious human body parts, organs and tissues and blood bags. [7] Examples of such wastes are tissue waste, removed organs, amputated body parts, placentas, etc.

Waste sharps: These are all objects and materials that are closely linked with health care activities and pose a potential risk of injury and infection due to their puncture or cut property. For this reason, sharps are considered as one of the most hazardous waste generated in the health care facility and they must be managed with the utmost care. [8] Examples of such wastes are all types of needles, broken glassware, ampoules, scalpel blades, lancets, vials without content.

Pharmaceutical waste: This embraces a multitude of active ingredients and types of preparations. The spectrum ranges from teas through heavy metal containing disinfectants to highly specific medicines. This category of waste comprises expired pharmaceuticals or pharmaceuticals that are unusable for other reasons (e.g. call-back campaign). [8]

Non-hazardous pharmaceutical waste: This class includes pharmaceuticals such as tea or cough syrup that pose no hazard during collection, intermediate storage and waste management. They are not considered

hazardous wastes and should be managed jointly with municipal waste. [9]

Hazardous pharmaceutical waste: They comprise of heavy metal containing and unidentifiable pharmaceuticals as well as heavy metal containing disinfectants, which owing to their composition require special management. [10] They must be considered as hazardous wastes and their management must take place in an appropriate waste disposal facility.

Blood and body fluids waste: This includes wastes that are not categorized as infectious waste but are contaminated with human or animal blood, secretions and excretions. It is warranted to assume that these wastes might be contaminated with pathogens. [9] Examples of such wastes are dressing material, swabs, syringes without needle, infusion equipment without spike, bandages.

Infectious waste: This class comprises all biomedical and health-care waste known or clinically assessed by a medical practitioner or veterinary surgeon to have the potential of transmitting infectious agents to humans or animals. Waste of this kind is typically generated in the following places: isolation wards of hospitals; dialysis wards or centers caring for patients infected with hepatitis viruses (yellow dialysis); pathology departments; operating theatres; medical practices and laboratories which mainly treat patients suffering from the diseases specified above. [11] It includes discarded materials or equipment contaminated with blood and its derivatives, other body fluids or excreta from clinically confirmed infected patients or animals with hazardous communicable diseases. It also includes carcasses as well as litter and animal faeces from animal test laboratories.

Highly infectious waste: It includes all microbiological cultures in which a multiplication of pathogens of any kind has occurred. They are generated in institutes working in the fields of hygiene, microbiology and virology as well as in medical laboratories, medical practices and similar establishments. [10]

The application of a color coding system aims at ensuring an immediate and non-equivocal identification of the hazards associated with the type of health care waste that is handled or treated. The most appropriate way of identifying the categories of health care waste is by sorting them into categories of waste in color-coded plastic bags or containers. In this respect, the color coding system should remain simple and be applied uniformly throughout the country. The WHO [11] waste regulations recommend a color coding system which all health care facilities must adhere to. Infectious wastes, pathological wastes and sharps are yellow in color and must be labeled with the biohazard symbol. Pharmaceutical waste, genotoxic waste and chemical waste are red in color and labeled with the word "Poison". Radioactive wastes are also yellow and labeled "Radioactive". Non-medical wastes are black in color and labeled "Non-hazardous". [12] Strict adherence to this color coding system is necessary in order to prevent exposure of people to hazardous wastes. Thus this study looks at the compliance of health care facilities in Lagos, Southwestern Nigeria to the color coding system of health care waste management.

MATERIALS AND METHODS

This study was carried out in health care facilities of Lagos, Southwestern Nigeria. It employed a descriptive design with the use of a harmonized checklist and a well-structured questionnaire to obtain data from the health care facilities and their workers. The sampling random sampling technique was used to select the health care facilities used for the study. All the respondents gave an informed consent to be part of the study.

RESULTS

A total of 507 workers in 16 health care facilities were interviewed in this study. Data obtained from the study showed that 20 (3.94%) respondents said that solid waste was dumped at the back of the

building; 310 (61.14%) said in large waste containers; 125 (24.65%) in waste store room; 63 (12.43%) said at any designated place (Table 1). The color identification of sharps in the waste bins showed that 472 (93.10%) said black; brown was 26 (5.13%); yellow, 10 (1.97%). For pathological wastes, black was 470 (92.70%); brown, 28 (5.52%); yellow, 6 (1.18%). For radioactive wastes, black was 475 (93.69%); brown, 5 (0.99%); yellow, 35 (6.90%). For chemical wastes, black was 483 (95.27%); brown, 20 (3.94%); yellow, 5 (0.99%). For infectious wastes, black was 461 (90.93%); brown, 32 (6.31%); yellow, 15 (2.96%). For pharmaceutical wastes, black was 467 (92.11%); brown, 36 (7.10%); yellow, 10 (1.97%).

Table 1: Storage of solid medical waste

Method	n	%
Back of the building	20	3.94
Large waste container	310	61.14
Waste store room	125	24.65
Any designated place	63	12.43

Table 2: Color identification of sharps

Method	n	%
Black	472	93.10
Brown	26	5.13
Yellow	10	1.97

Table 3: Color identification of pathological wastes

Method	n	%
Black	470	92.70
Brown	28	5.52
Yellow	6	1.18

Table 4: Color identification of radioactive wastes

Method	n	%
Black	475	93.69
Brown	5	0.99
Yellow	35	6.90

Table 5: Color identification of chemical wastes

Method	n	%
Black	483	95.27
Brown	20	3.94
Yellow	5	0.99

Table 6: Color identification of infectious wastes

Method	n	%
Black	461	90.93
Brown	32	6.31
Yellow	15	2.96

Table 7: Color identification of pharmaceutical wastes

Method	n	%
Black	467	92.11
Brown	36	7.10
Yellow	10	1.97

DISCUSSION

There are significant problems with health care waste management in Nigeria. These include lack of management commitment, poor waste handling practices, inadequate training on health care waste management, non-existent segregation of health care waste management and risky disposal practices. Although some form of segregation of sharps (needle and syringes) takes place at some healthcare centres, which has reduced the incidence of needle prick injuries, ^[13] health-care waste management in Nigeria is still below standard and the overall practice of health care waste management is still problematic. There is need for awareness and sustainable solution to this problem. In some Nigerian hospitals, waste is collected at a central open dumpsite and burnt periodically. Occasionally, the wastes are buried by covering with a layer of earth. ^[14] No prior treatment takes place. Human body parts such as placenta and amputated limbs are disposed with the general waste, buried in shallow pits or returned to the patient for disposal. Used swabs and dressings as well as pharmaceutical wastes are disposed with general waste. Sharps are collected separately in sharp proof containers and disposed by burying.

The high percentage of respondents using color code for identification indicates their level of understanding about its essence in management of medical waste. It also helps with easy recognition and disposal of the waste. A similar study ^[15] reported that 79.2 % of the health care facilities used color coding for proper identification. Another study ^[16] found that none of the health care facilities that were part of the study practiced color coding for segregation. There was satisfactory knowledge of color coding of wastes which is an essential factor for the proper segregation of waste. Proper segregation is achieved by making use of actual colored containers or colored liners to effectively separate infectious waste from general/domestic waste. World Health

Organization ^[17] proposed that hospitals should provide either plastic bags or strong plastic containers for medical wastes and that they should make use of different colored liners namely, Black, Yellow and Red (three bin system) for general, infectious and highly infectious waste respectively. Bags and containers for highly infectious waste should be marked with Biohazard symbol. ^[18] The use of a brown liner is also encouraged by WHO for pharmaceutical waste (expired drugs) but this is rarely used.

In conclusion, the health care facilities in Lagos did not adhere to the proper color coding for segregation of solid health care waste. It is recommended that proper enlightenment and awareness programs be organized for health care workers so that they will be familiar with the color coding system and appreciate the need to abide by it. Health agencies in every country should enforce strict compliance of color coding by health care facilities.

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