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Research Article

Healthcare Waste Management: A Neglected and Growing Public Health Concern in Nigeria

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Abstract:

This paper focused primarily on Health Care Wastes (HCW) specifically: definition, classifications, exposure pathways and its potential health, environmental and aesthetic implications. Health Care Waste Management (HCWM) was discussed as a tool used to avert the adverse effect of HCW. The challenges facing adoption and implementation of HCWM in Nigeria were enumerated and ways to overcome these challenges were recommended. An overview of World Health Organization (WHO) guideline on HCWM was presented. This was to emphasis the global concern on HCWM. The conclusion drawn was that, adequate HCWM is an indicator of efficient healthcare delivery system, after all if patients are to receive adequate healthcare services and recover in a healthy surrounding, waste generated must be effectively dispose of safely. Therefore, waste operators, the public, regulators and government agencies must braze up to the challenges of poor health care related handling and disposal as government must enforce stringent measures to protect the public and environment. Where feasible, reasonable budgetary allocation from all tiers of government and favouring the safe and environmentally sound treatment of hazardous HCW by autoclaving, microwaving, chemical treatment and steam treatment over waste incineration, open dumping and landfilling is imminent and of necessity.

Keywords: Risk, mixed waste, reusable items, scavengers, pathological waste, cytotoxic

Introduction

Nearly every activity produces some kind of waste in the environment, and health care activities are no exceptions [1]. Healthcare activities are means of protecting health, curing patients and saving lives and in the process, waste is generated. It is a universe of co-production of care and risks [2]. It is ironical that health care activities in centres and institutions such as hospitals, which provide succour to the ailing, and restores health, can also be a potential source of health hazard [3].

Presently in Nigeria, health care wastes (HCW) discarded by health workers are usually assembled together for disposal along with municipal wastes (mixed waste). A sizable number of reusable items or materials like needles, syringes, plastics and containers found in the HCW are picked up by rag-pickers, scavengers and recycled back into the market without any treatment for disinfection, the consequences of which could be anybody's guess.

Healthcare Wastes (HCW): Definition and Sources

HCW is any solid, fluid, liquid or water, including its containers and any intermediate product which is generated during health care activity like diagnosis and treatment or immunization of humans and animals [4]. It can also be defined as all wastes generated during medical activities such as diagnosis, preventive, curative and palliative treatments in the field of human and veterinary medicines [3] (WHO, 2016). HCW make up about 2-3% of the total amount of waste generated globally, nonetheless, it is the most hazardous waste after nuclear waste, United Nations Development Programme [5].

HCW are materials obtained from the evaluation and examination of patients, treatments and/or immunization of humans and animals [6]. Although, hospitals produce the bulk of HCW by volume, however, that is a small fraction of the total number of sources, Environmental Protection Agency [6] , others are;

i) Laboratory and research centres
ii) Mortuary and autopsy centres
iii) Blood banks and blood collection centres
iv) Nursing homes for the elderly
v) Animal research and testing laboratories among others.

Examples of HCW include a variety of materials and items like hypodermic needles, Scalpel blade, surgical gloves and radioactive substances. Others are blood-soaked cotton wools, patients' clothes and bandages, expired drugs, body fluids, tissues, organs, parts as well as hazardous chemicals, the list of HCW is in fact inexhaustible.

Classifications of HCW

HCW are classified as infectious or clinical hazardous, radioactive, non-infectious and general waste[7].

i) Infectious
ii) Clinical
iii) Radioactive
iv) Non-infectious
v) General
vi) hazardous

Clinical or infectious wastes are materials contaminated by blood and body fluid of patients with infection. Examples of such waste include discarded diagnostic samples, culture plates, swabs, bandages, clothes etc. These categories of clinical waste are also called pathological wastes. Sharps are also another form of clinical wastes which are disposable medical devices like syringes, needles, blades *etc*. They pose a great deal of risk of infection and injury to potentially exposed persons.

Hazardous wastes include chemicals, pharmaceutical and cytotoxic wastes. Chemical wastes are solvents and reagents used for laboratory preparations, disinfectants, sterilant and heavy metals contained in some medical devices such as mercury in broken or damaged thermometer. Pharmaceutical wastes include expired-and contaminated drugs and vaccines Cytotoxic wastes are specific type of waste stream containing substances with genotoxic properties and cytotoxic drugs used in cancer treatment.

Radioactive wastes are products or substances contaminated by radionuclides including radioactive diagnostic materials or radio-therapeutics devices. Non-infectious and non-hazardous wastes are by-products of health care activities that does not pose any particular hazard (biological, chemical, physical or radioactive). They are of two; offensive and anatomical.

Although, offensive waste is a non-infectious waste, however, it is unpleasant to come into contact with it. Examples of offensive waste are maternity waste, incontinence pads, nappies, stoma, catheter bags etc. Anatomical wastes on the other hand are materials such as recognizable body parts and placentas. Anatomical waste may not be hazardous to health, however, it has special sensitive effect on humans, if it is unexpectedly discovered.

General wastes or municipal wastes are similar to household waste. Its potential for harm is very low, since it is non-infectious and non-hazardous.

Potentially Exposed Persons

HCW pose a serious risk to both humans and environment (International Committee of the Red Cross [8]. All persons who have access to or are in contact with HCW at any point from its generation source to its final disposal point are potentially exposed to the various risks it entails. These persons are categorized into two groups. The first group are those persons inside the hospital or the healthcare facility. They include care staff (doctors, nursing staff and auxiliaries), stretch-bearers, technical and logistic personnel, cleaners. Others are laundry staff, carriers, pharmacist, laboratory staff, patients, and visitors. The second group are those persons outside the health care facility, such as the off-site HCW transport personnel, persons at the disposal infrastructure and the general public.

Among these potentially exposed persons, the different ways a person can be affected (called exposure pathways) are through inhalation, ingestion and dermal (skin) contact. Chemicals and microorganisms can be found and move through air, soil and water, hence are exposed through breathing contaminated air, the soil our plants grow in, the water we bath with and drink as well as the food we eat [7].

Effects of HCW

HCW is a special type of waste stream, carrying a high potential of infection: hazard, injury, trauma as well as psycho-emotional. It can be a source of different risks at each stage of the waste chain (that is from generation of waste to its storage, transportation, treatment or disposal) and pose varying degrees of risks for the patient, staff, visitors and the environment. HCW represents a higher risk to health [9], and usually put people under risk of fatal diseases [10] (UNDP/WHO, 2022). The potential of HCW to cause harm arise from its composition that is its nature and typology [11].

Exposure to HCW can result in a wide array of hazards depending on the type of waste involved and the exposure pathways. For example, HCW like chemical fumes or vapour affect people across large areas. For liquid waste, unless the liquid gives off hazardous fumes, people will need direct contact to be exposed, and symptoms are more likely to be related to skin exposure or ingestion. Some health effects are apparent, immediately on the first exposure while others may not manifest until later.

Many chemical and pharmaceutical products are used in health care facilities. Most of them entail health risk due to their properties, such as toxic, carcinogenic, mutagenic, reprotoxic, irritant, corrosive, sensitizing, explosive, flammable *etc*. (Occupational Safety & Health Administration [12]. These chemicals enter into the environment readily during incineration. Incineration of HCW has been widely practiced, but inadequate incineration or the incineration of unsuitable materials result in the release of pollutants into the atmosphere and in generation of ash residue. Incinerating materials containing chlorine for example can generate hazardous and

noxious substances like furan and dioxins which are known human carcinogens, and have been associated with a wide range of adverse health effects [3]. Incineration of HCW with high heavy metal content (in particular, lead, mercury and cadmium) can result in the spread and pollution of the environment [6].

Effects of HCW on Humans

Exposure of humans to HCW has both short- and long-term health implications. Some of the short-term effects include;

i) Eye and skin irritation
ii) Difficulty in breathing and headaches
iii) Chemical burns and nauseas
iv) General discomfort

Some long-term potential health effects of prolonged exposure to hazardous chemicals and infections pathogens are;

i) General abnormalities
ii) Cancer and genetic mutation
iii) Physiological malfunction e.g. kidney failure, reproductive impairment
iv) Physical deformation/significant disability
v) Birth defect and death.

Environmental Effects of HCW

Environmental impacts of HCW can have consequences that may result in additional threat to human health. Such effects are;

i) Water pollution; contamination of different sources of water eg. surface water; rivers and underground water sources.
ii) Soil pollution e.g. non-biodegradable waste disposed in landfills results to land degradation.
iii) Air pollution arising from incinerator emissions.
iv) Public sensitivity: making the environment unaesthetic and offensive [10].

Generally, poorly managed HCW can lead to a variety of negative consequences. The ripple effect from the disruption in the food chain can be felt everywhere.

Health Care Waste Management (HCWM)

HCWM refers to a streamlined process that involves actions and measures taken to ensure safe and environmentally-sound handling of HCW; from its generation source to its final point of disposal or recovery. HCW make up less than 3% of the total waste produced world wide, however, due to its infectious and hazardous potential, the issue of its management is of serious concern globally [13]. The prime objective of HCWM is to reduce the quantity of unusable materials and to avert potential health, aesthetic and environmental hazards. In other words, the goal of HCWM is to ensure that HCW is handled in such a manner, that they do not pollute the environment or become a source of infections to humans and animals.

HCWM is essential for so many other reasons. First, it is a tool used to reduce the amount of HCW generated, thus reducing the quantity of waste for disposal. Consequently, HCWM saves space in landfills and conserves natural resources. It also helps to eliminate the occupational risks which exist at the disposal facilities that are not well constructed or maintained. Effective HCWM can result in the availability of valuable materials for reuse. Furthermore, HCWM is essential in addressing, that is achieving Sustainable Development Goals (SDGs). For example, HCWM specifically addresses SDG 3 on good health and well-being, SDG 6 on clean water and sanitation and SDG 12 on responsible consumption and production [14].

Adequate HCWM is a prerequisite for and an indication of efficient delivery of healthcare services [15]. After all, if patients are to receive good health care and recover in healthy surroundings, waste generated must be effectively disposed of safely [8].

Nowadays, HCWM has started receiving attention, due mainly to the gradual realization of the potential risk arising from its inappropriate management. This is exemplified in the workshop and training organized in 2019 as a collaboration between the Waste Management Society of Nigeria (WAMASON), Rivers State Council and the Rivers State Waste Management Agency (RIWAMA) for the staff and scavengers in hospital waste management. That is the awareness that if HCWM is not ensured, it may pose serious risks of infection to anybody handling it, and sometimes may be the source or cause of an epidemic or endemic [16]. In addition, improper HCWM can create unsanitary conditions, and these conditions in turn can lead to environmental degradation. Again, if HCW is not properly managed, it can pose an even greater threat to health, than the diseases themselves [17].

Challenges Facing Adoption of HCWM in Nigeria

Generally, HCWM is a huge challenge in low-income and developing country like Nigeria, with poor hygiene and high population. These challenges facing adoption and implementation of HCWM in Nigeria are many and varied.

First, due to rapid increase in population, there is a corresponding increase in the amount of waste generated, and HCW is not an exception. In Nigeria, this upsurge in population has led to the generation of large volumes of HCW that surpass the capacity of the section responsible for waste to be handled.

Next, there is generally lack of awareness of the health hazards related to HCW. It is important to note that effective management of HCW requires proper understanding of the inherent risks associated with the improper handling of HCW. Most of the health care waste facilities and sections are headed by the rank of menial casual labourers. As a result, the level of knowledge of the risks

associated with the mishandling of HCW waste workers is usually very low. Employers of HCW workers do not provide adequate training to workers or personnel involved in handling wastes. This makes them (waste workers) inadequately prepared to perform their duties efficiently and safely [12].

There is also the problem of lack of proper records of information. Practices in the various HCW generating centres in Nigeria with respect to type of HCW and quantity generated, collection method, availability of storage, treatment and disposal facilities have not been routinely and efficiently documented. This information is important in the planning of HCWM. Quite often, HCW are disposed indiscriminately without prior treatment to reduce its health, aesthetic and environmental impact and the disposal facilities are not planned, well maintained or even secured. The disposal points or dumpsites as often called are usually undeveloped plots of land, sewage systems (gutters), large pits, rivers and streams.

There is also the challenge of Nigeria's dwindling economic fortune and the abysmal institutional governance that has plagued the general waste management administration in the country. This is the challenge of governance of the entire process of waste chain. This specifically refers to weak institution assigned to the tedious task of handling waste. An essential issue here is the lack of clear attribution of responsibilities. The recent establishment and inauguration of the Institute of Environmental Practitioners Council of Nigeria (IEPCN) Board in 2024 is a boost to the management and monitoring of health care waste in Nigeria as the WAMASON is a principal stakeholder.

Other challenges include chronic under-resourcing. This simply refers to the insufficient financial and human resource being allocated to management of HCW. This is due to the low priority being given to the issue of HCWM in Nigeria despite its health and environmental impact. Although, regulation and legislation do exist, however the lukewarm attitude towards monitoring and enforcement impede their implementation.

Overcoming HCWM Challenges and Improving Health Care Delivery in Nigeria

HCWM in Nigeria is in a deplorable state, with the prospect of further deterioration if drastic action that will help to improve health care delivery with special emphasis on HCW is not implemented. Key elements in improving HCWM in Nigeria are:

a) All employees handling HCM should be adequately trained on safety procedures and in dealing with spillage or other accidents in their respective areas of work. Adequate education and proper training of HCW workers and other stakeholders are essential in ensuring optimal outcomes in HCWM [18]. Proper training is a fundamental and critical step to ensuring the safe and proper HCWM. It is the only way to ascertain that workers especially potentially exposed persons understand the impact of HCW on the environment and human health, regulation that apply and the procedures that effectively protect themselves and the public from HCW hazards [19].
b) Encouraging health care workers to promote practices that reduce the volume of waste generated and ensure proper waste segregation at the point of generation. In addition, selecting safe and environmentally-friendly management options that will protect people from infections and hazards when handling HCW. Where feasible, favouring the safe and environmentally sound treatment of hazardous HCW. For example, by autoclaving, microwaving, chemical treatment and steam treatment over waste incineration, open dumping and land-filling.
c) Raising awareness of the risks related to HCW. Awareness should be created at all levels of society. This can be achieved through various means of communication and education, so that the risks of spreading the health hazards could be minimized [10] (UNDP/WHO, 2022).
d) Building a comprehensive system, addressing responsibilities, resource-allocation along with regulation to incrementally improve HCW segregation, collection, storage, transportation and final disposal practices, with the ultimate aim of meeting the international standards.
e) Legislation that will guide HCWM in Nigeria needs to adopt multidisciplinary approach. This opinion is important because HCWM is interdisciplinary in scope and therefore would need and require the involvement of several stakeholders from different professional background [15] .

Although, government commitment and support are needed for long-term improvement and sustenance of HCWM, immediate short-term action-plan can be put in place locally. These include: proper waste segregation practices at the point of generation, standard labeling; leak-proof storage systems, safe transportation procedure and safe disposal methods.

WHO Response

In recognition of the importance of effective HCWM to public health, environment and as a prerequisite or indicator of efficient delivery of healthcare services, WHO in 2010 issued guideline on "Safe Management of Wastes from Healthcare Activities." The guideline addresses aspects such as:

a) The creation of waste management organization.
b) The allocation of human and financial resources
c) The development of HCWM plan and its implementation in accordance with established timelines.
d) The development and implementation of a program of periodic training (man-power development).
e) Monitoring, evaluation and continuous improvement of the system among others.

WHO Recommendations

WHO also made recommendations to the various HCWM interest groups and stakeholders such as: national government, non-governmental organizations, private and public organizations. These recommendations were based on "WHO Core Principles on HCWM" that "safe and sustainable management of HCW is a public health imperative and a responsibility for all." The recommendations are;

a) That national and even regional governments should allocate a budget to cover the costs of establishment and maintenance of sound HCWM system, support capacity building and ensure worker and community health.
b) That Non-Government Organizations (NGOs) should include the promotion of programs and activities that contribute to sound HWM in their advocacy.
c) That private organizations should take responsibility for the sound management of HCW associated with the products and services they provide. In addition, they should develop innovative solutions to reduce the volume and toxicity of the waste they produce and are associated with their products.

Conclusion

From the foregoing, it is obvious that HCW is infectious, hazardous to health and is a potential source of environmental pollution. To avert HCW's negative impact requires that it should be 'handled' properly or managed throughout the waste chain. HCWM is a huge challenge in low income and developing countries like Nigeria for some reasons, such as unmitigated upsurge in the general and urban population, the abysmal institutional governance, the poor awareness of the health hazards associated with this variant of waste among others. Adequate HCWM depends on establishment of a functioning organization saddled with this task, sufficient funding for the organization, and active participation of trained and informed personnel *etc*. HCWM is a component of efficient health care delivery system; and every health care centres or institutions, large and small, rural and urban can have a positive impact on the public and environmental health of their community through its HCWM.

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