



# An Assessment of Hospital Wastes Management in Minna: Towards a Waste Management Approach in a Growing Urban Area

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## ABSTRACT

The motive for this study arises from the concern for the proper management of hospital wastes generation in Minna and its environs. In the study, various hospital wastes generation, transportation, treatment and disposal techniques were examined, and applied in the management of hospital wastes in health institutions in the study area. Hospital wastes management strategies, the problems and implications of such strategies were examined. The major findings showed that the health establishments in the study area recognized the hazardous nature of hospital wastes but there is a lukewarm attitude, given by some of them, towards the segregation techniques of wastes disposal, while other health institutions subject their wastes to treatment but other do not before disposal. There is also the management of hospital wastes in the study area by some management agencies but with little management capabilities as a result of poor equipment and lack of competent personnel. The recommendation contained in this study will go a long way to correct the observed problems in the management of hospital wastes and also help to evolve better planning approach to the establishment of hospital wastes management techniques in the study area in the future.

### Keywords:

Hospital wastes, Generation,

Treatment, Disposal and Management

## INTRODUCTION

The urban communities are potential places for wastes generation (Olafimihan, 2001). In the process of the reduction of health related problems and thereby reducing the risk of peoples health, health-care establishments have been involved in the creation of wastes that may itself be hazardous to man's health. Most of the wastes being generated during health care activities contain high potentials for infections and injury than any other type of wastes. Wastes that contain contaminated materials, dangerous chemicals and discarded sharps are hazardous to many patients, health workers and visitors to hospitals and the general community.

Hospital wastes require proper management and disposal because its improper handling could be very detrimental to the health of the host community (Mohammed, 2002). At the moment, the manner of medical waste management among the developing world, especially in a country like Nigeria, attracts the attention and enlightenment of the public particularly health-care workers, on the likely implications of improper treatment and disposal of the wastes generated in the course of carrying out their assignments. In Minna, the problem of hospital wastes management stems from its improper, ineffective and inappropriate means and methods of the disposal. More often, the wastes generated by health care institutions become problem when deposited in poor, uncontrolled illegal dumpsites and other forms of ineffective disposal (Ojemudia et al, 2006). This practice usually results in

the contamination of ground water and/or the environment at large (Kawu et al, 2007). The hospital health care workers such as nurses, waste management operators, laboratory attendants and the host urban dwellers are not isolated from the high risk of contamination.

As a result of the above situation, studies were undertaken to determine the level of waste management in hospitals in Minna metropolis and the specific objectives of the study are to:

- i. Determine the types, components of hospital wastes in Minna hospitals
- ii. Evaluate the existing disposal and treatment methods in place and finally
- iii. Offer recommendations for proper hospital wastes management in Minna and its environs.

## THE STUDY AREA

Minna is the administrative headquarters of Niger State; Nigeria and it is made up of numerous villages and wards. The National Population Census (2006) and the projections (2012) at 3.5% growth rate put the population of the town at 201,429 and 256, 274 respectively with twenty four (24) neighborhoods as indicated in table 1. The implication of such a large population on waste generation and its management especially hospital wastes with its associated health hazards is enormous in a growing population such as Minna.

**Table 1: Population of Minna by Neighborhoods (2012)**

S/N	Neighborhoods	Population 2006		Total Pop. 2006	2012 Population Projections	No of hospitals sampled
		Males	Females			
1	Kpakungu	9154	8621	17775	22615	4
2	Minna Central	10040	9456	19496	24804	
3	Barkin Sale	3010	2843	5862	7458	
4	Sauka Kahuta	2201	2073	4274	5438	
5	Bosso Town	22586	21270	43856	55797	2
6	Tundu Fulani	300	283	583	742	1
7	Chanchaga	11967	11269	23236	29563	2
8	Bosso Estate	300	283	583	742	
9	Tayi Village	730	687	1417	1803	2
10	Angwa Daji	315	297	612	779	1
11	Sango	3344	3150	6494	8262	
12	Tundu Wada South	2201	2073	4274	5438	6
13	Tundu Wada North	3344	3150	6494	8262	2
14	Makera	3401	3203	6604	8402	
15	Maitumbi	9154	8621	17775	22615	3
16	Tunga	3344	3150	6494	8262	1
17	Sabon Gari	3401	3203	6604	8402	2
18	Fadipe	2201	2073	4274	5438	

19	F- Layout	3401	3203	6604	8402	
20	Nasarawa	2201	2073	4274	5438	3
21	Dutse Kura	3401	3203	6604	8402	1
22	Limawa	2201	2073	4274	5438	
23	Jikpan	3401	3203	6604	8402	1
24	GRA	2201	2073	4274	5438	1
	<b>Total</b>	<b>103736</b>	<b>97693</b>	<b>201429</b>	<b>256,274</b>	<b>32</b>

Source: National Population Commission 2012 Projections

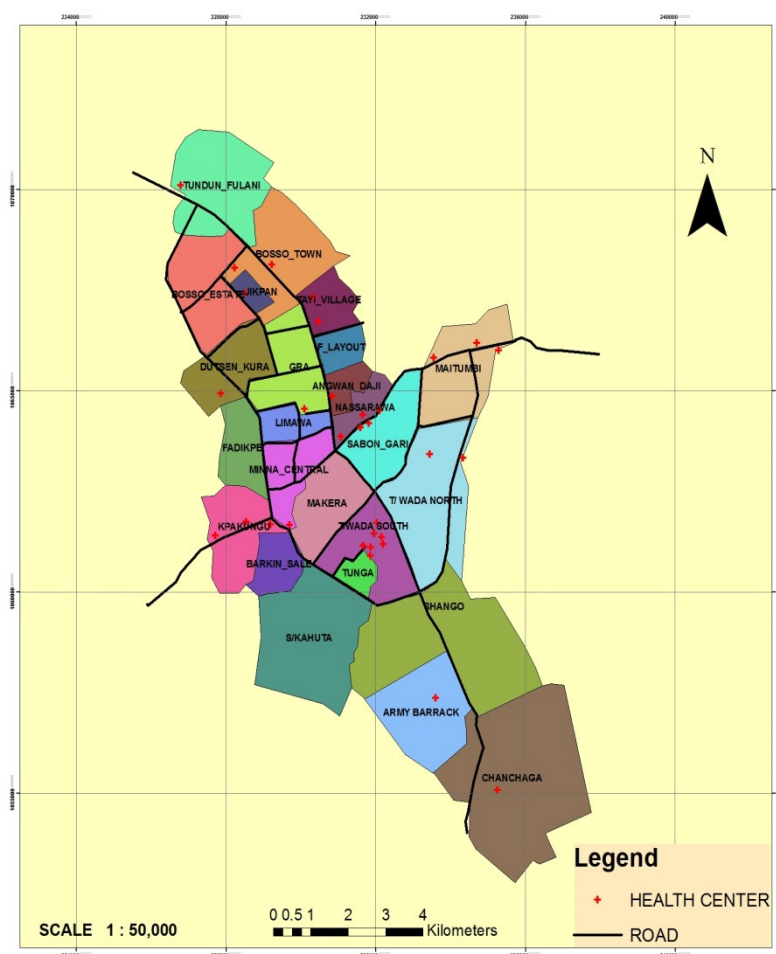


Fig. 1: Distribution of health facilities in Minna and the Environs

## MATERIALS SOURCES AND METHODS

Two sources of data collection were used for the study. They are i. Primary and ii. Secondary sources

### i. Primary Sources of Data Collection:

Information on hospital wastes generations, treatment, disposal and management from both private and public health institutions in Minna and its environs; (32) health centres were randomly obtained from the (24) neighborhoods for the study. The three tiers of government are responsible for the provision and management of public health clinics, dispensaries,

maternity centres, general hospitals and health institutions in the state, while the private sector provides for the privately owned institutions in the state.

### Sampling of Health Centres for Study

Based on the population and availability, a total of thirty two (32) health centres were randomly selected from the health centres in the area for study as indicated in table 1 and several survey visits were made to the health institutions for the administration of questionnaires and oral interviews.

### ii. Secondary Sources of Data Collection:

Literatures on hospitals wastes and its management were procured from the library, text books and journals, State Ministry of Health and other Ministries and Department/Units that deal with health matters in the state.

## LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Medical wastes have been defined as health care wastes which comprise of all wastes generated by health care establishments, research facilities and laboratories. This according to Rush brook et al (1999) comprises of the wastes originating from minor or scattered sources such as that produced in the process of health care undertaken in the home (dialysis, insulin injection etc.). Tsado (1988) further offered a definition of hospital wastes as materials procured from packaging such as wrappers from bandages and cutters, disposal items such as blood, tissues, sharps, cultures and various stocks of infectious agents.

The Federal Ministry of Health (1994) has disaggregated medical wastes to include body parts (discarded), pads, blood infusion bags, plasters, stationeries, papers, used pencils and pins in bottles, nylon bags, food wastes and remnants, gloves, needles, bed, pans etc. The Federal Environmental Protection Agency (FEPA), of Nigeria (2006) has further disaggregated medical wastes as cultures and stock of infection agents and associated biological wastes, pathological wastes as tissues, organs and body parts, stocks of infection agents from research and industrial laboratories, wastes of after births (placement and production of human blood), sharp instruments used on patients e.g. needles, syringes, pipette, broken glasses and scalpels, contaminated animal carcass and body parts, wastes from surgery and autopsy. In a more precise format the WHO (1983) classified medical wastes to include, among other things.

- Isolation Wastes: This include biological wastes and discarded materials contaminated with blood, excretion, exudates or secretions from human and animals.
- Cultures and stocks of infections agents: These include cultures from medical and pathological laboratories, cultures and stocks of infectious agents from research and industrial laboratories.
- Sharps: These are sharps that have been used in patients' care, treatments of medical research or industrial laboratories. It includes hypodermic needles, syringes, pipette, scalpel blades, blood vials, used slides etc.
- Human Blood and Blood Products: These include liquid wastes from human blood,

products of blood, item situated and/or dipping with human blood.

- Animal Wastes: These include contaminated animal carcass, body parts and bodies of dead animals.
- Unused Sharps: These consist of unused discarded sharps, hypodermic needles syringes and scalpel blades.
- Cytotoxic Waste: This toxic and mutagenic and/or tetragonal when discarded or spilled.
- Radioactive Wastes: These are wastes arising from the use of radioactive substance in the treatment of chronic and communicable diseases.

### Risk in Medical Wastes:

Exposure to hazardous health care wastes has been associated with disease and injury. As a result, Collins et al (1987) and Dean (1992) observed that the groups most at risk with medical wastes are medical care workers, especially nurses, medical laboratory staff and waste management operators outside the hospital. Epidemiological studies carried out in Canada, Japan and U.S.A have shown that the main concern of infectious hospital wastes is the transmission of HIV/AIDS virus and more often Hepatitis B and C virus (HBU) through injuries caused by syringes needles contaminated by human blood.

Okonkwo et al, (1997) have reported that wastes handlers in Jos discarded their protective gadgets for economic reasons and therefore became infected with hepatitis virus. Hazards from infectious wastes and sharps as expressed by Gur (1999) is through pathogens infections which can enter the human body through numerous routes such as punctures, abrasion, cut in the skin, mucus membranes, inhalation and ingestion.

Giroult (1999) while identifying the hazardous nature of the chemicals and pharmaceuticals used in health care establishments observed that many of the chemicals used have hazardous characteristics which include toxics, genotoxic, corrosive, inflammables reactive, explosives and shocks – sensitive. He maintained that these substances are commonly present in small amount in health care waste but may be very toxic either by acute or chronic exposure and injuries.

Fatal and other serious hazardous cases of radioactive hospital wastes and the activities of scavengers have been reported as potential hazard of hospital wastes. Nosocomial is another infection identified by Monreal (1991) as part of poor wastes management related disease in Latin American and the Caribbean.

### Hospital Wastes Management Strategies:

There are numerous strategies put in place for the proper handling of hospital wastes as commonly

practiced in the world over. Such wastes management strategies are discussed below.

1. Handling of Health care wastes: The method in the handling of hospital wastes is segregation and packaging. According to Durand (1999) as quoted by Olafimihan (2001), the key to minimization and effective

management of health care wastes is segregation (separation) and identification of the wastes types. The most appropriate way of identifying the categories of health care wastes are by sorting wastes into colour coded plastic containers, as recommended by the World Health Organization as shown below.

**Table 2: Recommended Coding for Health Care Wastes**

Types of Wastes	Color of Container and Markings	Types of Container
Highly infectious wastes, pathogenic and anatomic wastes	Yellow, and mark highly infectious	Strong, leak proof bag or container capable of being autoclaved.
Other infectious wastes, pathogenic and anatomic wastes	Yellow	Leak proof plastic bag or container
Sharps	Yellow, mark sharps	Puncture proof container
Chemicals and pharmaceuticals wastes	Brown	Plastic proof container
Radioactive wastes	N.A	Lead box, labeled with the radioactive symbol.
General healthcare wastes	Black	Plastic

**Source:** United Nation (1997) recommendations on transport of dangerous goods.

Geiner (1991) has observed that the much earlier observation of World Health Organization (WHO) is of significance in preventing contamination. He maintained that segregation aids in preventing contamination with other medical wastes and ensures safety of all persons handling the wastes. It has also been observed that packaging helps to protect wastes handlers and the public from possible injury and disease that may result from exposure to the wastes and as such certain factors should be considered in the selection of the appropriate packaging, into wastes type, handling and transportation of packaged wastes (before treatment), treatment techniques, special consideration for plastic bags and package identification.

### **STORAGE AND TRANSPORTATION OF HEALTH CARE WASTES**

The storage of hospital wastes is the key to the management process and it involves a large number of personnel. The United States of America Resource Conservation and Recovery Act (1976), recognizes the storage of medical wastes as an interim – wastes management technique and should be given adequate consideration as required. It suggests that the storage of wastes types can be done on site, off-site or both and the contingency plans use of proper tank and container management (including labeling) and training of personnel should be necessary prerequisite.

Storage temperature and duration are important conditions and it has been specified that storage requirements are functions of time and temperature. Regarding transportation, the UN (1997) recommendation on transport of dangerous goods specified adequate arrangement between consignor and consignee and in case of exportation, the consignee should have carrier with relevant authorities that the waste can be legally imported and that no delays will be incurred in the delivery of the consignment to its designation. According to the WHO (1994) report, transportation of wastes within site should be with carts and with mechanical devices, since carts have been known to be suitable for moving packaged infectious materials within the facility. It is equally recommended that such carts should frequently be disinfected and be used to transport other materials prior to decontamination. Transportation of hazardous wastes is governed by record keeping and cleans up regulations and routine requirements.

### **DISPOSAL AND TREATMENT OF HOSPITAL WASTES**

There are certain conditions to be met or considered before treatment of disposal of hospital wastes can be carried out. Such factors considered are disinfections efficiency, health and environmental considerations, volume and mass reduction, occupational health and

safety considerations, quantity of wastes for treatment and disposal/capacity of the system, infrastructural requirement, and options available for final disposal and regulatory requirements. Rush brook et al, (1999) observed that there are different available options for treatment and disposal of health care wastes but such options give rise to other health and environmental hazard as a result of lack of focus for local conditions. Consideration for local disposal of health care wastes would only aid the proper and appropriate disposal of these wastes. In order to ensure protection from the potential hazards posed by infectious wastes, it is necessary and very important for it to be treated before final disposal (Garcia, 1999). Several methods of treatment of health care wastes abound and they include sterilization (autoclaving), incineration, irradiation, chemical disinfections and steam sterilization systems.

### CONCEPTUAL FRAMEWORK

The theoretical framework adopted for this study is the concept of Safe Management of wastes. It is a concept developed by the international working Group of the World Health Organization (WHO) in conjunction with the World Health organization European Centre for Environment and Health in Nancy in France in 1999.

The concept of Safe Management of Wastes is based on the formulation of objectives and planning for improving health care waste management at the national, state and local levels, which was developed within the framework of the Agenda 2 of the UN conference on environment and development in 1992. The recommendations of Agenda 21 are among others.

- Prevention and minimization of waste production,
- re use or recycle waste to the extent possible,
- the treatment of wastes by safe and environmentally sound methods,
- disposal of final residues by land fill in confined and carefully designated sites

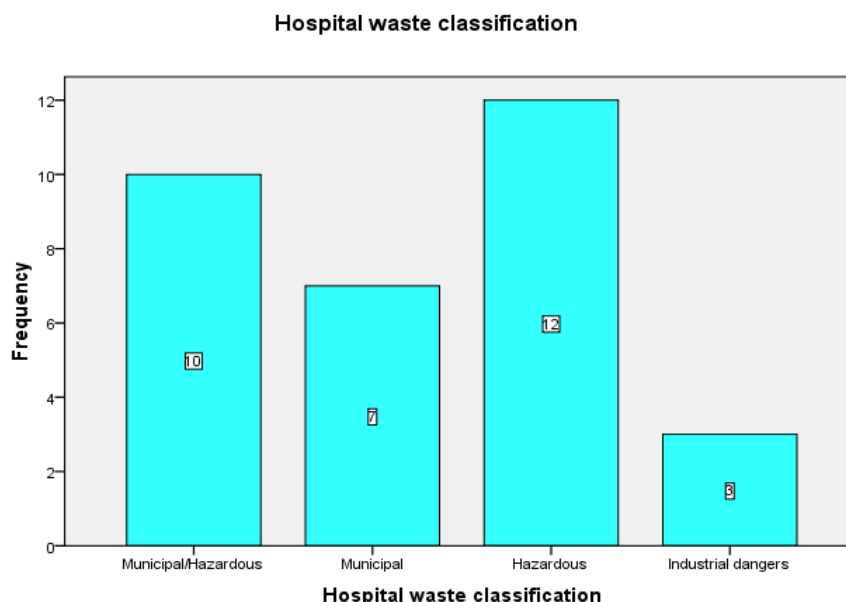
Further, Agenda 21 stresses that wastes producers should be responsible for the treatment and final disposal of its wastes, where possible each community should dispose of its wastes within its own boundaries. The safe management of wastes produce is formulated within the framework of a National plan for health care waste management.

### DATA PRESENTATION AND DISCUSSIONS

This section examines data from medical establishments and wastes disposal agencies and information on wastes dump sites in Minna and its environs.

#### Classification of Health Care:

The survey conducted in the study area showed that hospital wastes are classified into four (4) types as Municipal / Hazardous, Municipal, Hazardous, Industrial dangers respectively. The survey result as shown in figure 2, 10 (31.1%) hospitals classified their wastes as Municipal/ hazardous, 7 (21.9) hospitals classified their wastes as municipal wastes, 12 (37.5%) hospitals as Hazardous wastes and 3 (9.5%) hospitals had their wastes as Industrial dangers wastes.

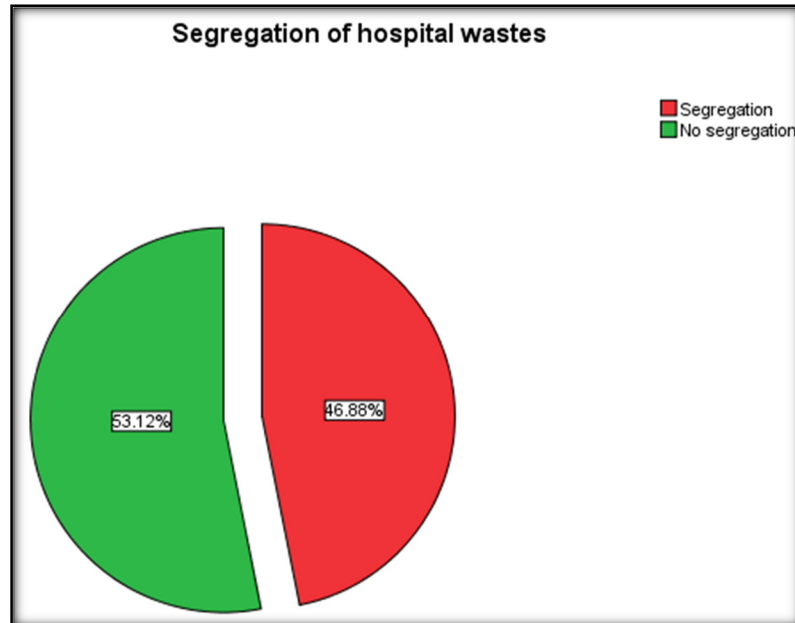


**Fig.2:** Hospital Wastes Classification in Minna  
**Source:** Field Survey October, 2011

### Segregation (Sorting) Approaches:

The aim of sorting of wastes is the minimization and effective management of health care wastes through segregation and identification of wastes. Appropriate handling, treatment and disposal of wastes by types reduce cost and protect public health. The results from the sampled health care centres in Minna as indicated in

figure 3, only 15 (46.9%) hospitals adopt different types of segregation techniques in wastes management, while the remaining 17 (53.1%) do not segregate their wastes before final disposal. Most of the hospitals establishments indicated that the reasons for not segregating their wastes were lack of adequate facilities to do so, while others indicated that the segregation of wastes was not their responsibility.



**Fig.3:** Segregation of Hospital Wastes  
**Source:** Field Survey October, 2011



**Plate 1:** Packaging of hospital waste in waste container **Plate 2:** Packaging of hospital wastes in special waste containers

### Treatment Approaches

This stage of wastes management is very crucial since it helps to curtail the hazardous potentials of infectious wastes on the environment. Results from the survey as

shown in table 3, 13 (40.6%) hospitals employ incineration as treatment before final disposal of wastes, while 9 (28.1%) hospitals used chemical treatment, 6 (18.8%) hospitals combined incineration and chemical

treatment method and only 4 (12.5%) of the hospitals indicated that they do not treat wastes before disposal.

**Table 3:** Treatment of Hospital Wastes in the Study Area

Treatment Types	Frequency	Percentage
Incineration	13	40.6
Chemicals	9	28.1
Incineration and Chemical	6	18.8
No Treatment	4	12.5
<b>Total</b>	<b>32</b>	<b>100</b>

Source: Field Survey October, 2011

### DISPOSAL TECHNIQUES OF HOSPITAL – CARE WASTES

Under this heading the disposal techniques for sharps, pathological wastes, infectious wastes, radioactive wastes, chemical wastes, pharmaceutical wastes and disposal of pressurized containers are discussed.

#### Disposal of Hospital Sharps:

The common practice adopted by medical institutions in the study area for the disposal of sharp objects includes open dumping, pit burial, re-use and recycling system and open burning. With regard to the sampled 32 hospitals in the study area, 9 (28.1%) hospitals practice the open dumping method for disposing their sharps. Six (6) (18.8%) health institutions use the pit method, only 3 (9.1%) recycle their wastes, 8 (25%) use the open burning approach, 2 (6.3%) use both the incineration and pit burial approach and only 4 health establishments use the incineration method as indicated in table 4.

**Table 4:** Disposal of Hospital Sharps

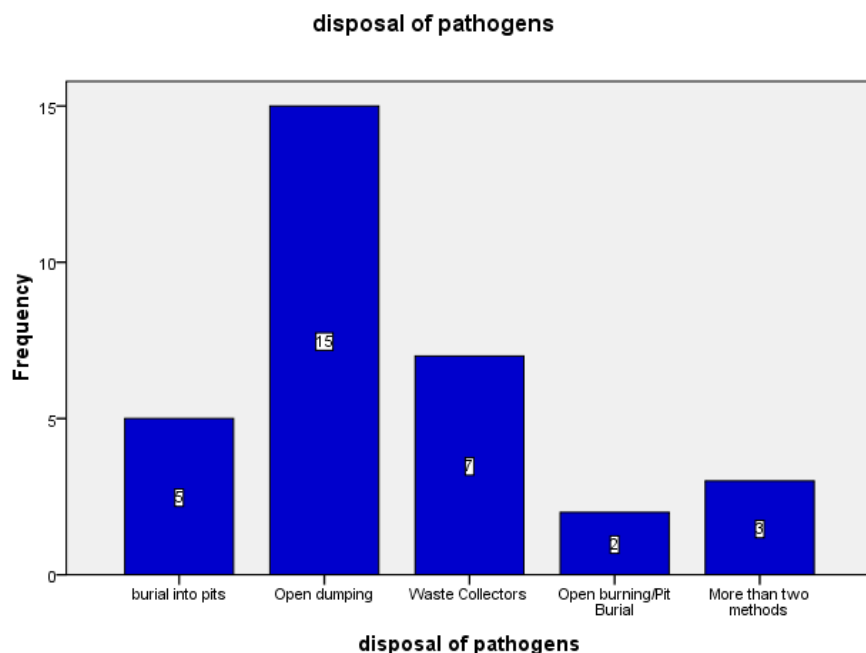
Disposal Methods	Frequency	Percentage
Open Dumping	9	28.1
Into the Pit	6	18.8
Recycling	3	9.4
Open burning	8	25.0
Incineration and pit burial	2	6.2
Incineration	4	12.5
<b>Total</b>	<b>32</b>	<b>100</b>

Source: Field Survey October, 2011

#### Disposal of Pathological Wastes

Medical establishments adopt different approaches and methods in disposing off their pathological and anatomical wastes emanating from their hospitals. The various methods use in pathological and anatomical wastes disposal, as observed in the study, includes pit burial, open burning and through the help of wastes collectors.

From the field investigation, 5 (15.6%) medical establishments utilize the pit burial system for the disposal of pathological wastes. This is because of the nature of this type of waste, while 15 (46.9%) use the open dumping method, 7 (21.9%) hospitals use the wastes collectors, 2 (6.2%) institutions use both the open burning and pit burials and 3 (9.4 %) hospitals used the combined methods.



**Fig. 4:** Disposal of Pathological Wastes:  
**Source:** Field Survey October, 2011

#### Disposal of Infectious Wastes:

Infectious wastes by their very nature contain pathogens (bacteria, viruses, parasites and fungi), which can cause disease to human life. The disposal method for infectious wastes is, therefore, open dumping, and pit burial, incineration and wastes collectors. Out of the 32

hospitals surveyed, 4 (12.5%) use the collectors systems, 6 (18.8%) use the open dumping method, 5 (15.6%) use the pit burial method, while 10 (31.2%) hospitals openly burn their infectious wastes and 7 (21.9) hospitals use the combined pit burial and open burning approach for the disposal of infectious wastes products from their hospitals as shown in table 5 below.

**Table 5:** Disposal of Infectious Wastes:

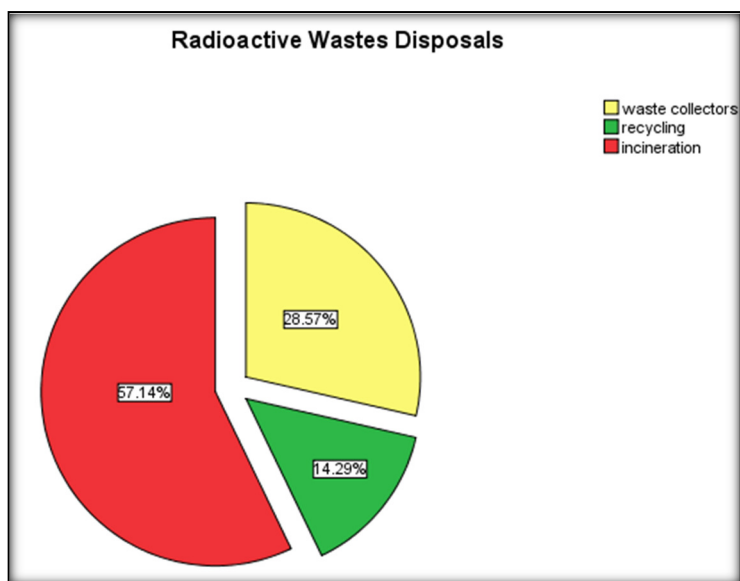
Disposal Methods	Frequency	Percentage
Waste Collectors	4	12.5
Open dumping	6	18.8
Burial method	5	15.6
Open burning/Pit Burial	10	31.2
More than two methods	7	21.9
<b>Total</b>	<b>32</b>	<b>100</b>

**Source:** Field Survey October, 2011

#### Radioactive Wastes Disposal

Radioactive wastes comprises of solid, liquid and gaseous materials contaminated with radio nuclides, produced as a result of procedures such as in – vitro analysis of body tissues and fluid in vivo organs, imaging and tumor localization and various investigative and

therapeutic practices. Amongst the 32 sampled hospitals, 14 (13.8%) hospitals produced radioactive wastes and 4 (28.6%) disposed of their radioactive wastes through the wastes collectors, 2 (14.3%) recycled their wastes; while the remaining 8 (57.1%) hospitals incinerate their wastes products as shown in figure 5.



**Fig.5:** Radioactive Wastes Disposals

**Source:** Field Survey October, 2011

#### Chemical Wastes Disposal Techniques:

Chemical wastes comprise of soluble and non-soluble wastes materials and their disposal is through various methods. The commonly used methods for their disposal, as indicated by the study conducted for 32

hospitals in Minna, include open dumping and sewer 13 (40.6%), incineration and sewer 8 (25%), combined wastes collectors, incineration and sewer method 6 (18.8%), and through wastes collectors and sewer method 5 (15.6%).

**Table 6:** Chemical Wastes Disposal

Disposal Methods	Frequency	Percentage
Through sewers	13	40.6
Incineration and Sewers	8	25.0
Waste collectors and Incineration	6	18.8
Waste collectors and sewers	5	15.6
<b>Total</b>	<b>32</b>	<b>100</b>

**Source:** Field Survey October, 2011

#### Pharmaceutical Wastes Disposal Techniques:

There are various methods for the final disposal of wastes of pharmaceutical background (Giroult, 1999). These methods include open dumping, wastes collectors, recycling and sale to wastes scavengers. Results of the study conducted showed that out of the 32

hospitals investigated 15 (46.8%) used the open dumping method for the disposal of its pharmaceuticals wastes, 6 (18.8%) use wastes collectors, 4 (12.5%) recycled their pharmaceutical wastes, while 7 (21.9%) sell their wastes to scavengers that buy such wastes products.

**Table 7:** Pharmaceutical Wastes Disposal

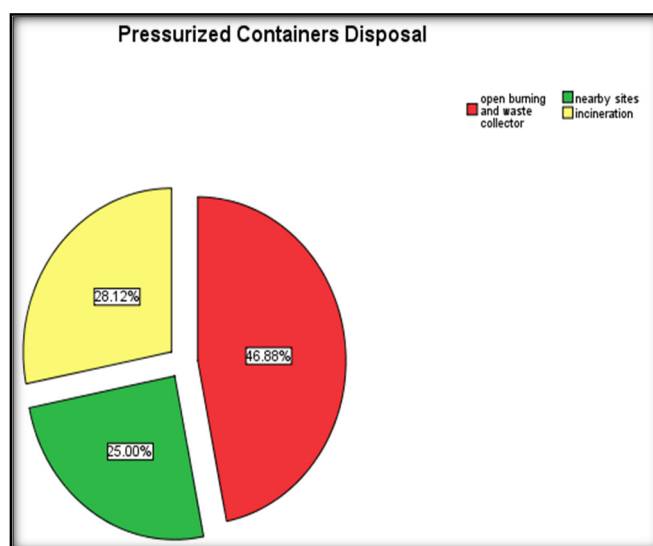
Disposal Methods	Frequency	Percentage
Open dumping	15	46.8
Waste collectors	6	18.8
Recycling	4	12.5
Sell to waste scavengers	7	21.9
<b>Total</b>	<b>32</b>	<b>100</b>

Source: Field Survey October, 2011

### Pressurized Containers Disposal Techniques:

The wastes materials under this group are pressured cylinders, cartridges and aerosol cans. From common practice, many of these cans are reusable while some other types such as aerosols must be properly disposed off. Observations from the survey conducted showed

that 15 (46.8%) health establishments in the study area use both open dumping and wastes collectors for waste disposal, 8 (25%) hospitals disposed their pressurized containers on nearby sites, while few hospitals 9 (28.1%) segregate their pressurized containers and re-use them for other purposes.



**Fig.6:** Pressurized Containers Disposal

Source: Field Survey October, 2011



**Plate 3:** Open dumping of hospital wastes in Minna **Plate 4:** Dumping of hospital waste along Bida – Minna road

### Agencies for Waste Management Policies and Strategies:

The management of wastes from the survey conducted is saddled at the shoulders of numerous agencies in the study area. As indicated in table 8, the state's Urban Development Board (NUDB) and the state Ministry of Health

and local Government councils take lead in waste management. Complimenting the efforts of these institutions with regards to health management, are the individual health institutions and some non Governmental Organizations in the state.

**Table 8:** Agencies in Charge of Waste Management Policies/Strategies

Agencies	Frequency	Percentage
Individual hospitals	2	6.2
NUDB	20	62.5
State Ministry of Health and Local Government Council	6	18.8
NGOs ( Commercial Wastes Managers)	4	12.5
<b>Total</b>	<b>32</b>	<b>100.0</b>

**Source:** Field Survey October, 2011

### Suggestions for Effective Waste Management:

For effective hospital wastes management in the study area, suggestions were given as indicated in table 9 as shown below. 10 (31.2%) suggested that the existing government urban development board should be strengthened in its responsibility of managing hospital wastes in the state, suggestion for the local government

councils to be adequately funded to live up to their responsibility in waste management was next with 9 (28.1%) response. The enforcement of the existing law and more proactive efforts in wastes management by private commercial non government organizations (NGOs) had 6 (18.8%) and 7 (21.9%) responses respectively.

**Table 9:** Suggestions for Effective Hospital Wastes Management

Suggestions	Frequency	Percentage
Enforcement of the existing laws	6	18.8
Strengthening of NUDB powers by adequate funding	10	31.2
Adequate funding of Local Government Council	9	28.1
More proactive efforts by NGOs private wastes managers	7	21.9
<b>Total</b>	<b>32</b>	<b>100.0</b>

**Source:** Field Survey October, 2011

### SUMMARY OF FINDINGS AND PLANNING IMPLICATIONS:

#### Summary of Findings:

- The health care establishments in Minna metropolis recognized the hazardous nature of medical wastes as they are by – products of materials used in the treatment of infectious diseases.
- There is, however, lukewarm attitude given to segregation techniques of wastes disposal. In most cases, many of the health institutions when carrying out segregation, it is partially handled by disposing off sharps and syringes with general wastes.
- It is further noted that the treatment procedures adopted by some health care establishments is

open burning, while some establishments use chemicals disinfections, and some use both methods for the treatment of their wastes. However, some health care establishments do not subject their wastes to treatment before disposal.

- In Minna metropolis, some wastes management agencies are responsible for the disposal and management of hospital wastes in the town, but with little management capabilities as a result of poor equipment and lack of competent personnel.
- It is also noted that the Niger state Urban Development Board (NUDB) is directly responsible for the formulation of standards and guidelines for the management of wastes in Niger State.

- The management and disposal of wastes by cart pushers are very inadequate and unhygienic, as most wastes collected by them are openly dumped on sites and thereby exposing them to scavengers and thereby endangering the environment.

### Planning Implications:

The importance of proper planning and structuring of medical wastes disposal cannot be overemphasized as regards environmental management and control.

The formulation of objectives and planning for their attainment are very crucial for the improvement of health care wastes. Planning requires the definition of strategy that will facilitate careful implementation of the necessary measures. The planning and strategies formulation by the department of solid wastes and sanitation services of Niger State Urban Development Board has tremendously helped in creating a solid framework for medical wastes management planning.

It should be noted that most of the strategies adopted for wastes management are short-term, but more precise long term planning approach is required so as to forestall future environmental disasters.

The open dumping techniques adopted by most health care establishments in the study area could lead to nosocomial infections (hospital related infections) and these calls for planning and designs for hospital wastes units for these institutions.

Wastes management, through open dumping, segregation and later usage for the manufacturing of manure for use by farmers, is a crucial step towards sustainable agricultural development both in the state and the country at large.

It must be noted that improper wastes disposal and management is an important factor of urban degradation and increased environmental pollution. Improper planning and management of medical wastes can lead to the transmission of infectious diseases through a host or the out – break of an epidemic.

## RECOMMENDATIONS AND CONCLUSIONS

### Recommendations

For the major findings of this study, it has become imperative for the following recommendations to be made for purpose of improved and efficient health care wastes management in Minna and its environs.

- The establishment of Wastes Management Committee (WMC) in each medical institution in the state is very important. Such committee shall be headed by a Management Officer whose responsibilities shall be the planning, collection,

treatment, disposal and overall management of wastes in such establishments.

- The organization of seminars, workshops, periodic wastes management meetings and sensitization of officers on the most proper and appropriate methods of collection, disposal, treatment, transportation and final dislodgement of health care wastes.
- Segregation of wastes is of great importance as it allows special attention to be given to the relatively different types of health care wastes generated by hospitals. Black colored bags should be used for pathological and infectious soluble pharmaceuticals, and chemicals should be disinfected and poured into the sewers, the colored bags should be used for radioactive and genotoxic wastes types and marked with international biological hazard sign.
- The adoption of pyrolytic incinerator instead of the open burning of wastes should be encouraged. A pyrolytic incinerator is appropriate for infectious wastes including sharps and pathological wastes as the process eliminates pathogens. The method is also appropriate for pharmaceutical and chemical wastes as it cause disintegration of most residues. A pyrolytic incinerator works at a temperature of between 800 - 900°C for its operations and can handle between 200kg/day to 10 tons per day. The machines have capacity for full automatic operation of loading of wastes, removal of ashes and internal movement of burning wastes. Cytotoxic wastes should be disposed through rotary kiln incinerators.
- The solid wastes and sanitation service section of the Niger State Urban Development Board (NUDB) should be re-energized to handle the operations of such incineration machines. Specially designed and constructed wastes collection trucks should equally be provided. For the larger hospitals like the Niger State General Hospital that generates highly infectious wastes, autoclave machine should be provided for the treatment of its wastes. Safety equipments for the handling of medical wastes should be provided in the form of face masks, hand gloves, caps, booths and protective clothing.
- The promotion of adequate handling and disposal of medical wastes is very crucial for community health centres. Promotion helps to sensitize the public about the dangers and hazards in improper wastes management. The use of poster exhibitions, in hospitals, at strategic location, giving information on where wastes bins should be located, instruction on wastes segregation etc. should be adopted.
- The training and retraining of personnel on wastes management is an important aspect of

proper health – care wastes management. Such training should involve the hospital managers and administrative staff of hospitals, nurses and nurse assistants, cleaners, porters, auxiliary workers and wastes handlers. Such training should also highlight the roles and responsibilities of health – care personnel in the overall management programme.

- The privatization of health care wastes service, where each health care establishment is made to be financially liable for the safe management of the wastes it generates should be highly encouraged and sustained. The cost of offsite transport, treatment and final disposal service, should be paid by health establishments. Under the privatization programme a private entity finances, design, builds, owns and operates the treatment facilities and sells its collection and disposal services to the private establishments and government. Privatization brings about competition and ensures better service delivery and efficiency.

## CONCLUSIONS

The motive for this study arises from the concern for the proper management of hospital wastes in Minna and its environs. In this study, various hospitals wastes generation, transportation, disposal and treatment techniques were discussed and applied in the management of hospital wastes in health institutions in the study area. Hospital wastes management strategies, the problems and planning implications of such strategies were examined against the background of the recommended standards.

The major findings revealed that the health establishments in Minna metropolis recognized the hazardous nature of hospital wastes as they are by – products of materials used in the treatment of infectious diseases but there is a lukewarm attitude given by some of them to the segregation techniques of wastes disposal, while some health establishments subject their wastes to treatment but others do not subject hospital wastes generated by them to treatment before disposal. There is the management of hospital wastes in the study area by some management agencies but with little management capabilities as a result of poor equipment and lack of competent personnel was also noted. The recommendations contained in these proposals will to a large extent correct the observed problems in the management of hospital wastes and help in evolving better planning techniques in the study area in the future.

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