
Knowledge, Attitudes/Beliefs and Practices in Medical Waste Management - An Appraisal of Jos North LGA, Plateau State, Nigeria

Erekpitan O. Ola-Adisa¹, Y. P. Elijah Mangden², Yohanna C. Sati³, James O. Adisa⁴

^{1,2,3} *Department of Architecture, University of Jos, Jos, Nigeria*

⁴ *Department of Medical Laboratory Sciences, University of Jos, Jos, Nigeria*

ABSTRACT

Bio-medical waste is defined as wastes that is generated during the diagnosis, treatment or immunization of human beings that are contaminated with patients' body fluids, syringes, needles, ampoules, organs and body parts, placenta, dressings, disposables plastics and microbiological wastes. Medical wastes poses a significant impact on health and environment. Proper waste management strategies ensure health and environmental safety. This study aims is an appraisal of waste management practices in Jos North LGA of Plateau State from a longitudinal study of 70 medical establishments in the LGA. The study reveals a waste-collection system that is sound in principle but with deficiencies because of the declining quality of the waste managers' service delivery, examining belief systems of stakeholders to determine the effect these have on actual implementation of waste management strategies in Jos North. Questionnaire administration to service providers and other relevant stakeholders and the subsequent analysis as a research instrument revealed knowledge gaps in the user base. The results showed that 50% of the general waste produce is non-infectious, majority of the waste is not segregated. The study also shows that most of the sampled facilities do not segregate their waste, nor use protective clothing such as gloves during waste handling. The study also shows majority of the medical facilities dispose of their waste on daily basis and have monthly and yearly record of their financial lending on waste management ranging from ₦20, 000, 00 to ₦100, 000, 00. Appropriate suggestions are made in order to curtail the risks of infection as result of improper disposal of medical waste in all medical establishments in Nigeria.

Keywords: Knowledge Base, service providers, Waste Disposal, Waste Generation Waste Management

INTRODUCTION

Waste generation is one of the earliest activities attributable to human beings and a significant part of anthropological and archaeological documentation of past civilizations. From the waste generated from hunting and gathering to the more complex and sophisticated waste generation patterns of this new millennium. Waste generation and its disposal and management is a paramount issue in sustainability of the built environment and the future of the planet; particularly as the complex components create greater environmental pollutions and make waste disposal and management more difficult [1].

Today's environment contends with global warming which studies in part say is attributable to poor management of both biodegradable and non-biodegradable solid waste. This is compounded by the astronomical increase in solid waste generation due to increase in population and urbanisation. Even

**Address for correspondence:*

olafeadisa@gmail.com

more critical in today’s environment is waste disposal the current trends of ineffective and irresponsible disposal of solid waste pollute the environment and pose as health risks to the society. Modern approaches to waste disposal only present a partial solution to the problem. These approaches include landfilling, which comes with attendant problems of smell from the land fill which makes it an undesirable environmental scheme in the neighborhood [2]. Incineration often involves burning of toxic combustible materials largely due to ignorance of the various stakeholders. An evaluation of the knowledge, attitudes beliefs and practices of the various stakeholders in medical waste management is relevant in the assessment of Plateau State’s viability as a sustainable city thirty five years after inception.

CONCEPTUAL FRAMEWORK

In establishing conceptual framework, this paper looks at three areas namely; concepts and patterns of medical waste management in Nigeria, knowledge attitudes beliefs and practices of stakeholders recommending mitigating measures of sustainable medical waste management practices. Waste management can be successfully established with the classification of the types of waste, waste generation statistics and methods of management (and disposal). Waste can be classified in a number of ways such as by material fraction or waste stream (organic, glass, paper), characteristics (combustible, recyclable, hazardous), and source (household, industrial, agricultural etc.). Another school of thought indicates that waste exists in solid, liquid, and gaseous forms. Solid waste in turn varies by content and has many sources. Solid waste may be classified by source as municipal, industrial, agricultural, or medical. It can also be classified by content as non-hazardous, hazardous, bulky, or biogenic. Medical waste can be classified similarly as solid and liquid waste as outlined in Table 1.

Medical Waste, which is waste originating from hospitals as well as waste from commercial labs and medical industry, is often generated in greater quantities relative to other forms of solid waste. Therefore, the value of medical waste as a resource as well as its impact on the functioning of cities makes it one of the most important components of solid waste[3].

Table1. Classification of Medical Waste

Type	Typical examples
Liquid Wastes	
a. Biological waste	Blood, excrement, body fluid etc.
b. Chemical waste	Solutions, inorganic salts etc.
c. Over-date medicine	Unused drugs, over-date drugs
d. Radioactive waste	Wastes from radiology (iodine 125, iodine 131 etc)
Solid Wastes	
a. Perforating and cutting wastes	Needle, syringes, scalpels, blades, broken, glass, vials. Wastes from treatment (dressings, stool napkins, plaster)
b. Non-perforating and non-cutting wastes	Parts of the body: organs, placentas, tissues etc. Over-date medicines (Expired drugs) Household-type wastes: other wet and dry waste.

Source: Eigenheer & Zanon (1991)[4]

Nigerian waste generation is on the increase at an estimated rate of about 0.5 – 0.7% per annum, with 2006 figures ranging from 0.4 to 0.8 Ton /capita /annum. Waste complexity is also increasing with biodegradable waste currently accounting for over 50%. This amounts to over 50 million tons per annum average waste burden on the nation with less than 10% waste management capacity. This capacity is generally provided and delivered by public sector. Commercialization of this sector has remained a task with poor or no success story throughout Nigeria due to poor national policy framework, infrastructural capacity and manpower. [4], The Nigerian Environmental Study/Action

Terms (NEST) estimated that about 40 million tonnes of waste would be generated in Nigerian between 2005 and 2010.

Table 2 highlights the sources of Medical waste, and they can be categorized into major or minor according to the quantities produced. This information is vital as architects and planners more often than not are not fully aware of the belief and practices of the service provider and generators of medical waste. Therefore design of these facilities as outlined in Table 3 should cater to the safe and effective temporary containment and disposal of medical waste from source.

Table 2. Sources of Medical Waste

Major Sources of Medical Waste		
Hospitals	Other Health-Care Establishments	Related Laboratories And Research Centres
Teaching Hospital	Emergency Medical Care Services	Medical And Biomedical Laboratories
General Hospital	Health-Care Centres and Dispensaries	Biotechnology Laboratories And Institutions
District Hospital	Obstetrics and Maternity Clinics	Medical Research Centres
	Outpatient Clinics	Mortuary And Autopsy Centres
	Dialysis Centres	Animal Research And Testing
	First-Aid Posts and Sick Bays	Blood Banks And Blood Collection Services
	Long-Term Health-Care Establishments and Hospices	Nursing Homes For The Elderly
	Transfusion Centres	
	Military Medical Services	
Minor Sources of Medical Waste		
Small Health-Care Establishments	Specialized Health-Care Establishments and Institutions with Low Waste Generation	Non-Health Activities Involving Intravenous or Subcutaneous Interventions
Physicians' offices	Convalescent nursing homes	Cosmetic ear piercing and tattoo parlours
Dental clinics	Psychiatric medicals	Illicit drug users
Acupuncturists	Disabled persons institutions	Funeral services
Chiropractors		Ambulance services
		Home treatment

Source: Pruss et al. (1999)[6]

The management and disposal of this medical waste is a major challenge for our cities and towns which should be managed so that it does not endanger human health, harm the environment, pose risks to air, water, soil, plants or animals, be a nuisance through odours or noise, or adversely affect places of special interest. Nigerian development policies have been poorly coordinated and, are highly dominated by economic objectives making environmental protection low in ranking. Furthermore available funding rests in the public sector hampering medical waste management primarily by the high rate of corruption and low private sector participation. Consequently, private sector contribution to medical waste management is low [5].

Currently less than one percent (1%) of Nigerian GDP is spent annually on waste management and water supply with Lagos and Rivers States leading with a monthly expenditure of about 300 and 100 million naira, respectively on waste collection and disposal. This is far less than the recommended standard of three to five percent (3-5%) of national GDP. Nigeria has over thirty five percent (35%) of her population living in the cities with a growing urbanization rate of about 7% per annum and less than ten percent (10%) of the city populations enjoying marginal waste management services The handling and disposal of MSW from its generation at source (by the waste producer) to incineration or final disposal in a landfill, can involve a number of intermediary stages such as waste prevention at source, collection, transport, sorting, recycling and biological treatment. While some traditional disposal methods may release environmentally hazardous gases and pollutants, green waste management methods focus on sustainable and ecological solutions such as green disposal systems and recycling. The most common disposal methods used are landfills and incineration. Other methods that include recycling and green methods like composting and waste reduction and segregation.

Medical waste segregation is an important step in reducing the volume of hazardous waste as it offers the ability to make more accurate assessment about its composition with the use of labelled bags to separate infectious waste from domestic waste effectively [9] The segregation consists in separating the different waste streams based on the hazardous properties of the waste, the type of treatment and disposal practices that are applied. A recommended way of identifying Medical waste categories is by sorting the waste into colour-coded and well-labelled bags or containers (Table 3). All the specific procedures of Medical waste segregation, packaging and labelling should be explained to the medical and ancillary staff and displayed in each department on charts located on the walls nearby the Medical waste containers that should be specifically suited for each category of waste. Figures 1 shows typical guidelines in the provision of waste storage and display points in nuclear medical waste management.

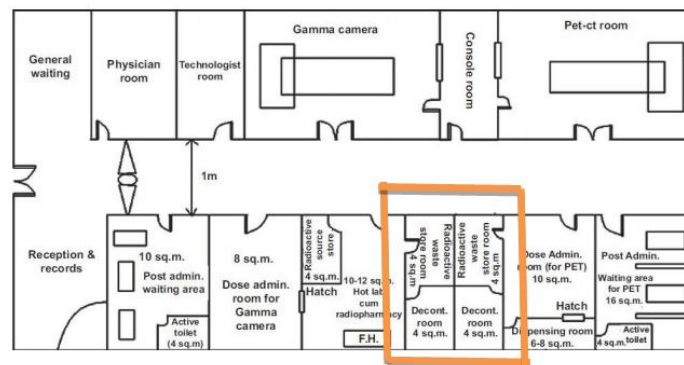


Figure 1. Typical Layout of Radiography floor showing recommended storage of Radio-Active waste*

Source: Indian Nuclear Medicine (2010) [7]

*Note decontamination rooms directly adjacent to radioactive waste storage to contain radioactive waste

Table 3. Recommended color-coding for Medical Waste

Type Of Waste	Colour Of Container And Marking	Type Of Container	Design Provision
Clinical Waste	Yellow	Strong, leak-proof plastic bag or container	make provision for store and adjacent room for decontamination within medical facility
Sharps Waste	Red	Puncture-proof container	make provision for store and adjacent room for decontamination within medical facility
Reusable Waste	Black	Leak -proof plastic bag or container	Make provision within the immediate vicinity and transport to remote location
General Waste	Green	Plastic bag or container	Incinerators and pit located in remote area of the site or off site

Source: Adapted from Khan (2004) [8]

Knowledge Attitudes Beliefs and Practices of Stakeholders

Improper management of solid waste can also be attributed to the Knowledge Attitudes Beliefs and Practices (KABP) of Stakeholders. The stakeholders in waste management can be classified into public sector and private sector stakeholders. The agencies responsible for solid waste management are:

- Federal Ministry of the Environment which is also the parent ministry for the
- Federal Environmental Protection Board (FEPA)
- National Environmental Standards and Regulation Agency (NESREA)
- Plateau State Environmental Protection Board (PLEPB)

- Senate Standing Committee on the Environment
- House Standing Committee on the Environment
- National Council on the Environment
- Environmental Health Officers Registration Council of Nigeria (EHORECON)

Private Sector Stakeholders are formal and informal service providers, nongovernmental and civil society organizations and the private individuals that reside in the various communities. These include:

- Formal service providers. These are currently service providers that have been engaged by the Plateau State Government to handle waste disposal. This doesn't include the private service providers that are engaged by the private individuals and corporate bodies.
- Informal service providers. These consist of local waste disposal contractors at the neighbourhood level.
- Nongovernmental and Civil Society organisations which include:
 - Waste Management Society of Nigeria (WAMASON)
 - National Society for the Environment (NSE)
- Landlord and tenants associations
- Individual medical facility owners.

The theory of planned behaviour shows the interrelationship between knowledge (positive or negative which informs beliefs. Beliefs are reflected in attitudes and ultimately be shown in the practices. Each of the various identified stakeholders therefore respond to waste management practices largely as a response to their knowledge base attitudes and belief system which has an effect on their behaviour.

SCOPE OF RESEARCH

This study adopted a case study approach to appraise the knowledge, attitudes, beliefs and practices of Jos North, Plateau State. Jos North was selected because of it's the largest of the suburban Local Government Councils. The case study research design was used because it sheds light on the unique characteristics of the sampled population, and because it helps to compare the findings of this research with the literature reviewed. Data was drawn from primary and secondary sources. The secondary data involved the use of information already in existence and this was sourced largely through rigorous literature review. Descriptive analyses as well as quantitative and inferential analyses were conducted. All attributes and indicators of waste management were considered and analysed for each category identified for analysis in the communities.

Primary data used was acquired through direct field measurement, questionnaire survey and interview methods. The questionnaire which was used to gather primary data was divided into four broad sections, with each section containing variables such as condition of environment, waste management facilities and services, waste management practices and questions concerning knowledge base, attitudes and beliefs. A separate questionnaire was administered to other stakeholders from the public and private sector. In order to aid primary data collection, a series of interviews were conducted with medical personnel and staff of the local government to gather additional data. During the field study, questionnaires were administered to the heads of the 30 sampled medical establishments in Jos North Local Government Area. During this research, focus has been made on distribution of questionnaires.

The questionnaires were administered to the heads of these sampled facilities and as well health professionals which include 7 medical doctors (23.33%), 7 chief nursing officers (23.33%), 6 community health workers (20%), 4 medical nurses and secretaries each (13.33%) and 2 medical laboratory scientist (6.66%). Interviews were also conducted with staff of the Plateau State Environmental Protection Board and relevant stake holders in the community.

RESULTS AND DISCUSSION

Figure 5 shows that medical doctors and chief nursing officers make up the highest percentage of up to 23.33% of the total respondents each, while the least are medical lab scientist which covers only 6.67% of the total respondents of the sampled facilities. Fifteen (50%) of the sampled medical establishments in this area are privately owned, while the remaining 50% are owned by the government. (26.66%) of the public medical establishments are owned by the Federal Government, while 2 (13.33%) are owned by the state government while the remaining 9 (60%) are owned by the local government council (Figure 6).

Segregation in this study means to separate one item of medical waste or group of medical waste from the rest, which in present time believed to be the best method in management of the medical waste. From the result of the field survey as shown in figure 8, out of the whole sampled medical establishments, only nine (9) (30%) do segregate their waste, while the remaining twenty one (21) (70%) do not. It was noted that out of the 9 medical establishments that do separate their waste, four (44, 44%) segregate their waste at the point of waste generation, four (44.44%) carry out segregation in a designated place within the facility and only one (11.11%) segregate their waste outside the facility premises. During this research it was discovered that 28 (93.33%) medical establishments waste handlers use gloves and other protective clothing during waste handling. Only 2 (6.67%) out of the 30 sampled facilities do not use any protective device. This is as a result of the absence of waste management staff.

In this research, it is shown that out of the 30 sampled medical establishment, 10 (33.33%) finally disposed of their waste at the municipal landfill, 8 (26.67%) finally buried their waste on the medical ground, while 12 (40%) incinerated and buried their waste. This shows that all the medical establishments have their own ways on how they treat their waste from collection to the final disposal. Figure 10 shows that 19 (63.33%) of the medical facilities dispose of their waste on daily basis. While 5 (16.67%) dispose of their waste weekly. 2 (6.67%) dispose of their waste in every two weeks and 4 (13.33%) dispose their waste monthly.

The cost of construction, operation and maintenance of system for managing medical waste represents a significant part of overall budget of a medical. Information received during this research indicate that 14 medical facilities have an estimate of the monthly and yearly expenses on their medical waste management. The remaining 6 (20%) could not estimate how much they spend in the management of their medical waste or may be, are afraid (o reveal out secret of their financial spending in their facilities. In the sampled facilities, those that responded having their monthly estimates of financial expenses ranges from N20,000 to N 100,000,00 monthly depending on the size, category and income of the establishment. The public medical facilities mostly complain on inadequate funding by federal, state or local government, having a very low budgetary allocation on management of medical waste. It was also discovered that none of the sampled medical facilities have an updated record of a detailed expenditure on medical waste management.

From the study of the questionnaire result which was administered to the thirty (30) medical establishments in Jos North, it was proved that out of all the staff that are involved in the management

Erekpitan O. Ola-Adisa et al. “Knowledge, Attitudes/Beliefs and Practices in Medical Waste Management - An Appraisal of Jos North LGA, Plateau State, Nigeria”

of medical waste in those establishments. (87.51%) are employed by the public medical establishments, while (12.48%) are employed by the private medical establishments. Of the total waste management staff, (11.28%) have tertiary education, while (30.87%) have secondary education, (54.90%) have primary education and only (2.95%) have no formal education. From the result so far, it could be said that a larger percentage of the waste management staff are partially educated with this percentage number that have a primary school education. There is an indication that majority of the waste management staff are partially educated in Jos North. But in training on the methods and procedures of medical waste management, the result was absolutely poor. Unfortunately, out of the 30 sampled medicals, only ten (10) (33.33%) ever allowed their staff to attend training, while the remaining twenty (20) (66.67%) never allowed their waste management staff for a training. This is rather discouraging, if at all training is being regularly attended, awareness on current methods and procedures for managing medical waste could be achieved by the staff, to enable them being more competent and capable in doing their duties.

The study has shown that (96.67%) of the sampled medical establishments are aware of the possible dangers associated with improper medical waste disposal. Only one (3.33%) respondent out of the 30 distributed questionnaires had not known these risks. Though the only problem is how the danger is been delivered, with diverse knowledge of the respondents from one medical establishment to another. Table 5 outlines the knowledge base and attitudes of respondents. Majority of the respondents strongly agreed that burning of waste contribute to health problems, even as a small percentage disagreed with this (2.7%). Generally the respondents displayed positive knowledge and positive attitudes with regards to the issues raised.

Table 5. Summary of Knowledge, Beliefs and Medical Waste Management Practices

	Questions	Yes (%)	No (%)	Don't Know (%)
1	Do you think that the medical personnel/patients have a role to play in assisting the Plateau State Environmental Board (PLASEB) to manage waste in Jos North?	95.5	1.8	2.7
2	Do you support the principle of waste reduction?	87.4	6.6	6.3
4	Have you ever heard about recycling?	94.6	5.4	0
5	If a recycling program was set up, that collected materials like plastic, paper, metals, etc., would you be willing to separate these into separate bags for collection purposes?	93.7	3.6	2.7
6	Would you be willing to pay for pickup of these recycling materials from your hospital?	69.4	19.8	10.8
7	Would you be willing to participate in a program to compost food and yard waste?	72.1	12.6	15.3
9	Would you like more information about how and what types of garbage you can compost, reuse, and recycle in order to reduce the amount of garbage that you need to get rid of?	90.1	4.5	5.4

Source: Authors' Field Survey



Plate ii: Walled incinerator for burning medical waste

Source: Authors' Field Survey

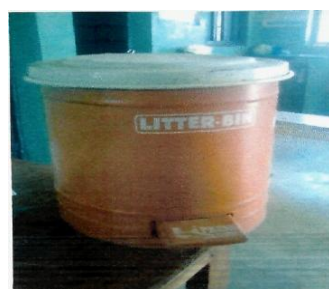


Plate iii: Container for disposing medical waste in a clinic

Source: Authors' Field Survey

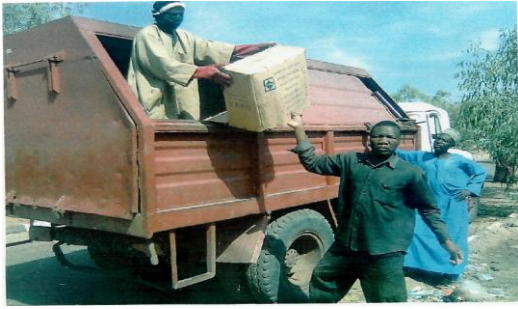


Plate iv: Refuse collectors collecting medical waste from the incinerators

Source: Authors' Field Survey



Plate v: General waste and other municipal waste in the final disposal site

Source: Authors' Field Survey



Plate vi: General (Non-Infectious) waste in the medical facility awaiting final collection and disposal

Source: Authors' Field Survey



Plate vii: Typical Waste Management Team*

Source: Authors' Field Survey

*note that personnel are not wearing protective clothing



Plate viii: Typical Medical waste disposal vehicle

Source: Authors' Field Survey

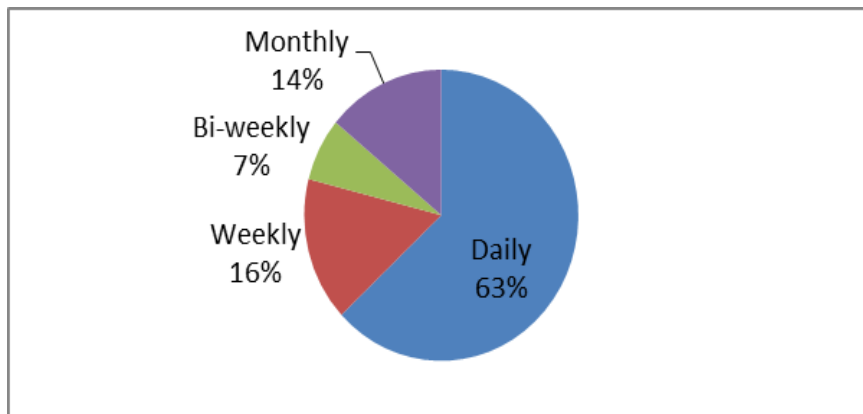


Fig5. Frequency of waste evacuation in the medical establishments

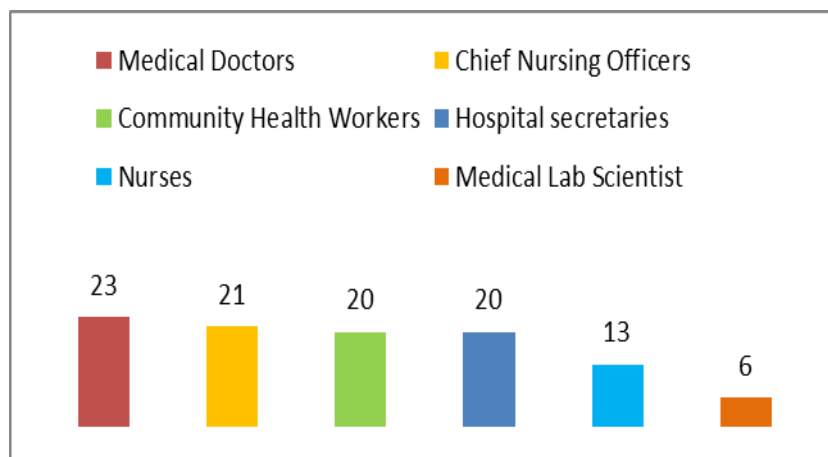


Fig6. Heads of Medical establishments surveyed

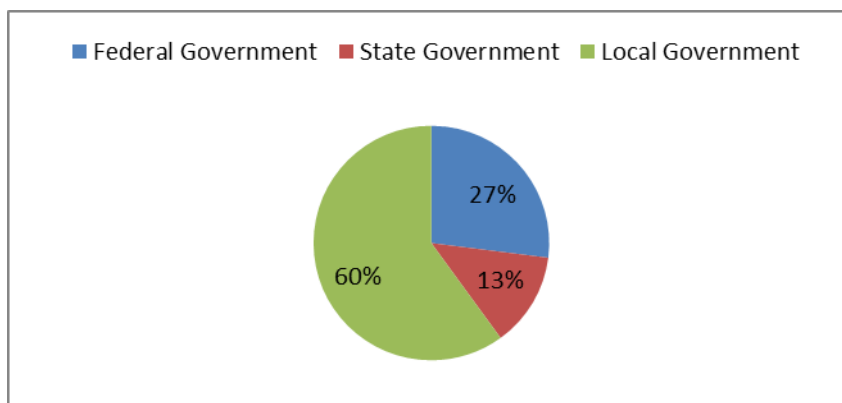


Fig7. Ownership Structure of Medical Facilities

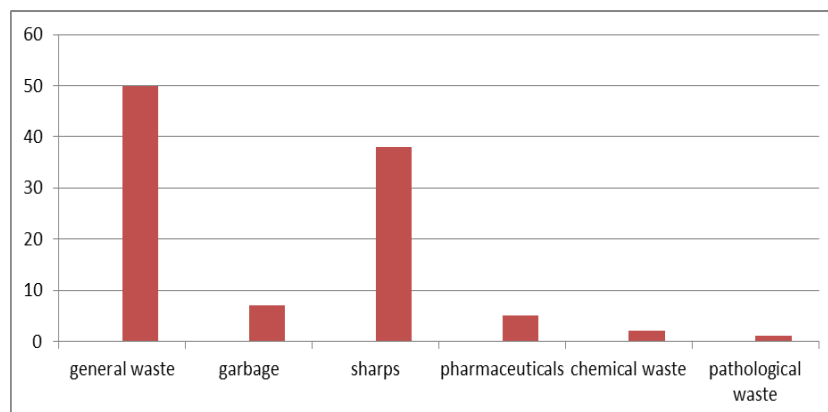


Fig8. Composition of Healthcare Waste in Jos North

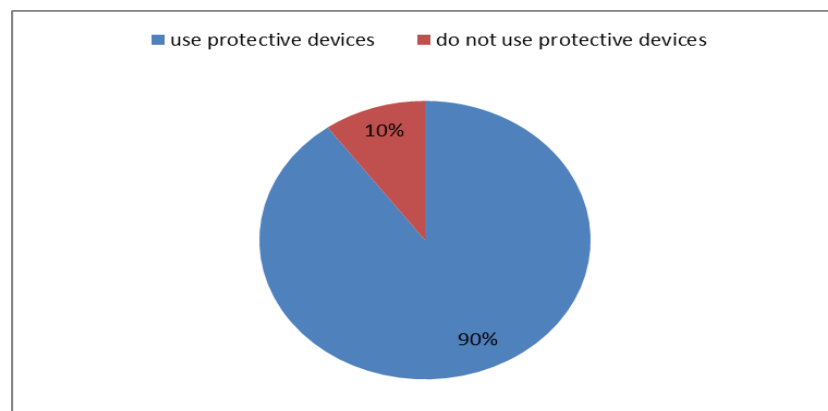


Fig9. Segregation practice of medical waste in Jos North

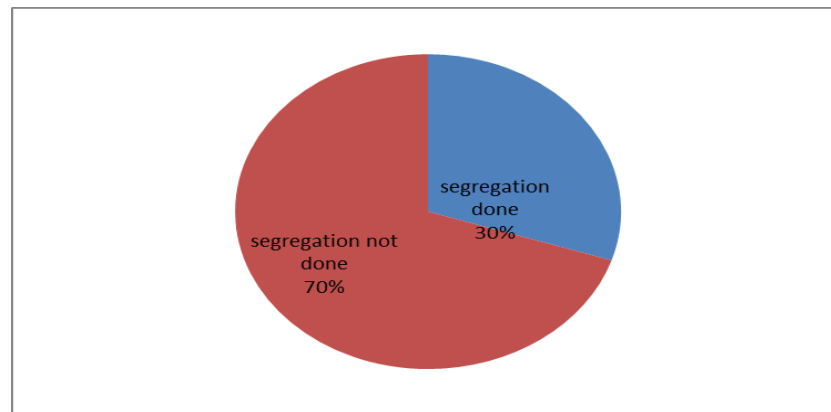


Fig10. Composition of usage of protective devices by the waste handlers

This research shows that out of the whole 30 respondents who filled the questionnaire, seven (7) were medical doctors (23.33%), seven (7) were chief nursing officers (23.33%), six (6) community health workers (20%), four (4) medical nurses and Secretaries each (13.33%) and two (2) medical laboratory scientist (6.66%). In this research, the researcher was able to select at random the medical facilities studied. 15 (50%) private medical establishments were selected, likewise 15 (50%) public medical establishments were also selected. Questionnaires were distributed evenly to avoid disparity and bias study in this research. The research found that 57% of the waste produced in medical establishment in Jos North is non-hazardous to human beings, e.g. kitchen waste, packaging material, paper, wrappers, plastics, polythene bags, bottles and leaves falling from the trees. It also include food remain, litter and faeces of the patients and visitors they produce in most of the medical facilities. The remaining 43% include Sharps, which include waste materials causing the person handling it, a cut or puncture of skin e.g. needles, broken glass, saws, nail, blades and scalpels. Pharmaceutical waste which includes pharmaceutical products, drugs, and chemicals that have been returned from wards, have been spilled, are out-dated, or contaminated. Chemical waste which comprises discarded solid, liquid and gaseous chemicals e.g. cleaning, housekeeping, and disinfecting product and Pathological waste. This consists of tissue, organ, body part, human foetuses, blood and body fluid.

Findings on the segregation of waste by the medical establishments in the study area revealed that 30% segregate their waste, while 70% do not segregate their waste. The present system of Medical waste management in Jos North is environmentally ineffective, inefficient and hazardous to health. No proper segregation has been practiced in the medical facilities. It was observed that all medical waste in the studied facilities is non hazardous and may be treated as general solid waste. Due to lack of proper segregation, this large portion of non-hazardous waste is unnecessarily polluted by hazardous waste besides, there is no separate collection bin for medical waste and all kinds of waste from medicals including clinical and sharp wastes, is dumped in the municipal waste collection bins. This ill practice creates the possibility of contamination of whole mass of solid waste by infectious medical waste. Segregation is the essence of waste management and should be done at the source of generation of Bio-medical waste e.g. all patient care activity areas, diagnostic services areas, operation theatres, labour rooms, treatment rooms etc. The responsibility of segregation should be with the generator of biomedical waste i.e. doctors, nurses, technicians etc. (medical and paramedical personnel). 93.33% medical establishments waste handlers use gloves and other protective clothing during waste handling but only 6.67% do not. Two out of the twenty studied facilities were diagnostic centers and they don't employ cleaners and ward attendants or labourers. They often employ scavengers otherwise known as "Almajiri" to collect and disposed of these wastes in the two facilities. These scavengers are not aware of the impact of improper management of medical waste, such as

prick by a needle stick, injuries and cross infection risks that can be contracted by a waste handler. Many medical facilities Though, this has not been a problem in medical establishment in Jos North, because most of the facilities don't allow their waste handlers to use bare hands in collection and disposing of this medical waste. But rather there is need for all waste handlers in medical facilities to embark on wearing this protective clothing so as to escape from these risks of injuries.

None of the sampled facilities studied has architectural design provision for holding of medical waste neither does any have a single electrical/mechanical incinerator. 33.33% finally disposed of their waste at the municipal landfill, 26.67% finally buried their waste on the medical ground, while 40% burn and buried their waste. Majority of this medical establishment have a walled-built incinerators. After this wastes are being burnt, they are later taken to the facility backyard for burial. The medical infectious and biomedical wastes are separated from the non-infectious ones before burning in the case of The Jos University Teaching Medical Jos , but all other ones collectively combined all categories of waste and burn together. In the case of human parts of the body as a result of amputation, the relatives of the patients are called to witness the burial of the amputated parts of the body, which is usually done within the facilities. Medical waste Incineration was identified to be the simple largest source of Dioxin air pollution in the United States of America in 1997 [8]

There is need to embark on the use of newer methods for the treatment of medical waste before final disposal which are safer and environmentally friendly than incineration. They include low heat thermal processes and mechanical processes [8]. The study revealed that out of the total waste management staffs in medical establishments in Jos North 11.28% have tertiary education, while 30.87% have secondary education, 54.90% have primary education and only 2.95% have no formal education. From the result so far, it could be said that a larger percentage of the waste management staff are partially educated with this percentage number that have a primary school education. [9] said that lack of awareness and knowledge regarding handling and disposal of medical waste at all levels is a major problem of medical waste management in developing countries.

Lack of managerial skill and training of bio-medical waste management is one of the reasons for indiscriminate management and handling of bio- medical waste. To provide necessary information to the concerned person, make arrangements of training for creating awareness. The result of the research shown that out of the 30 sampled medical facilities only 33.33% ever allowed their staff attend training on medical waste management. There has been no formal training of staff, to teach them how to deal with the disposal of medical wastes. Though they have received training on laboratory analysis, it is done in an ad hoc method. Medical officers are generally aware that medical waste could pose a problem, however, most thought they were handling the situation sufficiently. Nurses, lab technicians, and medical matrons, however, had no training (formal or non-formal) on handling procedures and disposal methods. According to Akter *et al* (1999), there was insufficient awareness at different levels, from a director or divisional head to the waste pickers, about the potential threat posed by medical wastes. It is clear that most people are simply unaware of and unclear about what constitutes medical wastes. Most of the respondents did not know the harmful impact of recycling of wastes. Also, they are not aware of the environmental effect of medical wastes.

Another finding from this research is that, 63.33% of the medical facilities dispose of their waste daily. They don't allow their waste to accumulate within their facility for over 24 hours before evacuation. There are different types of vehicles used for waste evacuation (See plate vii) but the most common are open tippers. In a few States like Anambra, Lagos, Abuja etc. they have some

compressing vehicles whose problems are constant breakdown due to inadequate funding and lack of spares. Collection of the waste is done manually with shovels and rakes from waste facilities by the men who accompany the vehicles. In a few cases earth moving vehicles like bulldozers are used but they also breakdown frequently. The vehicles take the waste to final dumping or land filling sites without sorting and they dispose their contents unguarded at any place of their convenience. So the frequency of the waste evacuation is the most important factor to be considered. This is to say the more frequent the medical waste is being evacuated from the medical facility, the more efficient and less environmental and public health problem it poses. It was noted that most of the medical facilities in Greater Jos Metropolis dump their waste within their facility.

CONCLUSION

The survey results reveal that while several medical personnel in the Jos North locality understand the need to have a clean environment as well as the challenges that might occur if the opposite were the case, the storage, collection and final disposal of waste is fast overwhelming the authorities in Plateau State. Steady increase in waste variety and quantity coupled with highly inefficient and ineffective solid waste management system in Jos North evidenced by waste dumps in drains and public spaces has established the need for improvement.

Despite environmental agencies and the federal presence as the nations' capital, the deterioration of the urban environment remains a challenge to the communities especially the local government that are constitutionally responsible for managing the waste. The system is based on temporary storage within households and/or communal dumpsites; collection and transportation to final disposal sites for open burning and open dumping, and a small but significant recycling of 8-22% by the informal sector [11].

A comprehensive assessment approach is essential to improve existing strategy, establish the performance of present strategy and improve the knowledge base through provision of information to stakeholders and creating a platform for discourse [11]. While the generic principles of sustainable development is especially relevant in Jos North LGA, an emerging city whose viability can only be established through sustainability experiences in its knowledge, attitudes, beliefs and practices in the face of an emerging economy and legislature and ambiguity in the regulations [11].

RECOMMENDATIONS

The case of waste management is neither peculiar to Jos North LGA nor Plateau State as a whole but efforts being made by all and sundry in tackling the physical, sociological and environmental issues that results can go a long way in minimizing the effects. There is an all-round need for increase in the knowledge base of all stakeholders so that policy and implementation would be sustainable. A situation where local waste collectors dump waste indiscriminately in the water ways and streams is an indictment of all stakeholders from the government who fail to provide the waste disposal services to the private waste disposal providers who act in ignorance by dumping waste indiscriminately to the resident who does nothing to reduce his waste or report the dumping. The provision of more facilities to improved waste management practices cannot be sustained without education to increase knowledge, re-orientation to change attitudes and workable private sector initiatives which will counter the Nigerian waste management beliefs that waste disposal is not a personal responsibility but solely that of the state.

- Medical personnel should be prepared to inculcate sustainable concepts as they relate to waste management as a way of contributing to an improvement or renewal of the environment where they live.

- Administrative bottlenecks and technical inadequacies should be resolved on the part of government. Public participation should be encouraged through planning which should be "for" the people and not "with" the people. This will help to ensure that this planning by the government becomes sustainable as the medical personnel are made to have a sense of belonging and responsibility to their environment.
- Improved efficiency in the service delivery to the people on the part of the government becomes imperative as it is not enough to make promises but being able to deliver on them hence boosting the morale of the medical personnel in the process.
- The Jos Metropolitan Development Board (JMDB) the governmental agency responsible for waste management in Jos North in terms of infrastructure development and maintenance should arise to its responsibility as their existence is not known to the medical personnel of the town and make an impact in waste management facilities.
- It also becomes pertinent that private public partnership in waste collection and disposal should be enhanced by the Plateau State Environmental Protection Board (PLEPB) venture of waste to wealth initiatives.
- A neat environment and indeed a renewed urban city are possible with the right attitude and necessary machineries in place and it is hoped that this study has helped to buttress that point.

REFERENCES

- [1] Jatau, A.A. (2013). Knowledge, Attitudes and Practices Associated with Waste Management in Jos South Metropolis, Plateau State. *Mediterranean Journal of Social Sciences of Rome* (4) 5 pp 119-Doi:10.5901/mjss.2013.v4n5p119
- [2] Ola-Adisa, E.O. and Mangden, Y.P.E (2013). Agenda 21 and Waste Management in Nigeria -21 Years On. Being proceedings of Architects Registration Council of Nigeria Colloquium 2013. Held in Abuja April 22-25, 2013
- [3] Abaza, H., Saab, N. Zeitoon B. Ahmed G., Mahmoud, R., Rami E. (2011), Green Economy – sustainable transition in a changing Arab world, Report of the Arab Forum for Environment and Development
- [4] Eigeheer, E. and Zanon, U. (11991). O que fazer os residuos hospitaleres. Proposta para classificao, embalagem, coleta e destinacao final. *Arquivos Brasileiros de Medicina*. 65 (3).
- [5] Ossai, R.M (2006). Moving Solid Waste Management into The 21st Century In Nigeria being paper presented At 6th National Council on Environment Meeting held at Katsina State Secretariat Katsina 13-17 November, 2006
- [6] Pruss, A. Giroult, E. Rushbrook, P. (Eds). (1999) Safe management waste from health care activities. Geneva: World Health Organization
- [7] Tandon, P. (2010). Regulatory requirements for designing PET-CT facility in India.. *Indian Journal for Nuclear Medicine* 25(2) pp. 39-43
- [8] Khan, S. M. (2004). Current Practices of Bio-Medical waste management in government medical college associated S.M. H. S Hospital, Srinagar, J&K, India, *Hospitals Today* 11(3) pp206-209
- [9] Longe, E.G., & Williams, A. (2006). A preliminary study of medical waste management in Lagos Metropolis, Nigeria. *Journal of Environmental Health Sciences* Vol. 3(2) pp 133-139.
- [10] Healthcare without harm. (2006). Non Incineration Medical waste Treatment Technologies in Europe. Retrieved on September 20, 2006 from <http://www.nohann.org>

- [11] Javied, S. Hanan, F., Munawar, S., Qasim, M., Anees, M.M., Ghani, M. U., Moeen, K., Ullah, I., Ansar, A. (2014). Management of municipal solid waste generated in eight cities of Pakistan. International Journal of Scientific & Engineering Research, Volume 5, Issue 12. 12 (1186).
- [12] Akter, N., Kazi, N.M., Chowdury, A.M.R. (1998). Medical Waste Disposal in Bangladesh with Special Reference to Dhaka city and Environmental Evaluation. Bangladesh: Published by Bangladesh JRural Advancement Committee Dhaka.Processes. p 179-211
- [13] Batagarawa, R.L. (2011). Sustainability appraisal of waste management in Nigeria: *Development and Evaluation of an Index Based Tool* Published Doctoral Thesis. Department of Civil Engineering, University of Portsmouth United Kingdom.