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## BIOSAFETY KNOWLEDGE, WASTE DISPOSAL PRACTICES AND IDENTIFICATION OF PARASITES IN BIOMEDICAL WASTES FROM HEALTHCARE ESTABLISHMENTS IN LAGOS AND ABUJA, NIGERIA

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### ABSTRACT

*In Nigeria, the level of biosafety awareness is low among workers in Health Care Establishments (HCEs) and neither have pathogenic organisms in wastes from HCEs been identified. Studies were therefore carried out to examine the level of biosafety awareness and the biomedical waste disposal practices in selected HCEs in Abuja and Lagos respectively as well as identify parasites from HCE wastes from Lagos prior to final disposal. A total of 200 questionnaires were administered to HCE workers in Abuja and Lagos respectively for information on their knowledge of biosafety and how biomedical wastes are disposed. Also, samples of urine (40) and stools (50) from 90 HCEs in Lagos were examined for presence of parasites using standard parasitological methods comprising of direct wet mount and formol ether concentration techniques. Both urine and stool were examined with 5 % lugol iodine and kinyoun carbol fuschin stain. Result showed that HCE workers had knowledge of the basics of biosafety but those in Lagos understood more than the ones in Abuja. Trichomonas vaginalis was identified in one of the urine samples. Female stool (22 %) had the highest prevalence of intestinal parasites relative to males (4 %). Entamoeba histolytica (6 %), Ascaris lumbricoides (6 %) and Cryptosporidium spp. (6 %) were prevalent in the stool samples. These results underscore the need for more enlightenment and education for HCE workers in respect of biosafety. It further showed that the HCEs in Lagos disposed biomedical wastes improperly, which can lead to further transmission of pathogenic organisms.*

**Keywords:** Biosafety knowledge, Health Care Establishments, Biomedical waste disposal, Parasites, Parasitological methods

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### INTRODUCTION

Healthcare establishments (HCEs) analyze, generate, handle, treat and dispose of biomedical wastes of various types including pathogenic microorganisms. Workers in these HCEs including scientists, researchers, students, technologists and attendants are often exposed to infectious agents, toxic chemicals, unhealthy processes and equipment. Also the products of

technological processes which include foods and genetically modified organisms (including plants) may lead to hazardous consequences to which man is exposed. The principles and practices of biosafety are therefore of extreme importance. Biosafety is the avoidance of risk to human health and safety and conservation of the environment, as a result of the use of research and commerce of infectious and genetically modified organisms (Zaid *et al.*, 2001). Also, the

Centres for Disease Control (CDC) define biosafety as the discipline addressing the safe handling and containment of infectious microorganisms and hazardous biological materials (CDC, 2010). Owing to its impact on human and environmental health, the principles and practices of biosafety are very relevant in Health Care Establishments (HCEs) which, because of their activities receive, handle, treat and dispose of various pathogenic organisms. These activities generate wastes of various kinds including sharps, swabs, syringes, corrugated packaging materials, paper, dyes, other chemicals and so on. Furthermore, HCE wastes also include infectious wastes like human and animal specimen culture from medical and pathological labs, waste contaminated with blood and by-products, cultures and stocks of biohazard agents; waste from patients in isolated wards, discarded diagnostic samples containing blood and body fluid, discarded live and attenuated vaccine culture devices used to transfer inoculate and mix culture. Contaminated materials such as swabs and bandages as well as contaminated devices such as disposable medical devices. Also, they may include pathological wastes such as recognizable body and animal parts, tissue fluids or carcasses suspected of being infected with infectious agents known having zoonotic potentials. Wastes generated from pharmaceuticals such as expired drugs, unused and contaminated drugs, vaccines, sera, genotoxic and heavy metals can also have profound effect on human health and the environment. It is estimated that HCE wastes are composed mainly of general wastes (80 %) and hazardous materials (20 %) which may be infectious, toxic or radioactive (WHO, 2000). The infectious component of HCE waste contains potentially harmful microorganisms capable of infecting hospital patients, health care workers, pets, livestock and the general public.

The foregoing underscores the need for biosafety knowledge and good management practice for biomedical wastes. There is a dearth of studies in this respect except for the report of Abah and Ohimain (2011) on health care waste management in a teaching hospital in Edo State,

Nigeria. Also, the level of biosafety awareness among workers in HCEs in Nigeria is not known, neither have the pathogenic organisms in their wastes identified. The present study highlights the level of biosafety awareness and the biomedical waste disposal practices in selected HCEs in Abuja and Lagos respectively and also identifies parasites from HCE wastes in Lagos prior to final disposal.

The study was carried out to evaluate the level of biosafety awareness in selected HCEs, document the medical waste disposal practices in Lagos and Abuja respectively and identify parasitic organisms in biomedical wastes from HCEs in Lagos prior to final disposal.

## MATERIALS AND METHODS

**Location of HCEs and Administration of Questionnaires:** Two locations were selected as study areas namely Lagos (6° 27' 55.51" N and 3° 24' 23.21" E) and Abuja (9° 4' 20.15" N and 7° 29' 28.69" E) due to their cosmopolitan nature as well as their relative importance to Nigeria politically and economically. Abuja is the seat of government at the federal level being the administrative capital of Nigeria, and Lagos is the commercial capital serving as host to more than 2000 industries and being the former administrative capital of Nigeria.

Structured questionnaires were administered over a period of three months (July – September 2012) in selected HCEs including hospitals, clinics and diagnostic laboratories in Lagos and Abuja respectively with the aim of extracting information on the level of biosafety knowledge among various categories of HCE workers in the two centres and how their biomedical wastes are disposed. A total of 200 questionnaires were administered in Lagos (100) and Abuja (100) with a recovery rate of 82 % and 79 % for each study area respectively.

**Biomedical Waste Characterization and its Disposal:** Wastes from selected HCEs were identified as solid wastes including corrugated packaging, labels, plastics, sharps etc or liquid wastes comprised of blood, sputum, urine, stool, sputum, semen, vaginal discharge etc.

The mode of waste disposal was identified as burying in pit holes, incineration, burning and open disposal in public waste disposal points.

#### **Collection and Analyses of Samples:**

Urine and stool waste samples were collected respectively from holding points in selected HCEs located in Lagos. The samples comprised of 56 % stool and 44 % urine samples. Fresh stool and urine samples were collected using clean universal sample bottles with tight fitting lids. After collection, the samples were transported in ice-pack to the laboratory for examination.

Urine samples were transported to the laboratory and the samples maintained in a deep freezer at temperature of about -20 °C before examination. Each sample bottle was labeled for type, age, sex and date of collection. The sample tube was half-filled and saline solution added. Centrifugation was carried out at 2000 rpm for 2 minutes. The supernatant was decanted and sediments were examined with microscope. The sediments were stained with 5 % lugol iodine prior to microscopic examination so as not to miss the trophozoites of *Entamoeba* and *Giardia*.

Stool samples were visually examined under the microscope to note the consistency, presence of abnormal features, whether they are watery, bloody or mucous. Stool samples were later processed through formol ether concentration techniques as described by Garcia (2007). The observations from formol ether concentration technique were used for identification of parasites.

## **RESULTS**

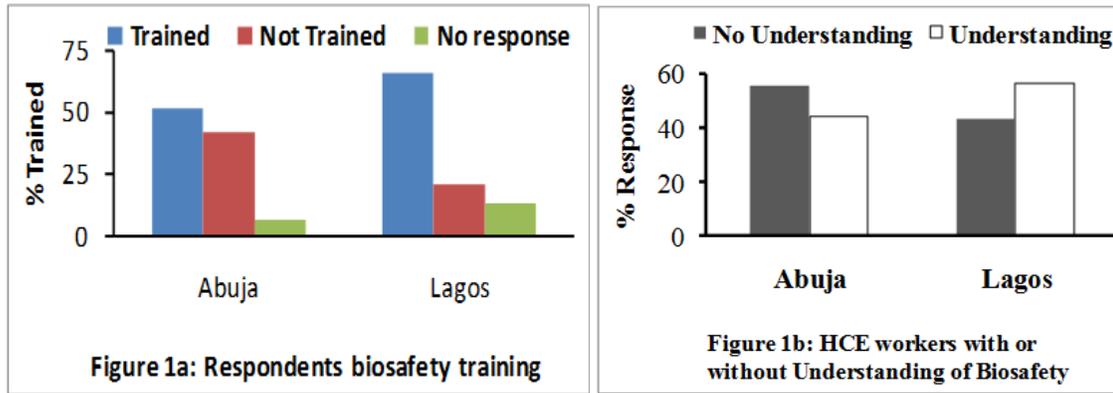
**Knowledge of Biosafety among HCE Workers in Lagos and Abuja:** Analysis of questionnaires showed that majority of respondents in both Lagos and Abuja had received training, while some HCE workers had no knowledge of biosafety. The results also showed that more workers in Lagos had received formal training in biosafety and there

were more HCE workers in Abuja that understood the concept of biosafety than the workers from Lagos HCEs (Figures 1a and 1b).

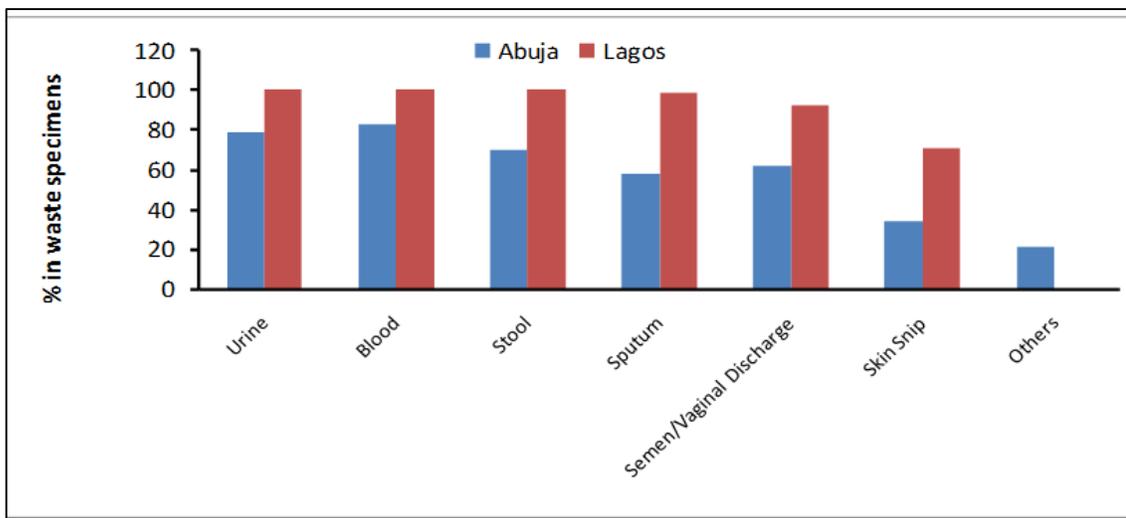
**Biomedical Waste Characterization by HCEs in Lagos and Abuja:** The biomedical wastes from HCEs in the two study locations were identified as urine, blood, stools, sputum, semen/vaginal discharge, and skin snip. Some of the wastes from Abuja could not be identified and characterized and were consequently group as others. There were more of all identifiable biomedical wastes in Lagos HCEs than in Abuja (Figure 2).

**Biomedical Waste Disposal Practices of HCEs in Lagos and Abuja:** In the two study locations, the wastes were sorted prior to final disposal. More sorting was recorded in Lagos relative to Abuja HCEs. All solid wastes were sorted by respondents from Lagos while 60 % or less sorted their wastes in Abuja (Figure 3a). More of the liquid wastes were separated into types in Lagos than in Abuja (Figure 3b). Also, HCEs in Abuja dispose of their biomedical wastes by pit hole, incineration, public waste disposal point, and Waste Management Authority while none of the HCEs in Lagos use pit method. In addition, most of the Abuja HCEs use incinerator while most of those in Lagos dispose of their wastes through services of the Waste Management Authority (Figure 4a). Most HCEs in Abuja dispose of their wastes more frequently (daily) than the ones in Lagos (weekly) (Figure 4b).

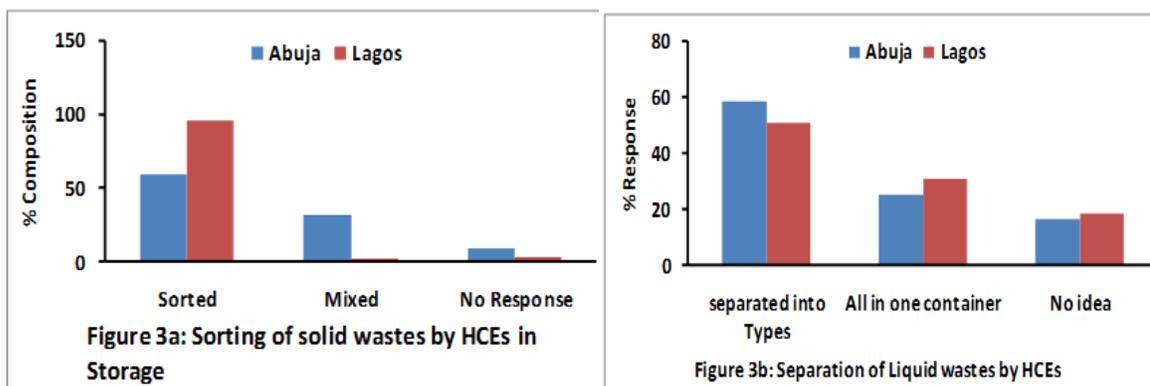
**Parasitic Organisms in Biomedical Wastes from Lagos HCEs:** One of the urine samples tested positive for *Trichomonas* species. Most of the stool samples (72 %) had no parasite. Four protozoans (*Cryptosporidium* species, *E. histolytica*, *G. lamblia* and *T. vaginalis*), one flat worm (*S. mansoni*) and two nematodes (*Trichuris trichiura* and *A. lumbricoides*) were identified in the stool samples (Figure 5). Most of the stool samples from which parasites were identified were collected from female patients (Figure 6).



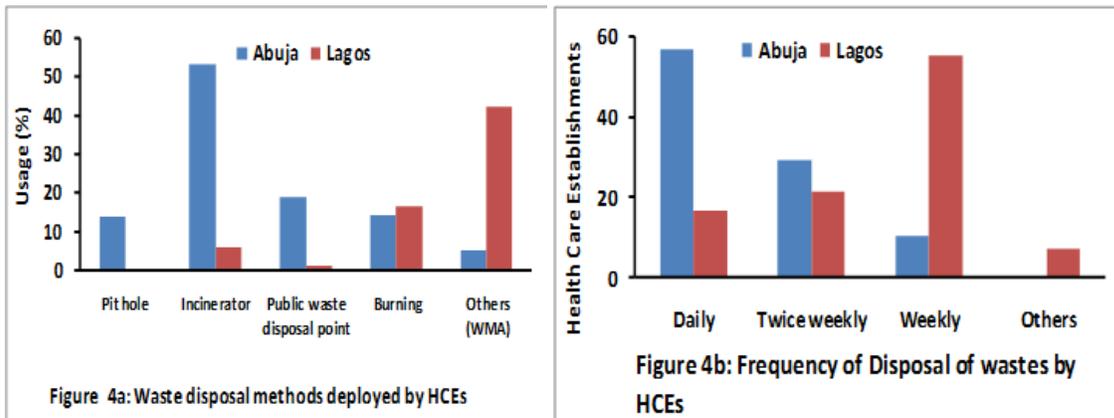
**Figure 1: Levels of biosafety training and understanding in Lagos and Abuja**



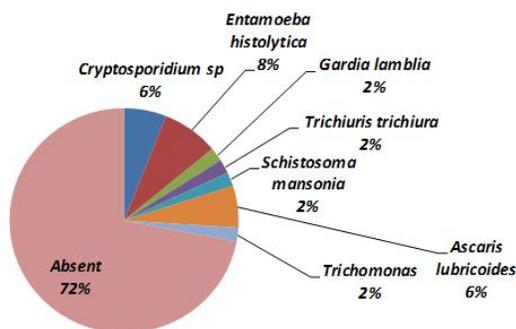
**Figure 2: Characterization of waste specimens from health care establishments in Lagos and Abuja, Nigeria**



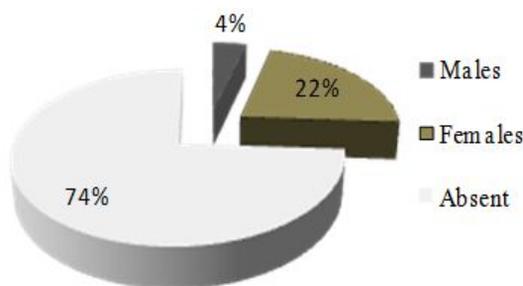
**Figure 3: Sorting of solid and liquid wastes from health care establishments in Lagos and Abuja, Nigeria**



**Figure 4: Methods and frequency of biomedical waste disposal in Lagos and Abuja, Nigeria**



**Figure 5: Intestinal parasites in stool samples from Lagos health care establishments**



**Figure 6: Percent positive parasites in male and female stool samples**

**DISCUSSION**

This study reveals the knowledge and practice of biosafety among workers in HCEs, biomedical waste disposal and the occurrence of pathogenic microbes in the wastes from HCEs in two Nigerian cities prior to final disposal. The results of this study showed that more HCE workers in Lagos understood the basic principles of biosafety more than those in Abuja. This may be because Lagos State has a better organized

waste disposal system relative to the Abuja. In Lagos State, the Waste Management Authority (LAWMA) are actively involved in the disposal of biomedical wastes using LAWMA-branded medical waste truck. The LAWMA also give out colour-coded boxes for waste segregation prior to final disposal. In Abuja, this active involvement of a Waste Management Authority in medical waste disposal is lacking. The foregoing non-committal situation with respect to medical waste disposal in Abuja by the waste board typifies the lack of commitment by management of waste disposal boards as shown by Abah and Ohimain, 2011. The lack of management commitment, poor waste handling practices, inadequate training of Health Care Workers (HCWs), non-existent segregation of HCW and risky disposal were the bane of a teaching hospital studied in Nigeria (Abah and Ohimain, 2011). In alluding to the poor handling of biomedical wastes, Ohakwe (2011) reported that HCEs in Enugu State, eastern Nigeria, store infectious wastes in plastic buckets, disposable bags, waste bins or rubber buckets without a clear indication of its content and that chemicals are poorly disposed of in sink without any form of treatment, allowing the untreated waste chemicals to run into open or underground pit. Such disposed waste chemicals pose serious environmental hazard in the near and distant future.

Responses to questionnaires in this study also showed that HCE wastes in both Lagos (18.82 %) and Abuja (50.63 %) were not treated prior to final disposal. The disparity in these figures is likely to be a result of the understanding of the principles of biosafety and

their putting them into practice by Lagos HCE workers relative to those in Abuja as earlier stated. It however shows that HCEs that failed to treat their wastes prior to final disposal do so in conformity with the general practice in Nigerian HCEs as reported by Abah and Ohimain (2011). It is established that the common practice in Nigeria is that the wastes are collected at a central open dumpsite and burnt periodically. Occasionally, the wastes are buried by covering with a heap of soil without any prior treatment. Furthermore, human body parts such as placenta and amputated limbs are either disposed of with the general HCE wastes or given to the patients or their relatives to dispose of in their own way (Abah and Ohimain, 2011).

Some intestinal parasites including diarrhoea-causing protozoans (*E. histolytica*, *G. lamblia* and *Cryptosporidium* sp.), helminths (*A. lumbricoides*, *T. trichiura*) and schistosome (*S. mansoni*) were identified in samples disposed of by HCEs. The presence of these parasites in wastes gives strong grounds to conclude that the wastes did not receive prior treatment. The presence of parasites shows that the handling of wastes from the HCEs is unsustainable and cannot be relied upon for the protection of human health and environmental integrity because healthy humans and animals in proximity with the HCEs in Lagos may get infected with these parasites (Santamaria and Toranzos, 2003; Mordi and Ngwodo, 2007). It is unclear how long the parasites identified in these wastes would survive and cause infection, some enteric parasites such as *E. histolytica* cysts have been reported to survive for up to 30 days (Cabrerá and Porter, 1958). Also, *Giardia* cysts could survive for up to 24 days at sub room temperature (Bingham *et al.*, 1979), while *A. lumbricoides* can stay alive for up to 20 years or more (Pecson and Nelson, 2005). It is interesting to note that *Cryptosporidium* oocysts have been found to survive and retain their infectivity for several months in both salt, fresh water and chlorinated water (Fayer *et al.*, 1998). The period of temporary stay at the HCE vicinity is therefore sufficient for the parasites to still be infective. The diseases caused by the presence of the identified parasites would

therefore continue to recur and spread in the environment.

**Conclusion:** The results obtained in this study indicates that although a large number of HCE workers sampled have knowledge of biosafety especially in Abuja, showed little understanding and practice of biosafety. It is recommended that HCEs and governments should expose their personnel to training and retraining. The use of improper waste disposal methods was recorded in Abuja during this study. It is recommended that waste disposal regulations should be enacted and that appropriate arm(s) of government in the Federal Capital Territory, Abuja must be committed to enforce the regulations as is done in Lagos.

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