UNIVERSITY OF CAPE COAST

HOSPITAL SOLID WASTE MANAGEMENT PRACTICES IN EASTERN REGION OF GHANA

RICHARD AMFO-OTU

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BY

RICHARD AMFO-OTU

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the results of my own original work and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature:……………………… Date …………………..

Name: ……………………………………………………………………………

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis were supervised in accordance with guidelines on supervision of dissertation laid down by the University of Cape Coast.

Principal Supervisor's Signature:…………………… Date …………………..

Name: ……………………………………………………………………………

Co-Supervisor's Signature:………………………… Date …………………..

Name: …………………………………………………………………………..

ABSTRACT

The study examined hospital solid waste management practices the Eastern Region of Ghana. A total of 320 hospital staff from six selected hospitals were randomly selected for the study with 279 returned responses for the questionnaire used. Interviews were conducted among 15 purposively selected staff from the six selected hospitals, the private waste collecting company, the Municipal Assembly and the Environmental Protection Agency. SPSS Version 20 was used to analysed questionnaires. Kruskal-Wallis, Chi-square and Spearman correlation were used to test for difference and relationships. The results showed that hospitals do not keep records on the quantity of waste generated. Waste separation practices were poor at all the hospitals except at Koforidua laboratory unit where proper separation was done. The main waste treatment methods used by the hospitals were incineration and bio-digestion. Disposal methods were dumping at open and controlled dumpsites, open burning and burying. Three of the hospitals engaged a private waste collection company for services while the other three did not. There was no specific policy framework at each hospital and two hospitals did not have copies of the national policy. Linkages between the hospitals and other stakeholders were weak. There were no statistical difference between the awareness of different categories of staff about health hazards associated with hospital solid waste (p = .463), as well as attitudes toward waste (p = .542). Occupational health and safety practiced by hospital staff was the use of personal protective equipment. Solid waste management practices at the hospitals were below standard. Hospitals should organise training on waste segregation, provide resources and collaborate with stakeholders to ensure good waste management practices.

KEY WORDS

Hospital solid waste

Awareness of hazards

Attitudes

Occupational health and safety

Institutional linkages

Health hazards

Hospital waste segregation

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DEDICATION

To my wife, children and parents

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LIST OF ACRONYMS

CSIR	Council for Scientific and Industrial Research
EPA	Environmental Protection Agency
GEF	Global Environmental Facility
HCWH	Health Care Without Harm
ISWM	Integrated Sustainable Waste Management
KATH	Komfo Anokye Teaching Hospital
KBTH	Korle-Bu Teaching Hospital
MLGRD	Ministry of Local Government and Rural Development
MoH	Ministry of Health
WHO	World Health Organisation
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme

CHAPTER ONE

INTRODUCTION

Background to the Study

Healthcare waste has become a critical development issue. Economic growth, urban development, and population growth have resulted in an increase in waste generation rates throughout the world with varied composition and characteristics (World Bank, 2012). Changes in technology, lifestyle and consumption patterns of people in developing countries are evident as part of modernisation and globalisation process (Todaro & Smith, 2009). These have contributed to the generation of large volumes of the untreated waste of all kinds, which are discharged into the environment. These potentially dangerous wastes emanate from different developmental activities such as household waste, nuclear waste, industrial waste, oil waste and healthcare waste, just to mention but a few. Some of these wastes have been captured as hazardous waste by various international conventions and national laws (UNEP, 2011).

Globally, efforts have been made to address the dangers posed by hazardous wastes from adversely affecting people and the general environment through the introduction of various conventions and protocols such as the Basel and Stockholm Conventions. However, it must be stated that any act of omission or commission in handling hazardous waste raises questions about environmental justice and equality that should guide such enterprises especially in the development and implementation of regulations and policy frameworks.

Diseases such as cancer and high blood pressure which were pronounced in the Western World are frequently reported in developing countries as a result of the citizens embracing socio-cultural change and being exposed to hazards of the waste produced. This has created the demand for proper healthcare facilities to offer appropriate and efficient health treatment services to the citizenry to meet their healthcare needs. Advancement in technology has also facilitated improvement in medical diagnosis and treatment of different diseases. These have all contributed to the generation of high volumes of healthcare waste in Ghana, which deserve proper management.

Global data on the quantity of healthcare waste produced may not be readily available. Some estimates have been made for various regions of the world based on the income level classification of the World Bank. According to WHO (2011), average generation rates for hazardous waste from healthcare facilities are 0.5 kg/bed/day and 0.2kg/bed/day for high and low-income countries, respectively. Some reports have it that more than 3.5 million tons of medical wastes are produced in the United States annually (MWC, 1994; Hyland, 1993). It has been reported that an estimated amount of 16 million injections are annually administered worldwide, however not all of the needles and syringes are properly disposed of (WHO, 2011).

According to the Environmental Protection Agency of Ghana [EPA-Ghana] (2002), healthcare waste means any untreated solid and liquid waste produced during the administration of medical care, veterinary care or medical research involving humans and animals which include infectious, pathological, radioactive and pharmaceutical wastes. This category of waste may include wastes like sharps, solid waste, disposables, packaging materials, anatomical waste, cultures, discarded medicines, chemical wastes, disposable syringes, swabs, bandages, body fluids, human excreta, kitchen waste, wastewater from laboratories and other operating rooms. The healthcare waste has infectious and hazardous components which can pose a serious threat to human health especially those who are in direct contact with it if not managed properly.

According to WHO (2011), a mass immunisation campaign in 2001 in the West Africa sub-region involving 17 million children resulted in the generation of about 300 metric tonnes of injection waste. Mulligan (2010) indicated that about 35 percent of dispensed pharmaceuticals outside the hospital setting is unused, leading to the generation of about 200 million pounds of pharmaceutical waste annually in the United States. In Turkey, it was estimated that in 2006 a total of 91,323 tons of medical waste were produced from 173,421 active beds (European Environmental Agency, 2010). The International Finance Corporation (IFC) (2007) indicated that in China about 1,800 tons of medical waste is produced daily. Out of 200 metric tons of hospital wastes generated per day in the city of Dhaka, Bangladesh, about 20 per cent is infectious and hazardous (Rahman, 2000).

In Ghana, the Waste Management Department of the Accra Metropolitan Assembly in 1992 estimated healthcare waste generation rate for six major hospitals in the metropolis as 1.2 kg/bed/day (EPA-Gh, 2002; MOH, 2006). A study by Wilson et al. (2006) estimated the total hospital solid waste generation rate for Komfo Anokye and Korle-Bu Teaching hospitals (KATH and KBTH) as 1.55kg/bed/day and 2.90kg/bed/day, respectively. Using the 1.2 kg/bed/day as a national average for hospitals in Ghana (EPA, 2002) and an estimated bed utilization rate of 60% of total number of beds of 22,164 (GHS, 2010), it can be estimated that 15,958 kg of healthcare waste is produced per day (15 tons/day) and 5,825 tons per year. Assuming that the hazardous or infectious waste (20%) is separated from the general waste (80%) as indicated by WHO (2013a), then a total amount of 3.2 tons of the hazardous waste will be generated per day amounting to 1,168 tons per year. However, various reports indicated that efficient separation is hardly practised in developing countries (WHO, 2011a; Wilson et al. 2006).

The adoption of an appropriate management strategy by stakeholders to safeguard public and environmental health is needed. This has been so due to the potential hazard the waste pose to the health of society and the environment. Hospital waste has been cited by the Stockholm Convention as a potential source for environmental pollution especially in the release of dioxins, mercury and other heavy metals into the environment. In addition, it has been captured as hazardous waste in the Basel Convention on trans-boundary movement of hazardous waste (UNEP, 2011). In fact, globally there are on-going campaigns to ensure sound management of hospital waste by organisations such as the World Health Organisation (WHO), the United Nations Development Programme (UNDP), Health Care Without Harm (HCWH) (UNDP 2013).

Considering the global campaigns, developing countries are becoming more conscious of this category of waste and are putting measures in place to deal with this canker with the support of various international bodies. In the year 2012, a manual for safe handling and management of healthcare waste was launched and a training workshop was organised for practitioners within the West Africa sub-region by the Abidjan-Lagos Corridor Organisation [ALCO].The UNDP is also currently undertaking a preliminary assessment of medical waste management in four countries (including Ghana) with funding from the Global Environmental Facility [GEF] (UNDP, 2013). All these are pointing to the fact that healthcare waste management cannot be ignored in our development effort.

It has been estimated that about 75 – 90 percent of healthcare waste is non-infectious and similar to domestic waste with about 10-25 percent being infectious (Prüss, Giroult, & Rushbrook, 1999; EPA-Ghana, 2002; WHO, 2013). However, if domestic wastes generated within a hospital facility are mixed with the infectious and hazardous components, it can be considered as infectious (Altin et al., 2003; Awad, Obeidat & Al-Shareef, 2004).

In the healthcare service delivery system, hospitals produce different types of both solid and liquid waste which may be detrimental to health and the environment. A study by Osei-Mensah (2012) indicated that wastewater from hospital facilities are untreated and are discharged into public drains which ultimately finds its way into water bodies except for the wastewater from the washrooms which is stored on-site by the use of septic tanks. Other studies on wastewater management at Korle-Bu and Cape Coast District hospitals revealed that wastewater effluents are normally discharged into nearby water bodies without any appropriate treatment (Aggor, 2013). The management of the solid component is also very important since it is normally stored and handled by personnel of the hospitals before treatment and disposal. Even how to transport and where to dump them should be of major concern so as to protect the environment and public health.

The cost of healthcare waste treatment increases with the quantum of waste produced, waste segregation practices, the treatment technology employed and model of treatment adopted. Park and Jeong (as cited in Lee, Ellenbecker, & Moure-Ersasob, 2004) indicated that the cost for treating or disposing of infectious wastes is about 10–20 times more than the non-infectious counterpart. Lee et al. (2004) showed that treating segregated medical waste of about100 ton per year is far cheaper than mixing them and can save up to $110,000 per year. Almuneef and Memish (2003) demonstrated how an implementation of waste management plan helped in reducing the amount of medical waste from 2000 kg/day to 850 kg/day between 1999 and 2000 which led to significant cost reduction. The total financial cost savings was US $17,936 with savings in fuel of US $5,262, labour-cost savings of US $8,990, and maintenance and spare parts savings of US $3,680 by 2001. The associated cost savings is sufficiently appreciable to implement segregation of medical waste.

Institutional arrangements which take into consideration both internal and external collaboration in managing solid waste is very critical in every country. Ghana has various institutions with diverse capacities to deal with waste management issues. The waste management operational function has been entrusted to the Ministry of Local Government and Rural Development by law (1993, Act 462) and it is discharged through the various metropolitan, municipal and district assemblies (MMDAs). These (MMDAs) normally deal with the collection of waste from various designated points either households, commercial centres, private and public institutions, hospitality facilities and industries to the final disposal site for management.

The Environmental Protection Agency (EPA) is another body with the legal mandate by Act 490 of 1994 to formulate and monitor environmental quality standards and guidelines to ensure sound environmental management. It has developed guidelines for managing healthcare waste emanating from different categories of healthcare facilities in the country (EPA-Gh, 2002). The guidelines stipulate the kind of institutional arrangement to deal with healthcare waste at all levels of healthcare facilities in the country and even the best management practices to be adopted.

Based on the EPA guidelines, the Ministry of Health as the statutory body to oversee healthcare delivery in Ghana also developed its healthcare waste management policy (MoH, 2006). The policy focus is to ensure that healthcare waste is managed effectively in compliance with existing laws and regulations in order to protect healthcare workers, their clients (patients, caregivers and visitors) and the environment from potential disease-causing waste materials. The policy and EPA-Ghana guidelines are to be used by all health institutions whether public, private, quasi-governmental, non-governmental or faith-based, that operate in the country at all levels. The policy emphasises on "Polluter Pay Principle" as the way to go and that the individual healthcare facility is responsible for managing its waste. In doing so private entities can be engaged to deal with part of the management process which is in line with the Neo-Liberal framework for development.

The risk of transmitting disease-causing agents through unsafe handling and disposal practices of medical solid waste can lead to environmental contamination of water sources, air and the soil which can pose a big threat to public health and safety (Patwary, O'Hare, & Sarker, 2011).

This in effect can create a major setback for the development of such societies because these environmental media are needed for proper development and growth of societies. The question of who is responsible in the hospital setup for managing the generated solid waste is critical in ensuring the safety of all categories of workers and the patients (Stringer, 2011). Complementary roles in the hospital setting may be important for achieving the best management of solid waste. Sharma, Sharma, Sharma, Singh (2013) found in India that hospital staff considered effort at safe management of healthcare waste as an extra work as well as financial burden on managers.

Pudussery (2011) and Stringer (2011) indicated that knowledge and awareness of health workers on solid waste management and its ability to serve as a route of disease transmission are important. This may be reflected in the behaviour of healthcare staff toward solid waste management and safety practices in the course of duty. According to Almuneef and Memish (2003), infection of hospital staff with HIV, Hepatitis B and C is possible especially those who are directly handling these wastes and the general public. As indicated by Pred's behavioural matrix (1967) awareness of the health hazards require that there is available information and the people have the capacity to analyse and make use of the information for safe behaviour. Ramokate and Basu (2009) reported that healthcare workers with access to information on healthcare waste management exhibited good handling practices than those with limited or no access.

Attitudes and perception of staff towards waste management activities, waste handlers and the waste management department within the hospital is very important. Kendie (1999) emphasised the need for positive attitudes to curb the rampant environmental degradation through unsafe disposal of waste in Ghana. If there is an expression and/or feeling of poor attitude among the staff of the waste management department of the hospital, the organisation of proper healthcare waste management will be difficult. The theory of planned behaviour by Ajzen (1985) indicated that attitudes, subjective norms and perceived behavioural control are predictors of behavioural intentions. According to Pudussery (2011), poor perception about healthcare waste management contributes to workers putting the waste categories into wrong storage bins, but positive attitudes towards training on healthcare waste management are important in shaping perception.

The Pred's behavioural matrix explains better the relevance of information and behaviour of people; which states that people or organisations with the right capacity and available information can make the right decisions than those with poor capacity and poor information (Pred, 1967). It is also important to know if the environmental factors and occupational settings, individual beliefs and social norms allow for the right attitudes to be demonstrated by workers as emphasised by the theory of planned behaviour. It is important to know what health workers know about waste generated from their own activities and how it reflects in their behaviour.

Cases of occupational injuries from improper treatment and disposal of healthcare waste have been reported. In 2000, WHO estimated that "21 million hepatitis B virus (HBV) infections (32% of all new infections); 2 million hepatitis C virus (HCV) infections (40% of all new infections); and at least 260 000 HIV infections (5% of all new infections)" were as a result of the use of contaminated syringes for injection (WHO, 2011a). Mulligan (2010) reported that pharmaceutical waste from hospitals is generally discarded down the drain or landfilled, except chemotherapy agents, which are often sent to a regulated medical waste incinerator.

Medical Devices Agency of the United Kingdom (as cited in Chaudry & McDonnell, 2008) indicated that from 1996 to 2004, a total of 2140 occupational exposures to blood-borne viruses occurred among health workers of which 21% of the injuries occurred during the disposal processes of healthcare waste. In Pakistan, on average scavenger boys who were going through medical waste, experienced three to five needle stick injuries a day (Altaf & Mujeed, 2002). Porta, Milani, Lazzarino, Perucci and Forastiere (2009) indicated that population living within 3 km of old incinerators saw an increase of 3.5% in the risk of contracting cancer.

In all of these, the philosophy of environmental justice, equity and equality should guide the actions and decisions of managers of hospital facilities to ensure the protection of their workforce as well as patients. Bullard (1996) stated the principle of environmental justice as "all people and communities are entitled to equal protection of environmental and public health laws and regulations (p. 495)." This implies that, as a nation, developing any regulatory and policy framework for managing healthcare waste should consider the right of the people. Implementation of policies should be free from all forms of environmental injustices, inequality and discrimination. Pellow and Park (2002) indicated that environmental inequality looks at all environmental hazards that affect specific social groups. Therefore, vulnerable groups such as patients should be protected from the hazards of hospital waste.

The health sector of Ghana is considered as one of the essential service providers in the country with many facilities spread all over the country to provide healthcare needs of the people. It was reported that in 2009, government expenditure on health as a percentage of gross domestic product (GDP) was 5.1% (Ghana Health Service [GHS], 2010). Apart from Ashanti and Greater Accra regions, the Eastern region has the next highest number of hospitals (20) and an appreciable number of health professionals (5, 026). It also has the third highest number of hospital beds (12.07%) in the country after Ashanti (18.50%) and Greater Accra (21.70%) as shown in Table 1 (GHS, 2010).

Table 1: *Number of Hospital beds in the Regions of Ghana by Ownership,* 2009

Region	Government	CHAG	Islamic	Quasi Gov.	Private	Total	% By Region
Ashanti	1,961	1,115	144	204	677	4,101	18.50
Brong Ahafo	657	1,101	68	44	9	1,879	8.48
Central	1,292	359	32	54	0	1,737	7.84
Eastern	1,505	993	0	177	0	2,675	12.07
Greater Accra	3,181	29	0	859	593	4,662	21.03
Northern	905	390	0	0	0	1,295	5.84
Upper East	522	289	0	0	72	883	3.98
Upper West	376	316	10	0	0	702	3.17
Volta	1,240	892	0	47	0	2,179	9.83
Western	1,191	419	52	363	26	2,051	9.25
Total	12,830	5,903	306	1,748	1,377	22,164	100.0
% By Ownership	57.89	26.63	1.38	7.89	6.21	100.0	

Source: Ghana Health Service Annual Report (2010), *CHAG – Christian Health Association of Ghana

On the availability of healthcare personnel, the Ghana Health Service (2010) report shows that Eastern Region has the third highest number of health personnel. Available data on doctor distribution in the country per region shows that the region had about 148 medical doctors as at 2009 **(**Ministry of Health, 2014). This formed about 7.3 percent of all the doctors in Ghana, with a doctor to population ratio of 1: 16,132. This ratio has been decreasing from 2006 (1:22,345) till 2009, implying that much attention has been paid to the region. All these data will imply high volume of healthcare waste generation which should be properly managed.

Statement of the Problem

Some studies have been done currently on hospital solid waste management. For instance, Bamfo-Tanor and Owusu-Agyei (2013) studied “healthcare waste management in Ghana: The case of Accra and Tema”, which dealt with some aspects of management and awareness but not attitudes. Abor (2013) looked at management of healthcare waste in Ghana: a comparative study of public and private hospitals and concluded that public and private hospitals employed standard methods to dispose of their waste. Wilson, Anyemedu, Kwarteng and Awuah, (2006) studied medical waste management in teaching hospitals in Ghana.

According to the Ghana Health Service, the standard of waste management in healthcare institutions is poor (GHS, 2008). Research by Wilson et al. (2006) also indicated non-compliance with MoH policy and EPA guidelines for managing healthcare waste in the use of colour coding, labelling, segregation, secondary storage, treatment and disposal of waste and residues. A report from Ghana Health Service indicates unacceptable disposal of waste by burying and open burning.In some cases, infectious waste was dumped on open grounds (GHS, 2008; MoH, 2006). There are a number of hospitals using incinerators for solid waste treatment in the country but the operations of such facilities and disposal of residues from the incinerators are not monitored and controlled. AERD (2009) points out that Africa has to critically consider waste disposal methods that are being used.

Ghana has both healthcare waste management guidelines and policy. The question is, are the healthcare managers and staff aware and are they really complying with the best practices stipulated in these documents? The HCWM policy of Ministry of Health outlines the best management practices to be adopted and the institutional arrangements to be instituted by the individual healthcare facilities which are also emphasised by the EPA guidelines. These arrangements originate from the integrated sustainable waste management (ISWM) model which considers waste as a resource and the management principles as being equitable, efficient, effective and sustainable.

Studies on the awareness of health and environmental hazards associated with hospital solid waste among the hospital staff are few and mostly pertaining to developed countries. There is a research gap on whether the hospital staff appreciate the effects of poor solid waste management on their health, the patients' recovery, the general public and the environment and how it can undermine their efforts at providing healthcare to the citizenry. According to Barret et al. (2005), the reasons for inefficiencies in achieving sustainable solid waste management practices can be traced to the behaviour of individuals. The question is whether the healthcare staff have requisite knowledge in healthcare waste management and whether they are able to process the acquired knowledge appropriately to make informed decisions.

In 2011, Ghana Health Service reported that the Eastern Region, specifically Koforidua and Agomanya, topped the national HIV prevalence rate with 5.8% record. The further indicates that Eastern Region (6%) was second to Greater Accra Region (87%) in cholera outbreak cases in Ghana, a disease that is attributable to insanitary conditions. The region also placed 8th on the rating of health care waste management practices among the ten regions in Ghana (GHS, 2011). It is therefore important to assess how hospital solid wastes are managed in the region since the HIV affected people may receive health care services from health facilities in the region. This is important for Ghana to avoid the Indian situation where used syringes were sold and reused by unsuspecting health facilities which contributed to the spread of hepatitis B infections among the community members (Solberg, 2009).

It is therefore relevant to study the hospital solid waste management practices in the selected hospitals in the region to establish the measures taken to ensure that the health of patients, community members, hospital staff and the environment is not jeopardised.

Objectives of the Study

The main focus of the research is to assess the solid waste management practices in selected hospitals in the Eastern Region of Ghana.

The specific objectives of the study were to:

i. describe the solid waste management systems adopted by the hospitals;
ii. analyse the institutional arrangements for managing hospital solid waste in the selected hospitals;
iii. assess the awareness of hospitals staff on the hazards associated with hospital waste;

iv. assess the attitudes of the hospital staff toward solid waste management in the hospital.

v. examine the occupational health and safety practices among the hospital staff;

Research Questions and Hypotheses

Research questions

The research questions that guided the study are:

i. how do the hospitals manage the generated solid wastes?

ii. what are the institutional arrangements for managing hospital solid waste generated by the hospital facilities?

iii. What is the level of awareness of the hospital staff on health hazards associated with hospital waste?

iv. What is the attitude of the hospital staff toward hospital solid waste management?

v. What are the occupational health and safety practices among hospital staff in handling hospital waste?

Research hypotheses

i. H_0 - The awareness of hospital staff about the health hazards associated with hospital waste does not differ among different professionals in the hospitals.

ii. H_1 - The awareness of hospital staff about the health hazards associated with hospital waste differ among different professionals in the hospitals.

iii. H_0 - The attitudes of the hospital staff towards waste management do not differ among different professionals in the hospitals.

iv. H_1 - The attitudes of the hospital staff towards waste management differ among different professionals in the hospitals.

Justification of the Study

The healthcare waste management activities include making decisions about resources allocation, controlling waste generation, practising waste segregation, selection of storage facilities, managing collection, transfer and transportation, treatment and disposal of the various fractions of waste. Proper management is therefore important considering the hazards posed by hospital waste to health practitioners and auxiliary staff of the hospital, the ecosystem, environment and public health. Therefore, the findings of the study will help hospital facilities to improve on their management practices. This will contribute in adopting measure aimed at reducing health risks to people and promoting sustainable environmental development both directly and indirectly, through reduced damage to flora and fauna by the hospitals (Centres for Disease Control and Prevention, 2001).

The examination of institutional arrangement for managing hospital solid waste is important for the hospitals to check their compliance with sector policy for handling waste and enhance their collaborative efforts with other stakeholders. The findings will also help them to appreciate the need to develop plans and specific budgets for their waste management activities. The study will help the Ministry of Health, Ghana Health Services and Environmental protection Agency to review the existing policy and guidelines to make them practicable and ensure their enforcement. The analysis of existing institutional partnership will help all stakeholders such as Hospital Managements, Ministry of Health, Ghana Health Service, Environmental

Protection Agency (EPA) and other actors to examine their activities to ensure that they have performed their roles in ensuring good environmental management.

The awareness of hospital staff about the health hazards associated with hospital solid waste as well as their attitudes toward solid waste management activities and the department is very crucial in determining their effort to contribute to solving environmental problems within their work environment. The study will therefore, provide an understanding of how the hospital staff perceive the role of waste management if they are aware of the health hazards that they and their patients are exposed to in the hospital environment. This will help in identifying capacity and logistical gaps that need to be filled by the hospital management. It will also explain their behaviour towards waste management and the general environment which can be corrected through appropriate behavioural change programme. Development partners and hospital administrators can use the information to build the capacities and provide the required resources to ensure proper management of hospital solid waste. Moreover, the study will contribute to the existing body of knowledge on hospital solid waste management practices among researchers and practitioners when the findings are published.

Theoretically, the study is very important considering the wide application of the theory of planned behaviour in the discourse of individual attitudes from diverse fields. The study will reveal how the application of this theory will help to examine individual behaviour in relation to hospital solid waste management. Pred’s Behavioural matrix has been applied in varied fields for locational choices, and other attitudinal decisions. It has not been applied in the study of hospital staff in relation to hospital solid waste management from available literature so far gathered. The utilisation of this model will also add credence to its validity for studying attitudes and behaviour. The resource dependence theory, which has been applied to study organisational behaviour, resource control and power relations for mostly profit-making organisations, will be applied in the provision of social service to broaden the applicability of the theory.

Organisation of the Study

The study is divided into eight chapters. Chapter one which introduced the study focuses on the general background of hospital waste management, statement of the problem and the objective of the study. Research questions, justification of the research and organization of the research work are also discussed. Chapter two is on the literature review, which critically examines theoretical and conceptual issues underpinning the study. Other important issues in healthcare waste management from peer-reviewed journal articles, unpublished thesis and dissertations and reports from international and national environmentally based organizations are discussed. This focuses on technology for hospital solid waste management and hospital waste disposal methods.

Chapter three covers the methodology for the study. The description of study design, sources of data, sampling method, sample size, data collection instrument, data collection method of analysis and presentation, field experiences and limitation to the study were discussed in this chapter. Chapter four focused on the presentation of findings with respect to existing hospital solid waste management activities in the selected hospitals and implication for environmental and public health. Chapter five focused on institutional framework and arrangement for managing hospital solid waste, the level of partnership with other stakeholders involved in hospital solid waste management. Moreover, financing and contractual issues for engaging the private company in hospital waste management is discussed. Chapter six examined on staff awareness of health hazards associated with their work and waste management as well as attitudes towards waste management activities and the department in the hospital. Chapter seven focused on occupational health and safety framework at the hospital, training of staff on safety issues, incident reporting and treatment of injuries. More so, it presents the results of the hypotheses for the study and the relationship between some socio-demographic factors and staff awareness and attitudes. Chapter eight covers the summary of findings, conclusions drawn from the study, contribution to knowledge and hospital waste management practices and recommendations for policy consideration and further studies.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

Literature reviewing is the process of searching and discussing issues in research based on what others have done in the phenomenon of study. A literature review can be seen as an evaluative report of studies found in published or unpublished form which are related to the selected subject area which briefly describes and summarize the literature (Boote & Beile, 2005). This review provides a theoretical basis for the research and helps in shaping the nature of one's own research. In most cases, reviews are written to reflect issues forming the body of the research topic, the objectives and are influenced by the worldview of the researcher.

This chapter covers the definitions and classification of healthcare waste, the theoretical framework for the study by examining behavioural theories and resource dependence theory. In addition, integrated sustainable waste management (ISWM) model has been discussed as a supportive concept for the study. Empirical studies on the subject have been examined with relevant theories as well as essential issues in hospital solid waste management. The last part of the chapter is devoted to the development of conceptual framework for the study which was informed by the theoretical framework, empirical studies and other hospital waste management issues reviewed.

Definitions and Characteristics of Healthcare Waste

The World Health Organization (2013) has classified medical waste into infectious, sharps, pathological, pharmaceuticals and radioactive. EPA-Ghana

(2002) categorised them into hazardous and non-hazardous waste. Healthcare facilities include hospitals, which will be considered in this study, veterinary institutions, health research institutions and alternative healthcare providers (EPA-Ghana, 2002). The volume of healthcare waste generation is generally increasing with increasing population, treatment of diseases and the spread of health facilities across the world.

According to Altin, Altin, Elivli and Cerit (2003), healthcare waste is composed of three main categories of waste: medical waste, infectious waste and domestic waste. They explained "Medical waste" as materials generated from patient diagnosis, treatment or immunization of human beings; "Infectious waste" is the portion of medical waste that is generated from patients with infectious diseases and has the capabilities of infecting others; "Domestic components" is the waste from the kitchens, compounds, offices and through housekeeping functions in the hospital. Longe and Williams (2006) and Jasem and Hani (2007) referred to hospital solid waste as a special waste due to its potential to cause infection and injury to handlers, hospital workers, patients and the surrounding communities compared to other types of waste.

Pruss et al. (1999) defined infectious waste as any waste produced in a hospital that is suspected to contain pathogenic organisms in sufficient amount to cause disease in a susceptible host. The hazardous category (20%) is made up of infectious waste (15%), chemical and pharmaceutical waste (3%), sharps (1%) whilst the rest (1%) is accounted for by the radioactive matter, genotoxic and heavy metal content (WHO, 2011). Each type has its own characteristics as described in Table 2.

Table 2: *Categories and Characteristics of Hazardous Healthcare Waste*

Type of healthcare waste	Characteristics
Infectious	All waste contaminated with blood and its by-products, cultures and stocks of infectious agents, waste from patients in isolation wards, discarded diagnostic samples containing blood and body fluids, infected animals from laboratories, and contaminated materials (swabs, bandages) and equipment (such as disposable medical devices).
Pathological	This includes recognizable body parts and contaminated animal carcasses;
Chemicals and Pharmaceuticals	Examples include mercury, solvents and disinfectants; expired, unused, and contaminated drugs; vaccines and sera.
Sharps	These are items that can cause cut injury such as syringes, needles, disposable scalpels, blades, knives, and broken bottles, etc.
Genotoxic	In this category are highly hazardous, mutagenic, teratogenic or carcinogenic, such as cytotoxic drugs used in cancer treatment and their metabolites.
Radioactive	This refers to waste such as glassware contaminated with radioactive diagnostic material or radio therapeutic materials.
Heavy metals	Heavy metal waste include broken mercury thermometers, x-ray developer.

Source: WHO, 2011

Hospital solid waste management in this study refers to all processes involved in the waste generation, segregation, storage, collection, transportation, treatment and final disposal of all types of waste generated in a hospital or health facility. It has been indicated that hospital solid waste generation rates depend on factors such as established waste management method, type of hospital facility, hospital specialisations, season in the year, amount of reusable items being used in healthcare services, proportion of patients visiting and being treated on a daily basis as well as admitted patients

(Agenda for Environment and Responsible Development [AERD], 2009; Awad et al., 2004; Debere, Gelaye, Alamdo & Trifa, 2013; EPA Ghana, 2002; Manyele & Lyasenga, 2010; Pruss et al., 1999).

Theoretical Perspective

Behavioural theories

There are numerous behavioural theories that try to explain why people have a certain attitude and demonstrate it by the behaviour they put up. These include the theory of planned behaviour (TPB) by Ajzen (1985), social cognitive theory by Bandura (1971), theory of reasoned action (TRA) by Fishbein and Ajzen (1975) and Value, Belief and Norms (VBN) theory of Stern, Dietz, Abel, Guagnano, & Kalof, (2000). Pred's Behaviour matrix (Pred, 1967) which was developed for business and enterprises in the selection of an appropriate location for doing business is also important in studying behaviour of people.

Basically, the Value-belief-norm (VBN) theory as developed by Stern et al. (2000) focuses on environmental and social activism behaviours of individuals or groups in society. It is appropriate for environmental movement, willingness to take action in favour of the environment and conservational studies. Social cognitive theory (SCT) also called social learning theory, developed by Bandura (1971) addresses social behaviour from the cognitive point of view under learning and doing conditions. It posits that people learn not only from their own experiences, but by observing the actions of others and the benefits of those actions (Bandura, 1971). This theory is more useful in the evaluation of programmes and projects aimed at behaviour change.

The theory of reasoned action

The theory of reasoned action (TRA) developed by Fishbein and Ajzen (1975) posits that 'intention to take action' is a product of 'attitude towards taking action' and 'subjective norm'. The attitude was defined as decisions taken based on one's personal norm. The attitude toward action is determined by one's priority of taking a particular action and the evaluation of possible effect or consequence of the action. The subjective norm is defined as decision making based on how the individual is expected to behave in the society by the members of that society such as family members, superiors at workplace, subordinates, friends, parents, etc. that the individual interacts with. The subjective norm is determined by an evaluation of expectation by others and strength of one's feeling of responsibility to meet the expectation or social norm laid down to guide members' behaviour. The model implies that once an individual has a behavioural intention toward an action there is a strong motivation for that behaviour to be demonstrated as shown in Figure 1.

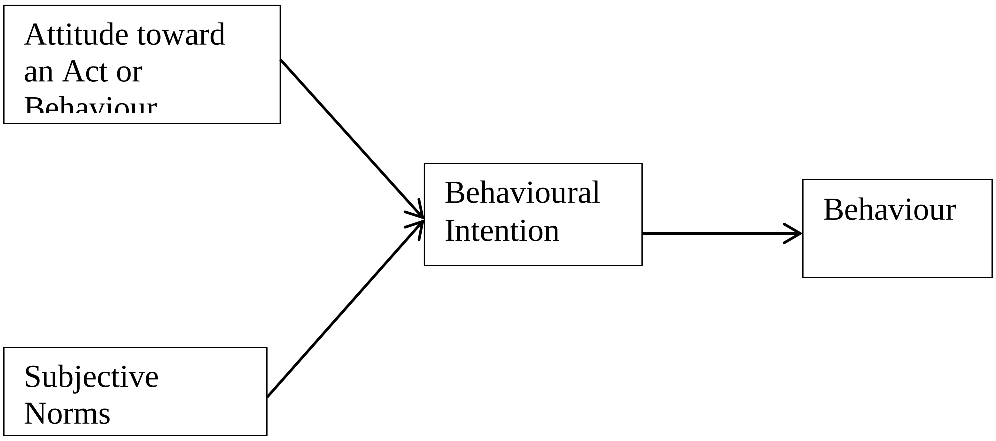

Figure 1: Theory of reasoned action
Source: Fishbein and Azjen (1975)

The model has been criticised on the bases that sometimes norms can be considered as attitude so using these to predict behavioural intention is a problem. For example in a community where females are supposed to bow to males, it can be seen as the norm so every woman is supposed to conform and this becomes part of the societal attitude. Therefore, in some instances, the norm can be seen as attitude and one dare not change that. The second criticism is on the fact that the model assumes that when an individual forms an intention to act in a particular way they will have the freedom to act without any hindrance or limitation (Azjen, 1985). Sometimes there may not be any limitation, yet the person voluntarily abandons the intentions to act. In reality, the individual is subject to many constraints such as the capacity and ability to act, time, environmental or organisational limits, resources constraints and some unconscious habits. Some authors have also criticised this model because it does not consider the past experiences or of the individual which makes him or her behave in a certain manner. Moreover, people act in a manner that is not understandable to other members of the society due to available motivation from which one derives inspiration to perform an act. Fishbein, (1993) indicated that TRA cannot predict behaviours requiring skills, resources, or opportunities not freely available.

Theory of planned behaviour

To address the weakness of the theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) was developed by Ajzen (1985). In the TPB (Ajzen, 1985, 1991) perceived behavioural control was added to the model in the theory of reasoned action to address the limitations identified. It applies cognitive perspective to explain human behaviour based on what their beliefs and attitudes are. In the theory of planned behaviour intention to act is seen as the predominant or best predictor of behaviour under volitional behaviour as shown in Figure 2. The behavioural intention is predicted by a person's attitude, subjective norms and perceived behavioural control (PBC). It implies that the higher a person intends to perform behaviour, the greater the probability that the behaviour will actually be performed (Sheeran, Trafimow, & Armitage, 2003; Darker, Larkin, & French, 2007).

The theory proposes that attitude is developed from a summation of beliefs that the behaviour will produce certain results and the evaluation of the weight of these outcomes (behavioural beliefs). Subjective norms are determined by normative beliefs and motivation to comply. Normative beliefs imply the behavioural expectations that important individuals or groups will approve or disapprove of the behaviour and motivation to comply is the person's general tendency to go along with the wishes of salient referents (Fishbein & Ajzen, 1975; Armitage & Corner, 2001).

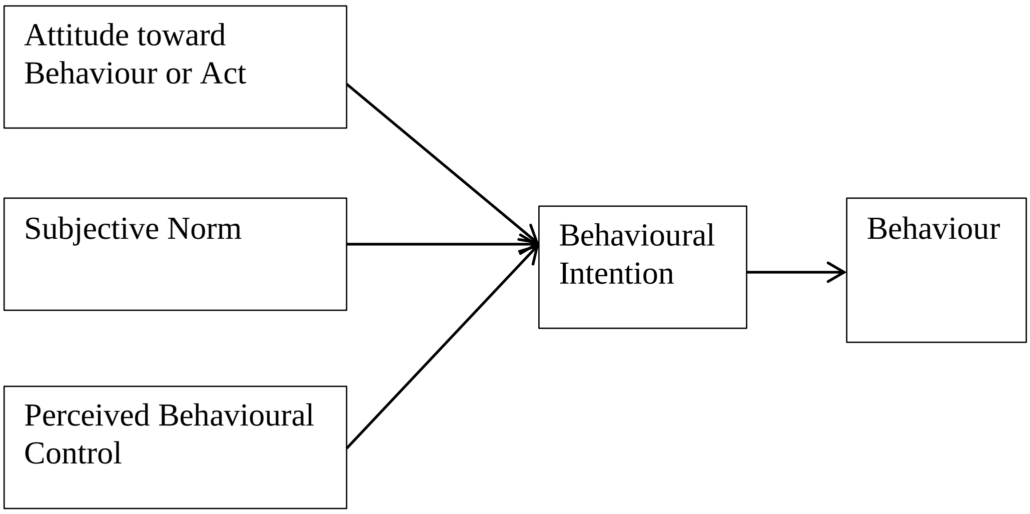

Figure 2: The theory of planned behaviour
Source: (Ajzen, 1991)

PBC is underpinned by a set of control beliefs and the perceived power of these beliefs which is similar to notions of self-efficacy (Bandura, 1997; Terry et al., 1993). Control beliefs refer to the perceived presence of factors and conditions that may influence or impede the performance of behaviour and perceived power refers to the perceived impact that facilitating or inhibiting factors may have on performance of behaviour. The limiting or promoting factors were said by Conner and Armitage (1998) to include internal factors (e.g., information, personal deficiencies, skills, abilities, emotions) and external control factors (e.g., opportunities, dependence on others, barriers).

According to Fisher and Fisher (2000) in the absence of the perceived control, the theory is practically the same as TRA. In that case, the general weakness of TRA can be applied to the TPB. In fact, not many people consider the perceived control as a constraint to demonstrate a planned behaviour in all cases. This point was confirmed by Rye (1999) that safer sex behaviours are under volitional control such that the TPB reverts to the TRA, and perceived behavioural control is simply irrelevant to such behaviour. For instance, an ill-motivated person may not take into consideration the so-called perceived behavioural controls but may go ahead to take the action. Moreover, when the egoistic part of the individual overshadows the superego, the perceived controls may not matter.

Another criticism from Fisher and Fisher (2000) is that the theory ignores the role of the type and magnitude of information as well as behavioural skills required by individual to undertake and maintain specific actions. A model of information-motivation-behavioural skills required to maintain behaviour was developed by Fisher and Fisher (1992). This criticism holds in the sense that individual behaviour may be influenced by the magnitude of the information or past experience or provocation received (external stimuli) before taking an action. Quine and Rubin, (1997) showed that past behaviours induced new behaviour through attitude and perceived behavioural control. The role of information and past experience can in no way be underestimated in behavioural studies. This has been emphasised by the Pred (1967) behavioural matrix which is discussed in the next section.

Fife-Schaw, Sheeran, and Norman, (2007) criticised the TPB as a good model for behavioural prediction but fails to specify how the behaviour predictors (i.e., attitude, subjective norm, and PBC) should be changed to produce the desired behavioural intentions. This is important because in an event of changing an undesired behaviour, which of the predictors should be targeted, what should be the magnitude of change with respect to the variables and how that change should be done is not addressed in the theory. It should be possible to know the predictability contribution of each variable to behavioural intention. Meta-analyses show that attitude, subjective norm, and PBC can explain 30–50 percent of the variance in intention to perform an act (Armitage & Conner, 2001; Sheeran & Taylor, 1999) and that intention and PBC explain 20–40 percent of the variance in behaviour (Armitage & Conner, 2001).

Despite this weakness of the theory, it is relevant for this study. In fact, Conner and Armitage (1998) indicated that the theory is complete for understanding and studying human behaviour because any other factor affecting behavioural intention will exert its influence through predictors. Abraham and Sheeran (2003) pointed to two major strengths of the theory as first, being parsimonious; only a small number of variables need to be measured in order to obtain an accurate prediction of behaviour. The second strength is that in order to ensure the predictive accuracy of the model the theory provides clear guidelines about how to measure cognitions specified by the model, (Ajzen & Fishbein, 1980). For instance, the TPB highlights the importance of ensuring that measures of attitude, subjective norm, PBC, intention, and behaviour are compatible and are taken as closely as possible in time (Abraham & Sheeran, 2003).

It has been applied in waste management studies from different disciplines to consider behaviour of households and students (Mahmud & Osman, 2010; Karim Ghani, Rusli, Biak, & Idris, 2013) towards waste segregation. The theory is critical for studying how individual's personal beliefs, referent beliefs and control beliefs work together to determine the person's behaviour. In waste management activities, individuals may have their own beliefs and norms but there are certain factors that obviously constraint them from demonstrating the desired behaviour once they are aware of what is expected of them. Hence the TPB is convenient for this study.

In this study, the relevant variables from TPB will be used to assess the attitudes, and safety practices among the healthcare workers with respect to waste management. On the theory of planned behaviour, "information component and perceived lack of resources" will inform the results and discussion of staff practices in waste management and occupational health and safety fused into the predictors to assess how it influences behavioural intentions of the hospital staff towards healthcare waste management practices.

Allen Pred's behavioural matrix

After criticising normative location theories, Allan Pred (1967) introduced the concept of the behavioural matrix in connection with a theory of behaviour and location. According to Selby (1987) this matrix was aimed at introducing a behavioural theory of location to replace normative location theories. The arguments against normative location theories by Pred (1967) were that i) they were logically inconsistent, in that it is not possible for competing decision makers to arrive at optimal location decisions simultaneously; ii) the problem of motivation, i.e. maximizing behaviour versus sufficing behaviour; and iii) the problem of human ability, i.e. man is simply unable to attain perfect knowledge.

Pred (1967) argued that behaviours are predominantly developed based on available information and the capacity of the individual to accurately analyse the information to make an informed decision as to the course of action to take or the choice to make (Mariwah, 2008: Rodrigue, Comtois, & Slack, 2006). The matrix simply places the capacity of the individual on the x-axis and the available information on a vertical axis to give six by six matrixes (Figure 3). Pred (1967) explained the capacity to include the skills, acquired knowledge and experiences that one possesses and the information available on the object of discussion. The matrix recognises that sometimes the quality of information may still be available but each person will have a different interpretation and as such will apply the same information differently (Pred, 1967). This brings to bear the differences between decision makers, thus some decision makers are better than others.

Some of the decisions made from the same available information may be acceptable and not entirely wrong but may not be the optimal or the maximum (B11, B12, B21, B22) whiles others can make optimal and best decisions (Bn1, Bn2). Those who can optimally utilize the available information constitute the rational decision makers from economic theory perspective (Pred, 1967; Selby, 1987). It is also clear that people can make optimal and best decisions without having the optimal information (Bn1, Bn2) and at the same time others may have all the quantity and quality information but will make wrong choices as irrational decision makers (Bn1, Bn2, Bn3). Every decision made has a margin of error; hence the decision maker should prepare to cope with the consequences that must be paid to compensate for that marginal error in judgement.

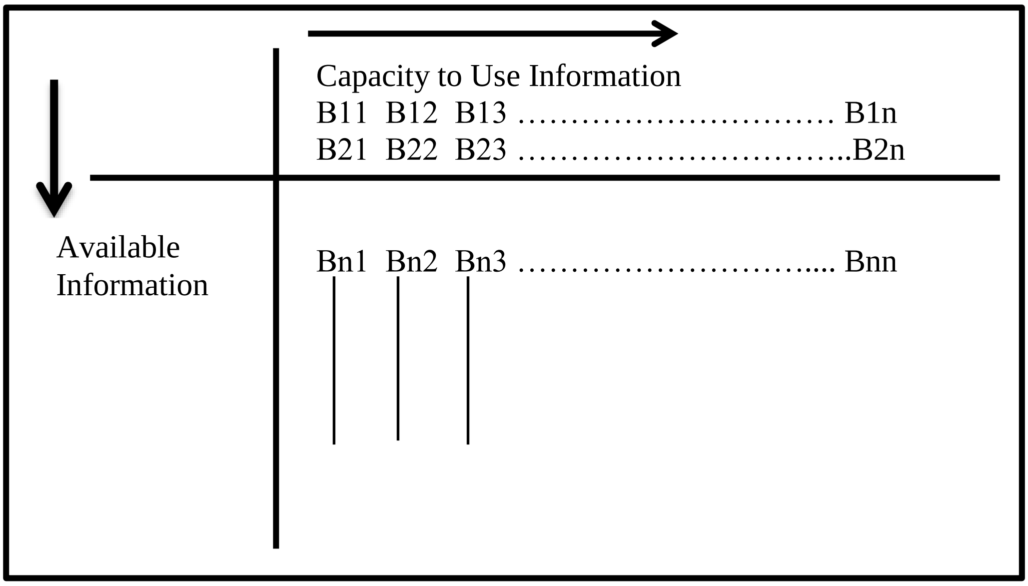

Figure 3: Allen Pred's behavioural matrix.

Source: Pred (1967)

Harvey (1969:312-314) as cited in Selby (1987), rubbished behavioural matrix in the sense that it was only based on two basic concepts - information and ability- which were "so vaguely defined, ambiguous and non-operational”. Harvey (1969) argued that “the whole idea of the behavioural matrix as a foundation for a geographical location theory appears doomed from the start". However, Selby (1987) argued that the claim against the behavioural matrix concepts as being ambiguous and vaguely defined seem to be exaggerated by Harvey (1969), considering the explanations given in Pred's second work (Pred, 1969). Nonetheless, Selby (1987), agreed with the criticisms by Harvey (1969) on the legality of the assumption that information and ability-to-use are orthogonal in a two-dimensional behavioural space. This criticism is valid since there has not been any correlation between information and ability to use.

The other weakness of the Pred's behavioural matrix is that, it does not recognise the limitation placed by the social and environmental setting on the decision maker. One can have all the available information and the maximum required capacity to make the optimal decision but prevailing environmental, social and sometimes political conditions can make it impossible to act as expected. The case for environmental constraint affecting behaviour of firms has been proved by Raven, McCullough and Tansuhaj (1994) that firms perceived environmental uncertainty affected their decision-making process as to export product. The environmental conditions in this case include the provision of the required resources within the working setting to make the practicing of the behaviour possible. The political environment and conditions in a particular area may not be conducive for certain course of action or decisions to be taken.

An individual may have the capacity and information to take an optimal decision but may not be acceptable to the society. This makes it deviate from the theory of planned behaviour where social norms are considered in decision making process to act (Ajzen, 1985). Secondly, it does not consider the conditions under which one acquired the information as influencing one's ability and readiness to use such information. Information acquired passively may not be used at all or optimally whiles actively acquired information is likely to be used. This was indicated by Longo et al. (2009) that active information seekers mostly used the information more than passive seekers. Moreover, one can have all the information but may lack physical resources to facilitate the performance of the behaviour as discussed in the theory of resources dependence (Pfeffer & Salancik, 1978).

Despite these weaknesses, the behavioural matrix has been used by behavioural geographers and other professionals to inform behavioural studies. According to Hayter and Watts (1983) even though behavioural matrix may not be useful in predicting locational change it gives a better understanding of locational choice processes. Selby (1987) argued that the behavioural matrix is operational and has great potential as an analytical tool in development studies. Its current utility is an indication of its validity in studying human behaviour where information is critical. This matrix is important for studying the behaviour of health workers towards healthcare waste management practices at the hospitals.

At the hospitals, if workers do not have enough and quality information on waste management activities it becomes difficult for them to make appropriate decisions. This is particularly so when hospital staff want to reduce the risk associated with their waste handling practices. Prior information about the potential of healthcare waste to infect workers and community members will critically be evaluated by such a worker to inform his/her actions and in-actions within the hospital. Display of information, available trainings on healthcare waste management, health hazards and safety measures are needed by healthcare workers to protect them. If the information is available all the time, a rational being will by all means consider and make use of some aspects or all the information to his or her benefit. On this score, this behavioural matrix perfectly fit this study.

The study will draw on the job trainings, communication facilities at the hospitals, education on healthcare waste from schools attended and personal reading to assess the availability of information to the worker. Other variables like environmental conditions at the work place (social, resources, political) and motivation (personal, financial, health) will be applied to the behavioural matrix to examine its influence on the attitudes of staff. Capacity to use information will be examined by considering the educational qualification, experience on the job, willingness to do and resources availability. The influence of these variables on decision making towards healthcare waste management will be considered.

Resource dependence theory

The advent of resource dependence theory by Pfeffer and Salancik (1978) brought a lot of insight into the study of organisational behaviour and enhanced understanding into decision making processes of organisations. The central argument of the theory is that organizations will try to manage their resource dependencies using different strategies in order to achieve greater autonomy and thus reduce uncertainty in the flow of needed resources from the environment (Pfeffer & Salancik, 1978). According to Pfeffer, “Resource dependence was originally developed to provide an alternative perspective to economic theories of mergers and board interlocks, and to understand precisely the type of interorganizational relations that have played such a large role in recent ‘market failures” (Pfeffer, 2003, p. 25).

Pfeffer and Salancik (1978) were of the view that in a normal social system and social interactions there should be interdependent conditions especially when the social actor (e.g. organisation) has to depend on another for resources for its functional operations to achieve its set goals. In this case, each actor has some power over the other but the actor controlling the resources has more power to allocate resources for production. The dependent organisation has to increase its sources of resources to reduce the influence of the resource holder (Pfeffer & Salancik, 1978; Nienhüser, 2008). They also recognised that organisations can be constrained by existing laws and rules which can limit their access to resources (Pfeffer & Salancik, 1978). The theory also looks at the resources allocation, decision drive among the units in the organisation and considered the unit that makes good returns on the allocated resources to achieve organisational goal as more powerful.

Like most theories, it may not be perfect to be used in certain circumstances since time and events are not static but dynamic. Davis and Cobb (2009) criticised the resource dependence theory by asserting that if it was developed as “an alternative perspective to economic theories of mergers and board interlocks,” then the analyses of mergers and interlocks were done at the industry level rather than the organizational level, which leaves their results susceptible to claims of an ecological fallacy. The theory has been criticised because it does not consider that organizations are not always capable to take actions to manage external dependencies partly due to power imbalance between two organisations or units within organisation (Casciaro & Piskorski, 2005)

Autonomous or private institutions which are into active production of goods and services and are in competition may be able to manage their dependencies through divestiture. In the case of public institutions that depend on government subventions as the main source of capital for the production of goods and services, it becomes difficult to diversify their sources of resources (capital) to perform their expected functions successfully. In managing and running government owned hospitals where resources such as medicines, funds, infrastructure, etc. are provided by the government through an established agency (Ghana Health Service) such regulation of dependency becomes extremely difficult. If resources are not provided due to external controls and power struggle the hospitals become helpless and will have to increase their charges to patients for services that should be free or less. This can make access to health care expensive and prohibitive. The ultimate is that people will no longer use the services of the hospitals if they cannot afford and this will increase morbidity and mortality.

Moreover, within the hospital set up, various departments depend on the central administration for resources to conduct daily operations. Assuming that the administrator unfairly distribute resources and side-line some units in the hospital, the relevance of that unit is taken away and they will have no capacity to diversify to meet their unit goals. Therefore, the powerful theory may not be able to address all the issues in organisational behaviour especially those that depend on Government. A classic example in Ghana is the situation where some Municipal and District Assemblies that have been depending on statutory payment from Government of Ghana for their operations are complaining of no funds for implementation of development projects due to economic challenges in the country.

The environment under which the theory was developed is quite different from conditions that prevail in other geographical areas so may not address the entire pertinent issues specific to different geographical context. Moreover, the level of globalisation and technologies that exist currently in the world are certainly different from what existed at the time when this theory was developed, therefore the solutions proffered by the theory to reduce dependence may not work. The theory may not also address issues related to intra-organisational power dynamics and reduction of dependence of various units on central administration holistically. It is still relevant to the study since there is a level of dependency between hospitals, private sector actors, local assemblies, municipal health directorates and the regulatory agency. Furthermore, since there is dependency among the departments, it can be applied despite its limitations.

There is no doubt about the wide applicability of the resources dependency theory in organisational studies. A review in 2002 showed that there were about 2,321 citations of the book, with 58 per cent of the citations being in the most recent ten years (Pfeffer & Salancik, 2003). Notwithstanding its initial purpose, the theory has been useful in many dimensions of organisational behaviour and their sustainability in competitive economic environment (Hillman, Withers & Collins, 2009). The ability of the theory to explain the operation of inter-organizational influence, or social control processes has contributed to its wide usage across many disciplines (Davis & Cobb, 2009). The theory constructs looked at inter-organisational relationship as well as intra-organisational relations as being resources, external and power controlled with certain tactics to reduce external influence.

The resource dependence theory (RDT) will also be used as a supportive theory to inform the study when examining the institutional arrangements (stakeholders, mandate, power, relationship, coordination and control) available resources (financial, human, tools, equipment) and its allocation to the departments for managing the waste. The core issues in this theory however, will not be tested in this study.

Integrated Sustainable Waste Management Concept

The integrated sustainable waste management (ISWM) approach advocate for the inclusion of all stakeholders in making decisions on the best waste management system to adopt, details out of the functional element of waste management system and the consideration of local conditions in deciding the kind of waste management system to be implemented for sustainability reasons (van de Klundert & Anschütz, 1999; 2000). According to van de Klundert and Anschütz (2001), ISWM concept is to "promote technically appropriate, economically viable and socially acceptable solutions in the development of a waste management system that best suits the society, economy and environment in a particular location". The concept identifies four principles' equity, efficiency, effectiveness and sustainability with three dimensions of sustainability as: stakeholder, system element and local aspect which need to be integrated.

"Sustainable" in the ISWM concept means a system that is appropriate to the local conditions in which it operates, from a technical, social, economic, financial, institutional, and environmental perspective, and; capable to maintain itself over time without reducing the resources it needs (van de Klundert & Anschütz, 1999). The capturing of the time element in the concept is the right direction. Heinberg, (2010: 1) stated that the term “sustainable” is “that which can be maintained over time”. Quantity of waste generated, transportation, treatment is changing over time with characteristics and composition because of the dynamic nature of societies (Hoornweg & Bhada-Tata, 2012). If the system is not sustainable it will definitely fail to deliver the expected output and deplete the limited resources available. For example the use of compaction trucks with no available spare parts and skilled manpower to fix locally will not support the system to be sustainable.

Some bench marks to check for the sustainability of the system are needed to ensure value for money or the system functions well as expected. Van de Klundert and Anschütz, (2000) suggested that to assess the sustainability of waste management system, various sustainability goals need to be defined to cover technical, social, economic, financial, institutional, and environmental perspectives. The specified goals should be evaluated with either qualitative or quantitative indicators that appropriately fit the goals. Broadly, Grafakos and Baud (1999) proposed indicators that cover policy/legislative, organisational, operational and performance levels based on the local conditions for waste management. Van de Klundert & Anschütz, (2000) supported these indicators to be appropriate for ISWM but the weights for the indicators need to be developed. Indeed, these indicator areas can be used by stakeholders to do individual evaluation of the system.

The word integrated is used in many professional fields. According to van de Klundert and Anschütz (1999) the concept of integrated in ISWM is defined as a system that uses a range of inter-related collection and treatment options, at different habitat scales (household, neighbourhood, city); involves all stakeholders, (governmental or non-governmental, formal or informal, profit- or non-profit oriented); and takes into account interactions between the waste management system and other urban systems. The ability to incorporate all these units together as a unit is by no means easy but will help to ensure sustainability of the system.

The four major principles for the implementation of ISWM according to van de Klundert and Anschütz, (2001) are efficiency, effectiveness, equity and sustainability. Equity principle advocates that all citizens are entitled to an appropriate waste management system for environmental health reasons irrespective of the socioeconomic status. Effectiveness means that the waste management model applied should lead to safe removal of all waste within specified schedule. Efficiency principle is viewed as managing all waste by maximising the benefits, minimising the costs and optimising the use of resources, taking into account equity, effectiveness and sustainability. In sustainability, the waste management system is appropriate to the local conditions and feasible from a technical, environmental, social, economic, financial, institutional and political perspective. It can maintain itself over time without exhausting the resources upon which it depends.

Schmeer (2000) indicated that stakeholders in a process are actors or “interested parties” (persons or organizations) with a vested interest in the policy being promoted. In ISWM concept, stakeholders are people who are affected or have benefited from or have a stake in waste management project (van de Klundert & Anschütz, 2001). The system element starts from the generation, storage, collection, transfer and transportation, treatment and disposal of waste in a sanitary manner. The concept identified six local aspects to be considered to ensure equity efficiency, effectiveness and sustainability of the system. The concept strongly advocates for the integration of these dimension: elements, stakeholders and local aspect to make the waste management more efficient and sustainable. In fact ISWM concept hinges on the waste minimisation ideologies as epitomised by the waste management hierarchy (Gertsakis & Lewis, 2003) with reuse, recycling and composting to recover resources from waste (See figure 4).

The integrated sustainable waste management (ISWM) concept which helps in examining the stakeholder's collaboration, the actual performance of waste management activities and its relevance to the local conditions is relevant for the study. The nature of collaboration can affect waste management positively or negatively. Even though the ISWM concept is very elaborate and addresses pertinent issues in waste management, it fails to specify those who are responsible for the various aspects of the waste management systems. That is, the operationalization of the concept was left general in terms of who has to do what, therefore, this study proposes a complement to the ISWM concept. The proposed "NATIO Functional Framework" (See Fig. 5) assigns various functions to government (National function), managers of institutions or facilities, technical staff and individuals in the institutions for ensuring proper waste management.

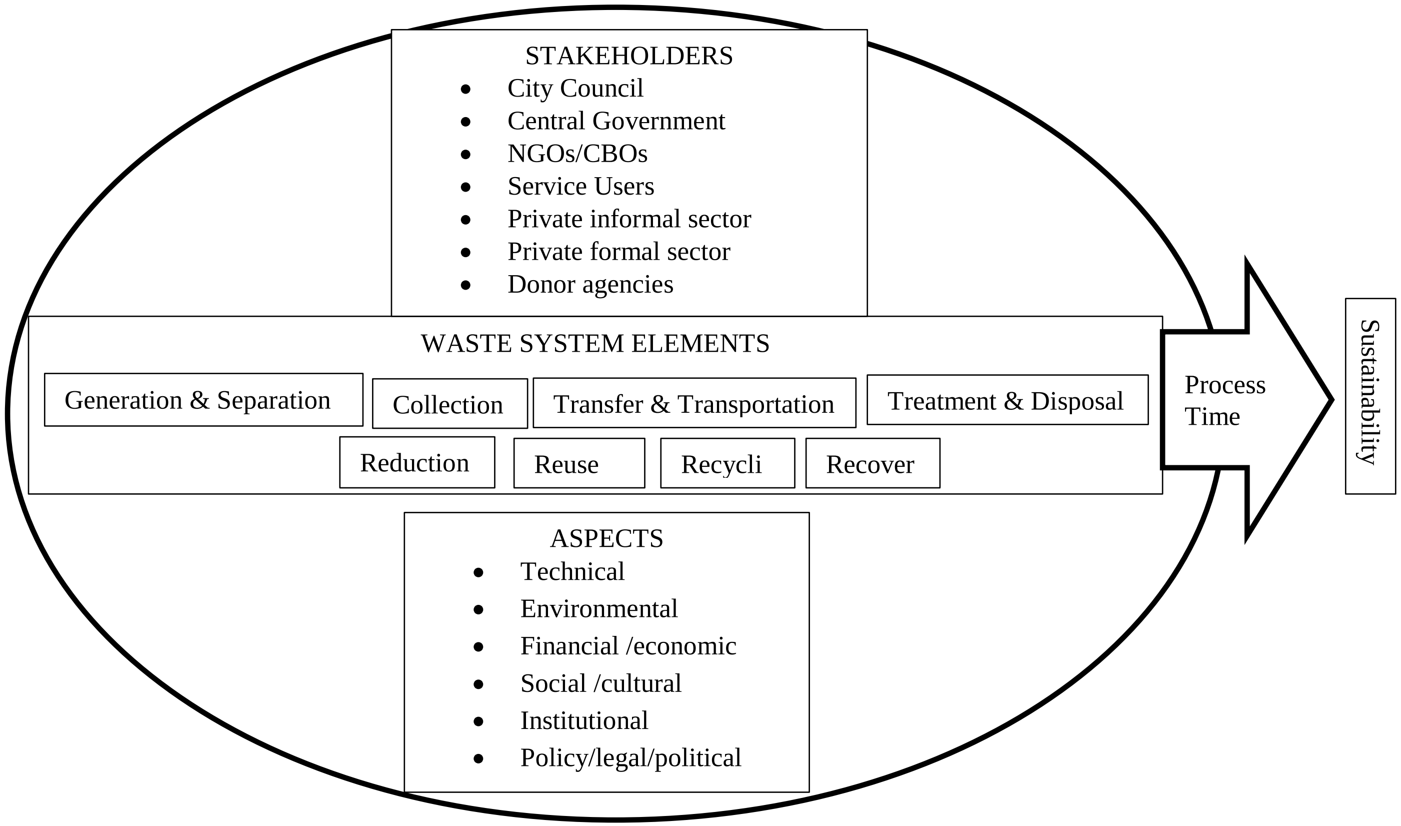

Figure 4: Dimensions of ISWM
Source: van de Klundert & Anschütz (2001)

Empirical Studies

Many behavioural studies have utilised the theory of planned behaviour from various perspectives. In Nigeria, Agwu, MNIM & MNISP (2012) studied the solid waste management practices and challenges from behavioural perspective in Port-Harcourt City using the theory of planned behaviour. It was found that residents were aware of the environmental situation but showed negative practices from both correlation analysis and chi-square results. They observed a significant relationship between sex, age and social class and the level of awareness, knowledge, and practices of solid waste management. It was concluded that the theory of planned behaviour can be applied in a wide range of field including waste management studies and behaviour of stakeholders.

Karim Ghani, Rusli, Biak & Idris (2013) modified the TPB by adding "situational factor" as a convenience to study factors influencing participation in source separation of food waste. The added factor did not show any significant relationship, which suggests that convenience is not an issue when it comes to food waste separation. They concluded that the TPB provides a useful model to identify underlying factors that may influence waste separation behaviour. In a study by van der Linden (2011), the theory of planned behaviour was modified to study charitable intent by introducing moral construct. It was reported that social norms do not play any role in charitable intention but moral norms, attitude, perceived behavioural control and past behaviour were significant predictors of a person's intention to give donations to charity homes. The theory has also been used in conjunction with

Altruism and Self-construal for studying and designing recycling campaigns for different societies by Chaisamrej (2006).

In the United State of America, Cordano and Frieze (2000) tested the theory of planned behaviour in examining pollution reduction preference among environmental managers. Their results indicated that there may be substantial communication barriers within organizations that inhibit environmental performance. This is because many of the environmental managers had positive attitudes about pollution prevention but felt little pressure to improve environmental performance beyond regulatory requirements. They concluded that Ajzen's theory of planned behaviour provides useful bases for researching into managerial decisions that impact environmental performance.

The theory was applied in a study to assess students' awareness, attitudes, and perceptions towards solid waste management in Malaysia by Desa, Kadir and Yusooff (2011). The authors used self-administered questionnaire approach for the data collection. A sample size of 537 at 95 percent confidence level, a margin of error at 5 percent was estimated for a student population of 5,000. To cater for errors and non-responses, 600 questionnaires were administered by convenience sampling. A total of 589 undergraduate students from eight different faculties at the National University of Malaysia completed the questionnaire. Descriptive statistics and chi-square test were performed to determine the relationships between attitude and practices and also between facilities and practices.

They reported high level of awareness (64%) but negative attitude (65.9%) towards solid waste management. Perception of the students was also low, with about 40% of them showing positive perception. The Chi-square results indicated no relationship between attitude and practice ($x^2 = 2.452$, $p > 0.05$), and also between facilities and practice ($x^2 = 1.618$, $p > 0.05$). They explained the result as being attitudinal problems, lack of enforcement, lack of monitoring and lack of understanding of student's roles and responsibilities in environmental protection. In fact, a number of studies have also found similar trend indicating a gap between awareness and performance (Lyons & Breakwell, 1994; Pfeffer & Sutton, 2000). If people are given information about solid waste management and the right management support system and resources for practicing is not provided, the acquired knowledge may not be utilized. More so awareness programmes should probably emphasise the role of individuals in ensuring sound environmental management.

The authors failed to examine what might have been the root cause of this result since there are other demographic characteristics that might have contributed to the results. For instance, the programme of the students, the sex, years spent in the university and prior environmental education can influence the awareness and attitude. The willingness and ability to practice the acquired knowledge given the right resources could have been explored by the authors. In the concept of the TPB, the perceived behavioural control was not properly examined. This study will assess how awareness, personal demographics, and perceived controls influence the attitude of hospital staff toward waste management activities.

The Pred's behaviour matrix has been used by many authors to study different group of people and how they made decisions or choices based on the available quality and quantity of information at their disposal and their capacity to utilize the information optimally. The one who uses information optimally is expected to have a change in behaviour on an issue. In 1978, Selby aimed at operationalizing Pred's behavioural matrix, as a tool for analysing small-scale sawmills enterprise in rural areas. He operationalised the "ability-to-use" concept in the matrix with five variables as: age of the entrepreneur, level of education, length of management of the present enterprise, previous entrepreneurial experience (dichotomous) and previous professional experience (dichotomous).

The "quantity and quality of information" was operationalised with eight variables which were mainly for the quantity of information. These variables were attitude towards information seeking, primary interest in seeking administrative information, primary interest in seeking information on raw material supply, primary interest in seeking information on product development, primary interest in seeking information on product marketing, primary interest in seeking information on other (unspecified) fields, number of professional affiliations and marketing or activity area. Principal component analysis was used in the analysis and the results indicated that age, level of education and entrepreneurial experience accounted for 21 per cent, 16 per cent and 13 per cent of the components respectively. It was concluded that the informational and ability-to-use concepts in the behaviour matrix have remained intact, operational and has considerable potential as an analytical tool in development studies.

Adomah (2001) used the behavioural matrix to examine the variability in perception of individuals in agricultural, mining and logging communities and companies on environmental degradation in Ghana. He reported high awareness of environmental problems in the study areas yet the respondents were still engaged in activities that facilitate environmental degradation. A significant difference in the perception of the local people was reported with respect to sex from one community to the other. It was reported that both human and natural factors contributed significantly to environmental degradation.

The behavioural matrix was used by Mariwah (2012) in a study with the title “Shylock Vs. Antonio: informal money lending in rural communities in the Jaman North District, Ghana”. The author examined lending and borrowing in a rural environment and the possible implications for microfinance schemes using a qualitative approach. The results indicated high awareness of the existence of bank loans at lower interest rate but were not willing to access it due to perceived complexities. It was argued that the fact that most of the respondents had very limited knowledge about the operations of the formal financial institutions in the District is an indication that they will not access loans from such institutions. Therefore, in applying Pred’s Behavioural Matrix, it was pointed out that these people were not going to make rational decisions by going for bank loans at lower interest rates because they had inadequate and poor quality information.

In a research conducted to assess the reproductive health decision making among Ghanaian women by Darteh, Doku and Esia-Donkoh (2014), the behavioural matrix was used. The study sought to examine the factors that influence women’s decision making in sexual and reproduction health issues. The decision-making process was linked to information availability and the social characteristics of the women. They concluded that age, region of residence, level of education, ethnicity and wealth were found to be associated with Ghanaian women's decision to engage in sexual intercourse and condom use.

Resource dependence theory (RDT) has been used to study resource distribution and dependencies in organisations. A study by Kassinis and Vafeas (2006) on "Stakeholder pressures and environmental performance" in the United State of America (USA), resource dependence theory (RDT) was used to examine how stakeholders pressure could influence firms decision making processes to improve on their environmental performance. They specifically studied the linkage between the internal heterogeneity of community and regulatory stakeholder groups and the resource dependence dynamics that describes their relationship with firms. They then tested empirically if the heterogeneity had any relationship to the environmental performance of firms. They predicted an inverse relationship between pressures from community stakeholder groups and toxic emission levels of firms, using data from 5,033 chemicals, primary metals, and electric utility plants which were known to be most polluting industrial plants.

They used the level of toxic substances emitted into the environment as the dependent variable to check for environmental performance and stakeholder pressures facing the plant or firm and the resource dependence dynamics characterizing the relationship between these plants and their environments as independent variables. They argued that stakeholder pressure may come from the geographical location of the industrial plant and the origin of industrial plant. They were of the view that the community capacity to pressure firms should be based on the community income, community population density, and community environmental preferences. Correlational analysis was conducted to give an indication of the nature of the relationship between stakeholder pressure variables and environmental performance. Since the pressures to be studied were from different levels of proximity to a plant, and also factors specific to each plant, they used hierarchical linear modelling (HLM) to estimate the relationships between toxic releases and stakeholder pressures.

To capture community stakeholder, community income was used by estimating the per capita income in the county where an industrial plant was located to help also capture heterogeneity in the capacity of the stakeholder groups to influence organizational outcomes. The population density in the county where an industrial plant was located was measured as the number of county inhabitants per square mile. However, community pressures associated with community environmental preferences were measured using the number of community members belonging to a major national environmental and conservation organisations and are regularly paying their dues towards the work of the union. Regulatory stakeholders' pressures from the government were measured in two ways, as the environmental voting records of the nationally elected officials from the zone where the industrial plant was located (Kassinis & Vafeas, 2002) and as the amount of budgetary allocation for environmental issues. As discussed earlier, budgets and staff can serve as measures of stakeholder power (Carroll, 1989; Frooman, 1999). In this case information on state budgets and employment was used to measure a state's resource allocation for environmental issues.

The results of correlational analysis indicated significant but negative correlations between pollution levels and the following stakeholder variables: per capita income in the county where a plant is located; county population density; membership of state residents in environmental organizations; congressional district voting record in support of environmental issues; and the fraction of state employees working on environmental affairs. Furthermore, it was reported that plants and utilities which were publicly owned released the highest toxics. They also recorded high significant positive pairwise correlations among the measures of stakeholder pressures, implying that these measures partly captured overlapping effects.

The results from the hierarchical linear model showed county-level per capita income is negatively associated with pollution ($t = -4.82$, $p > .01$) and asserted that if wealthy people apply pressure on firms polluting their environment they are likely to get relatively toxic-free environment. The results of the densely populated community also showed an influence on the level of toxic emissions into the environment by the firms ($t = -2.53$, $p >.02$). Implying that densely populated communities recognising the risk status are more likely to mobilize and influence firm environmental decisions, directly or indirectly. They finally reported that the stronger pro-environment community pressures the lower the level of toxic emissions from firms or plants in the community ($t = -3.45$, $p >.01$).

On the other hand, the results of district voting records and toxic emission did not show any significant relationship. It was found that state environmental spending was positively related to plant toxic emissions ($t = 2.75$). They indicated that the possible reason for such relationship may be explained as state respond to greater pollution and worsening environmental quality by allocating more funds for the environment, to be able to better regulate polluting manufacturing activities (Greenstone, 2002) or for remedial action. The last measure of stakeholder pressures captured by the fraction of state employees working for environmental agencies did not show any relationship to toxic releases. The control variable (plant ownership as public or private) was positively related ($t = 11.63$, $p > .01$), confirming the assertion that plants embedded in larger structures (such as publicly owned) are likely to pollute more. Additionally, the finding was consistent with resource dependence theory, suggesting that plants which have access to their parent firms' resources have relatively little incentive to respond to stakeholder pressures.

They concluded that resource dependencies of organizations vary within stakeholder groups and that intra-group stakeholder pressures are heterogeneous and associated with different levels of environmental performance. They also indicated that their findings confirm the notion that managers recognize the inherent heterogeneity of stakeholder groups, and the stakeholders' varying capacity to pressure plants, so managers respond accordingly in shaping organizational policies towards the natural environment. They recommended a number of areas for future research, two of which are important to this work are: (1) a study of the financial costs and benefits associated with stakeholder pressures to explore if organizations facing greater stakeholder pressures with stricter environmental standards, become more efficient or under-perform; and (2) explore intragroup stakeholder heterogeneity and the specific resource dependence pathways associated with it.

The article was well articulated and addressed all the objectives set out in the study. The methodology was very robust. Despite the fact that they did not use firm-level data, the results were very insightful for studying organisation resource dependence and environmental performance. The statistical analyses used were solid to give the possible relationships of the studied variables. However, the measures used for measuring the regulatory stakeholder pressures by using congressional voting records and environmental preferences was not appropriate, hence no relationship, as rightly acknowledged by the authors. To cure this inadequacy, the authors proposed that a future study should consider how legislators vote on environmental issues. This may be better in predicting the relationship elsewhere but not in an environment where every decision is based on political interest. Moreover, voting on environmental issues is likely to be influenced by the environmental perception and professional background of the legislator. Instead, it could have been well captured by considering the involvement of the legislature in environmental or conservational activities aimed at abating environmental pollution.

Rao, Brown and Perkins (2007) studied “host Country Resource Availability and Information System Control Mechanisms in Multinational Corporations: An Empirical Test of Resource Dependence Theory. The central argument of the paper was that the resource-control-dependence scenario extends to the case of intra-organizational control and coordination in Multinationals Corporations (MNCs). They empirically examined the validity of RDT as applied in Information System (IS) management in MNCs, the relationship between the level of control and coordination (formal and informal) and strategic relationship using key variables in the RDT as resources, dependence and strategic role.

They operationalised the strategic relationship variables as follow: (1) Resources as the required hardware, software, vendor support, IS resources and IS personnel available to a subsidiary in the host country; (2) Part a subsidiary plays as a provider of goods, services, or information to other peer subsidiaries in the MNC and (3) The extent to which a foreign subsidiary relies on the MNC headquarters for necessary IS resources. The level of control and coordination variables which were formal and informal were operationalised as, the level of usage of planning and standardization mechanisms imposed by the corporate headquarters and the level of use of coordination mechanisms such as personal contact, manager transfers, committees, task forces, conferences, and centralized training respectively.

The study utilizes a linked-pair design in which a valid data point is defined as matched data collected from the headquarters of an MNC and from one of its subsidiary units. Two sets of different questionnaires were used after receiving input from panel experts, revised and pre-tested before mailing to the randomly selected MNCs. survey. The final sample included responses from 54 headquarter-subsidiary surveys from 19 countries across six continents and a diversity of industries. Canonical correlation analysis was conducted using the two coordination variables (formal and informal) as predictors of the three independent variables (dependence, resource, and strategic role).

The results of the standardized canonical coefficients (Rc) for the latent predictor variable showed that all three dimensions (dependence, resource, and strategic role) are important contributors to the strategic relationship composite. More so, formal and informal criterion variables were found to contributing to the level of control and coordination composite. The squared structure coefficient (Rs^2) showed the variance in explaining strategic relationship as dependence (30.7), strategic role (26.4) and resource (8.9 %). To their surprise, both “formal” and “informal” variables explained the variance in the level of coordination with 66.2 per cent and 90.2 per cent respectively. The results of multiple regression analysis indicated that the level of usage of formal mechanisms of control and coordination is strongly correlated to dependence and moderately so with the strategic role ($p = 0.061$). There was no significant relationship between a resource and formal control and coordination as well as the strategic role and informal control and coordination. However, a highly significant relationship was found between dependence and informal while resource was also strongly related.

The finding from the study seems to suggest that the control and coordination of subsidiary IS operations where the subsidiary has sufficient access to the necessary IS resources in the country of operation should be done using informal mechanisms, instead of the hard formal mechanism of control. This is certainly true because once the resources are available they can do a lot of things and therefore informal control becomes more appropriate. They argued that RDT does not address power balance and mutual dependence which is really true as this fact was pointed to by Casciaro and Piskorski (2005) that the RDT favours power imbalance situations. The moderate significant relationship found between a subsidiary unit's strategic role and the use of formal controls and coordination implies that MNCs depend on the use of standardization to force a particular subsidiary behaviour, especially those units considered to be critical to global operations. They concluded that even though the RDT well-explained dependence, the expected relationship with IS resource availability was not observed. Although there was a significant relationship with the use of informal mechanisms of control and coordination, it was in the opposite direction to what was expected.

Wells and Kipnis (2001) also applied the resources dependence theory (RDT) to study managerial dependence on subordinates based on the relevance of the subordinates' contributions (e.g., responsibility level, job complexity) and identified a positive relation between managerial dependence and control. A positive relation between dependence and trust was identified since actors develop trust in high-dependence relationships to avoid psychological discomfort and possibly entrench their power on the subordinate.

The resources dependence theory is very important for the study of healthcare waste management in that, the appropriate handling and management cannot be achieved without resources of all kinds. The availability of the right human and financial resource for handling the various aspect of the healthcare waste management is important (Bamfo-Tanor & Owusu-Agyei, 2013). The infrastructure and technology for managing healthcare waste within hospital facilities depend on the availability of financial resources to procure and maintain them. The hospital administration depends on government and charges from services rendered to patients. The environmental health units in the hospital also depend on the hospital administration for resources to be able to properly plan and manage the generated healthcare waste. Any resources constraint will lead to a setback in the proper handling and management of healthcare waste. The resources dependency theory, therefore, help in understanding the resource dependency within the hospitals.

Healthcare Solid Waste Treatment Technologies

Treatment of healthcare waste cannot be overemphasised due to its potential to pose health risks to people and the environment through contamination of air, soil and water resources. Management processes and practices should, therefore, incorporate technically feasible and economically viable treatment technologies that are environmentally friendly and conform to best environmental practice. There are many treatment technologies available for healthcare wastes (Emmanuel, 2007) and developing countries can adapt the ones that are appropriate to their conditions (Abah & Ohimain, 2011). These technologies are broadly categorised based on their processes of operation as thermal, chemical, irradiation, biological and mechanical treatment processes (WHO, 2013b). Any of these options can be employed to treat the 10 -25% component of the healthcare waste which is hazardous and infectious if proper segregation is achieved through staff training, clearly established standards and enforcement of regulations (WHO, 2013; Run-dong, Yong-feng, Raninger & Lei, 2006).

Healthcare waste treatment based on chemical treatment methods utilises disinfectants such as dissolved chlorine dioxide, bleach (sodium hypochlorite), peracetic acid, lime solution, ozone gas or dry inorganic chemicals (e.g. calcium oxide powder) to disinfect the waste (WHO, 2013; UNEP, 2012). This method includes chemical disinfection and alkaline hydrolysis or digestion with alkali. Chemical disinfection only inactivates micro-organisms and therefore, effective for treating blood or fluid and stained waste whilst alkaline hydrolysis uses heated alkali to digest body tissues such as pathological and anatomical waste. The time for digestion ranges between six to eight hours depending on the amount of alkali and temperature used (Thacker, 2004). The chemical disinfection works well if the waste is properly shredded, or mixed to increase exposure of the waste to the chemical agent. These disinfectants are corrosive and irritant which require effective use of personal protective equipment and maximum precautions to avoid direct exposure (UNEP, 2012; Emmanuel, 2001).

Irradiation treatment designs uses irradiation from electron beams, cobalt-60 or ultraviolet sources in a shielded environment to prevent elevated occupational exposure to electromagnetic radiations. This technology has been used to supplement other treatment options and pathogen destruction efficacy depends on the dose absorbed by the mass of waste (UNEP, 2012; Emmanuel, 2001). The biological treatment occurs in natural living organisms and in this instance it refers to the degradation of organic matter components of healthcare waste. Biological treatment systems may use enzymes to speed up the destruction of organic waste containing pathogens, composting and worms (vermiculture) to digest placenta waste (Mathur, Verma & Srivastava, 2006). In other cultures, natural decomposition of pathological waste occurs through land burial.

Mechanical treatment processes are physical processes such as shredding, grinding, mixing and compaction technologies which reduce the volume of waste but do not destroy pathogens (UNEP, 2012). In most cases, they are used to supplement other treatment methods such as low heat thermal and chemical treatments. To reduce the risk of pathogenic infection among worker of the mechanic plant, the shredders, mixers and other mechanical devices should be an integral part of a closed treatment system (WHO, 2013b). All these treatment technologies apart from incineration but including low-heat thermal, chemical, irradiative and biological processes have been collectively called non-incineration treatment technologies (Mathur et al., 2012).

According to WHO (2013), thermal treatment technology works on the principle of disinfection of the waste to destroy any pathogenic, infectious micro-organisms. Run-dong et al. (2006) indicated that apart from making pathogens inactive, thermal treatment also partially decomposes toxic organic and hazardous substances in the waste. It has been said that the thermal treatment options have been used widely across the world (WHO, 2013; UNEP, 2012; Salkin, Krisiunas & Turnberg, 2000). Thermal treatment technologies have been grouped into low-heat and high heat treatment designs. As indicated by United Nations Environmental Programme [UNEP] (2012), the high heat technologies include incineration and pyrolysis and gasification designs normally operated above temperatures of 180 ºC but functions well above 850 ºC. However, the low heat thermal technologies are operated within the temperatures of 100 ºC to 180 ºC and are subdivided into wet and dry systems (e.g. microwave, autoclaves, etc.) (UNEP, 2012; Emmanuel, 2001).

There are various designs and models of the incinerators used in various settings for handling municipal and hazardous waste. For optimal environmental requirement, an incinerator should have a combustion chamber (primary), a post-combustion chamber (secondary), air pollution control devices to meet national and international standards for pollutant emissions, a wastewater treatment system if a wet system is used for flue gas cleaning and a stack that is 2.5 times the height of the highest nearby structure (UNEP, 2012). Furthermore, a waste feed system that is able to prevent temperature drops in the primary chamber during feeding of waste, and an ash collection system to prevent dispersion of hazardous incinerator ash are required. The most commonly applied models are the dual-chamber controlled-air incinerators, multiple chamber incinerators, and rotary kilns (WHO, 2013a).

Incineration technology is said to be the old and most widely applied treatment options employed for healthcare waste management globally (Salkin Krisiunas, & Turnberg, 2000). This is based on the fact that incineration treatment can hygienize the waste and reduce the mass and volume of waste by 80-90% (UNEP, 2012; Run-dong et al., 2006; Batterman, 2004). In fact, Run-dong et al. (2006) indicated that the incineration is favourable treatment option because it does not require pre-treatment, no stringent separation is required, no initial grinding of feedstock is necessary and heat energy can be harnessed for energy production from large installations. According to Mathur, Patan and Shobhawat (2012), combustion in incinerators can be oil-fired or electrically powered or a combination of them to support the combustion process in situations where the calorific value of the waste is low. They indicated that multiple hearths, rotary kiln and controlled air types of incinerators with primary and secondary chambers to ensure optimal combustion are broadly used for hospital waste treatment.

Many concerns have emerged from the use of incineration technology from environmental and public health perspectives. From environmental scale, the release of various gases and particulate matter into the atmosphere and the generation of hazardous residues as by-products of the combustion are the major worry about incineration. According to UNEP (2012), combustion of healthcare waste produces gaseous emissions, including steam, carbon dioxide, nitrogen oxides and a range of volatile substances, particulate matter, plus solid residues in the form of ashes. Production of dioxins and furans from low technology incinerators have been a major concern and have contributed to the huge objection and stringent environmental standards (Knox, 2005; Lee, Ellenbecker & Moure-Ersaso, 2004; Emmanuel, 2001). However, Run-dong et al. (2006) pointed to high investment and operational costs and the negative impact on the environment as the major setback of the technology given way for non-incineration alternatives.

From a public health perspective, it has been argued that establishing a clear link between emission from incinerators and health effects are generally difficult since people are exposed to various pollutants from multiple sources. Nevertheless, some studies have found some relationship between people residing near incineration sites and cancer development (Emmanuel, 2007). Franchini, Rial, Buiatti and Bianchi (2004) reported from a literature review study that most of the papers reported positive associations for congenital malformations and residence near incinerators. Studies in the United Kingdom by Knox (2000) found an increased risk of childhood cancer, childhood leukemia, and solid tumors of all kinds among children living near incinerators. More so, Batterman (2004) reported that emissions of toxic and persistent compounds from small incinerators may result in human exposure at levels associated with adverse health risks.

According to Pickens (2007) and Gulyurt (2012), the ‘De Montfort’ incinerators were developed by the De Montfort University Innovation Technology Center (Leicester, UK) to provide a cheap but effective healthcare wastes treatment for developing countries. Picken (2007) indicated that the initial design of the incinerator was called “mark 1” and has been built in many African countries through the support of WHO, UNICEF and national governments, but the technology has been modified to the current “Mark 9” designs. Batterman (2004) intimated that the technology is preferred to open burning of healthcare waste. Adama (2003) reported that about 44 De Montfort type incinerators were constructed in 2002 in Kenya and 13 in Tanzania between 2001 and 2003. However, Agenda for Environment and Responsible Development (2009) and Batterman (2004) reported broken incinerators, poor siting, poor standard of operation, maintenance and management of incinerators in many African countries.

The low heat thermal treatment options of the thermal technology have become more attractive than the incineration counterpart. The autoclaves have been said to be capable of treating a range of infectious waste, using steam heat penetration at a specified pressure in a closed vessel for a specified time (UNEP, 2012; Emmanuel, 2001). Autoclaves have been used for more than a century to sterilize medical instruments, and for several years they have been adapted for the treatment of infectious waste (Salkin et al., 2000). This can treat healthcare waste such as cultures and stocks, sharps, materials contaminated with blood and limited amounts of fluids, isolation and surgery waste, laboratory waste, gauze, bandages, drapes, gowns and bedding from patient care (WHO, 2013; Salkin et al., 2000). Removal of air from the autoclave is essential to ensure penetration of heat into the waste. Unlike instrument sterilization autoclaves, waste-treatment autoclaves must treat the air that is removed at the start of the process to prevent the release of pathogenic aerosols (UNEP, 2012).

Other types of autoclaves have been designed with integration of mechanical treatment systems to improve the transfer of heat into the waste for effective treatment (WHO, 2013b). The mechanical processes can be before, during or after steam treatment in the autoclave. These continuous systems have been referred to as advanced autoclaves, hybrid autoclaves or advanced steam treatment technologies (Emmanuel, 2001; Emmanuel & Stringer, 2007). Microwave technology has also been used in healthcare waste management as low heat thermal technology. This technology ranges from medium- to large-scale, semi-continuous system using an internal shredder, rotating auger, and industrial magnetrons (Emmanuel, 2007). Microwave technology uses dry heat, higher exposure time-temperature parameters in order to meet minimum disinfection levels as compared to the moist heat systems (UNEP, 2012).

Types of Hospital Solid Waste Disposal Sites

Disposal of wastes of all kinds is an inevitable venture in waste management despite the numerous advanced treatment technologies (as discussed above) currently available to the global world. Hazardous waste such as health care waste cannot be exempted when discussing safe management and disposal of waste. The most common of all the disposal methods traditionally practised across the world is the disposal of waste on land (Komilis, Ham, & Stegmann, 1999). Most engineers and literature available discuss three types of landfills as being an integral part of most solid waste systems. These are the open dump, the semi-controlled/controlled landfill, and the sanitary/engineered landfill (ISWA, 2015; Remigios, 2010). These types of dumping have been explained and described to bring into proper perspective their advantages and disadvantages to the environment and public health.

Open dump is an unplanned "landfill" where dumping of waste is done in depressions, excavations or on bare soil of the land. Normally this type of dump site does not have leachate control and access control systems in place, no covering of waste after dumping, no proper management of the place and many scavengers freely operate at the site. Controlled dumps have been described to mean a planned landfill that incorporates, to some extent, some of the features of a sanitary landfill. These features include siting considerations with respect to hydro-geological suitability, grading, compaction in some cases, leachate control, partial gas management, regular (not usually daily) cover, access control, basic recordkeeping, and controlled scavenging (ISWA, 2015; UNEP, 2005). According to UNEP (2005), and Davis and Masten, (2004), a sanitary landfill is an engineered method of disposing of solid waste on land, in a manner that meets most of the standard specifications. These standard specifications include sound siting, extensive site preparation, proper leachate and gas management and monitoring, compaction, daily and final cover application, complete access control, and recordkeeping.

It can be generalised that open dumps do not necessarily take into consideration environmental and public health consequences into consideration before their citing and during their operation period. The controlled dumps are the intermediate between the open dumps and the sanitary landfills. Sanitary landfills are therefore the engineered dumping facilities that take into consideration the environmental and public health effects of waste management and put in measures to appropriately address or mitigate these effects on the environment and health. Oyaro, (2003) argued that sanitary landfills are costly to construct and most developing countries cannot afford them unless they get external funding support. That is rightly so, but the environmental and public health effects of operating an open or controlled dump may be so costly and devastating to cope with by the developing countries. Zurbrugg, (2003) rightly indicated that inadequate waste disposal translates into economic and other welfare losses. Construction of sanitary facilities to accommodate health care waste should be given priority by developing countries to help contribute to sound environmental management and reduced morbidity and mortality.

Unfortunately, the general situation as assessed by AERD (2009) in Africa is that dumping of untreated HCW is practiced in many countries due to unavailability of treatment facilities as well as the frequent breakdown of incinerators. They found that such dumping is not often controlled as there are no agreed rules of on-site working with scavengers, no fence to secure dumping perimeter and in most cases no soil to cover the waste dumped in the site. Many municipalities also lack necessary equipment that can make provision for burying waste on-site. For Ghana, it was reported that disposal at the municipal dumping sites is the most common method employed in the disposal of solid waste i.e. infectious, general, and pharmaceutical and in some cases sharps. Most of these dumping grounds were not engineered to serve as sanitary landfill sites, hence it constitutes a high potential for the spread of infections through runoffs during rains and contamination of underground water (AERD, 2009).

Imam, Mohammed, Wilson, & Cheeseman(2008) reported that by 2007, Abuja, the capital city of Nigeria, did not have sanitary landfills for waste disposal, and all solid waste from the formal collection in the various districts were transported to a single site at Mpape. In Botswana it was said that over 175 waste disposal sites existed throughout the country, only two of them were properly engineered landfills and one of them has been reduced to an ordinary waste dump site due to poor management and maintenance (Simon and Phatshwe in Gwebu, 2003). The situation is not so different from Ghana's case. Currently, the country is operating four engineered landfills which are located in Tamale, Takoradi, Kumasi, and Tema. Managers of these sites are under critical stress due to the huge volume of unsegregated waste they receive every day and lack of funds to comply with proper and efficient landfill operation and management protocols. All other places are either operating open dumps or controlled landfills across the country. Most of these dumping sites are receiving waste from hospitals which presents a major threat to the environment and public health.

Files, Allen and Criner (2002) indicated that the healthcare waste management policy in Marie requires that shredding of biomedical waste to make it unrecognizable. This provides an indication that the waste has been treated and reduces the potential for anxiety over the presence of intact biomedical waste in public landfills. The healthcare policy of Ghana, however, does not promote such stand but indicate that hospitals with constraint to proper waste collection services should consider the principle of proximity. This is when hospital waste is dumped on the premises of the hospital to reduce possible spreading of cross infection through transportation of healthcare waste (MoH, 2006). Shredding of treated waste before disposal is a positive policy posture to show commitment to infection prevention through reuse of such health care waste. Pawel, Roshan, and Radhakrishnan, (1999) indicated some hospital waste such as papers can be recycled. In fact, shredding of treated hospital waste such as plastics, papers or metal and sometimes glasses can be used by recycling companies for producing other products to conserve natural resource.

Specific case Studies on Healthcare Waste Management

Research on healthcare waste management has recently gathered momentum in various parts of the world. In Ghana, Wilson et al. (2006) conducted a study on “management of medical waste from teaching hospitals in Ghana”, with the intention of setting the bases for effective medical waste management in developing countries. Interviews and observations were used in the data collection. They identified various challenges with the healthcare waste management in the two most prestigious teaching hospitals to include the inadequate or unavailable record on waste generation, non- separation of waste and compliance to colour code system was a challenge. They also found that sharps such as needles, blades, etc. were either buried or disposed of at the landfill site except those to be reused for surgical operations which are sterilised using autoclaves. They discovered that apart from pathological waste all other medical wastes were not properly disposed of.

They found that healthcare waste management in the two teaching hospitals has been privatised for collection, transportation, and disposal. The contract was supervised by the two Metropolitan Assemblies in which the hospitals are located. They reported that disposal at the landfill was not done in a specialised cell, no covering, no records kept at the disposal site and scavengers were not controlled at the site. Stakeholders like EPA and the Metropolitan Assemblies did nothing to check the practices. They recommended the need for a national law to regulate the management of healthcare waste and public health to be passed and enforced.

In a study by Alagoz and Kocasoy (2008) in Istanbul to determine the best practices for healthcare waste management, a mixed method approach was used. The study involved about 401 clinics and 197 hospitals registered with the responsible State agency. The study results indicated that private hospitals generated less waste and practised good segregation than the public. They indicated neglect of healthcare waste management among top management members, head nurses and other unit managers. This was attributed to their insufficient knowledge about the significance of the subject and their lack of interest.

They found that there were no persons assigned with the responsibility of managing healthcare wastes in the hospitals. Low budgetary allocation affected the number of staff employed for waste management and their capacities to perform the assigned roles. Training of personnel in waste management was lacking, tools and equipment for managing the waste within the hospitals were not adequately supplied. High treatment cost for the separated waste, non-availability of resources for waste separation created the opportunity for mixing the waste with domestic waste which increased workers risk in contracting infections. Workers usage of personal protective equipment was low partly due to lack of appreciation of the health implications and the irregular supply of the same. These contributed immensely to the institutions' inability to comply with the national regulation on healthcare waste management.

A cross-sectional survey which was conducted by Debere et al. (2013) focused on assessing the healthcare waste generation rates and its management system in six selected hospitals with different capacities in Addis Ababa, Ethiopia. The study involved different types of hospitals with different bed capacities as Amanuel hospital, Zewditu hospital, Gandhi memorial hospital, Hayat hospital, Bethezata hospital and Saint Yared hospital were 260, 215, 112, 70, 64 and 30 respectively. Descriptive statistics were used to report the results on evaluation of hospital waste management system.

The findings indicated that the hospitals surveyed did not adhere to any colour coding for storing the waste, no segregation was practised for infectious, pathological and pharmaceutical waste except one hospital. Sharps were kept in specialised puncture proof boxes, almost all the hospitals mixed the non-hazardous waste with the infectious waste and collection from generation points to temporary storage point was done by waste handlers. They further reported that one of the hospitals stored the waste in the temporary area for about a month and another two weeks before collection to final disposal site whiles three of them collected to disposal site daily.

On treatment technology, it was found that all the hospitals had incinerators for treating their waste but one was not working and others had defects on their chimneys. No pre-treatment was done for infectious laboratory waste in all the hospitals except Zewditu and Gandhi hospitals which disinfected sharp waste after use. Two of the hospitals disposed of their untreated waste off-site at insanitary landfill site through open dumping. Waste handlers were found to be using personal protective equipment such as disposable hand gloves, goggles, nose mask, and aprons.

In India, a cross-sectional study was conducted in a dental hospital by Sharma, Sharma, Sharma, & Singh (2013) to determine the awareness of staff about biomedical waste management policy and practices, attitude towards biomedical waste management and prevalence of needle-stick injury. The study utilised closed-ended questionnaire which was distributed to 144 out of 200 staff including dentists (50), nurses (52), laboratory technicians' (20) and 22 Class IV employees (cleaners and maintenance personnel) all at Jaipur Dental College. The results indicated that the staff had poor knowledge and awareness about the hazards associated with biomedical waste, legislation and management. There was poor awareness among the nurses (36%) about biomedical waste management practices which was similar to, Dentist, Laboratory Technicians and Class IV employees (35% each).

The study also showed that 41 (29%) of the respondents agreed to the fact that safe management of healthcare waste was not an issue at all whereas 57 (41%) disagreed and 42 (30%) did not comment. Ninety-one (65%) of the staff agreed that waste management requires teamwork and no single team member is responsible. Safe management efforts by hospital staff were considered to be an extra work burden and 70 (50%) respondents agreed that it increased the financial burden on management. From the study, 50 per cent of the Class IV employees, 5 per cent of the dentists and 2 per cent of the nursing staff have had needle-stick injury experience. The study concluded that the level of knowledge and awareness about biomedical waste hazards, legislation, and management among healthcare personnel in Jaipur Dental College were poor. Regular monitoring and training for all levels of staff for better appreciation of healthcare waste management for public and environmental safety were recommended.

The study did not consider the social demography of the respondent which is likely to influence their awareness towards biomedical waste legislation, hazards, and management practices. The sampling approach for the study was not stated as well as how the sampling size was arrived at. Treating dentist doctors, nurses on an equal platform may not be a fair analysis of the situation. If dentist and other professionals have the excellent knowledge it is not surprising because their information and capacity may be different and therefore their ability to comprehend issues will not be the same. The study did not consider any theoretical framework underpinning the study. In some cases, the nurses scored poorly because their numbers were more than all the other professionals that participated in the study

A research was conducted in Ghana by Bamfo-Tanor and Owusu-Agyei (2013) on healthcare waste management in Ghana, the case of Accra and Tema aimed at identifying the gaps in healthcare waste management practices to inform proactive solutions relevant to the socio-economic conditions of the country. This study recognised the importance of human ecology concept in relation to healthcare waste management. The study used primary data collected through structured questionnaire and direct observations as well as secondary data from the relevant literature. Five healthcare facilities in Accra and Tema (Korle-Bu Teaching Hospital, Legon University Hospital, Police Hospital, Tema general hospital and Nyaho Clinic) were used for the study of which four were public and one was privately owned.

The hospitals were selected based on the levels as a national or local clinic and operated by different administrative setup. The data collection instrument was pre-tested in Korle-Bu which was part of the studied hospitals. The authors randomly selected 34 departments in total for interviews and observations. About 84 questionnaires were administered and 73 responses were received of which 46 were medical staff, 17 were waste handlers and 10 were administrators/waste management officers. Consultations were held among stakeholders like Ghana Atomic Energy Commission, Environmental Protection Agency and Waste Management Departments of Tema and Accra Metropolitan Assemblies.

They found that the hospitals were not keeping records of the quantities of waste generated and the cost of healthcare waste management. It was only Korle-Bu that kept records for waste management services. They found that 68 percent of medical and laboratory staff and 29 percent of the waste handlers were aware of the risk associated with poor management of healthcare waste. On training, they found that only 20 percent of the medical/laboratory staff and 18 percent of the waste handlers have been trained after employment, implying low training of healthcare staff. On the use of personal protective equipment (PPE), it was found that 61 percent of the medical and laboratory staff and only 18 percent of the waste handlers used them. Hand washing and disinfection practices as a hygiene measure was low with 26 percent of the medical staff washing and disinfecting their hands, 52 percent washed without disinfection and 70 percent of the waste handlers washed their hands without disinfection.

The study concluded that healthcare waste management in Ghana has been done without the appropriate and adequate infrastructure, finance, technical capacity and the required legal instrument. Workers were not adequately trained and motivated on issues of healthcare waste management. The security and safety of workers from the point of generation of the waste to the disposal were poor. They recommended high awareness creation on the subject by all stakeholders to safeguard the life of the current generation and the future as contained in the concepts of sustainable development.

The use of human ecology concept is a plausible gesture in trying to link the healthcare waste management practices to human and the natural environment but did not feature in the discussion and conclusion of the thesis. The inclusion of other stakeholders in this case was a very important point since healthcare waste management requires a concerted effort from all stakeholders. The methodology lacks some technical details for instance sampling method used for the selection of respondents; the total number of staff in each hospital and the selected departments were not specified. The basis for using 84 respondents, use Korle-Bu for pre-testing of the questionnaires were not stated. It was not clear if only questionnaire was used for the data collection. The study did not bring to bear the reasons for using different healthcare facilities in the results and discussion sections.

Conceptual Framework for the Study

From the ensuing discussions, it can be conceptualised that for efficient hospital solid waste management to be practised there is the need for stakeholders to perform specified functions as shown in Figure 5. The NATIO Functional framework is proposed to be used for planning and undertaking healthcare waste management activities. The "national function" is to set out the legal and regulatory regimes that can be enforced to ensure best hospital waste management practices. Where there is no legal framework, people, organisations, and stakeholders are left to do what they want and such situations are dangerous for proper environmental management. It is also required to establish an agency or authority with the requisite capacity to enforce the instituted legal regimes and subsequent ones to be developed. This institution should operate freely without any state interference to enforce, monitor and supervise the health facilities to comply with the existing laws.

The Administrative functions are more or less internal work where the managers of the hospital have to perform specified functions that will lead or contribute to the efficient management of the hospital waste. They have to develop policy and plan for managing the waste with respect to their peculiar conditions to conform to the national legal regime. Managers have the responsibility to plan and regularly scheduled training for the hospital staff on waste management practices required by the hospital as specified in the hospitals' policy framework. Safety awareness creation among staff and provision of relevant information on healthcare waste management through formal training (capacity building) and poster communications should all be integrated.

As part of the internal functions, the hospital needs to have a responsible person for waste management and its related activities and possibly a committee to advice on what needs to be done. Institutional linkages with both private and public sector actors need to be well developed and consolidated to ensure complimentary roles in delivering of efficient solid waste management services. Internal control and coordination between the departments and units should be well strengthened to ensure that all the staff have their roles clearly spelt out for safe management of healthcare waste. Provision of all the required resources for healthcare waste management should be prioritised at the management level. This should inform the need for allocating funds purposely for hospital waste management activities that are devoid of competition from the curative or other functions of the hospital. This fund can be used for procurements of waste related equipment and tools, repair and maintenance of waste equipment, etc. in the hospital.

The technical function is the main practices that need to be done by the assigned persons and all staff that have something to do with waste generation and management. The provision of storage facilities with the right colour codes, collection scheme, and transportation arrangement need to be well specified and implemented. The choice of treatment technology that responds to the need of the hospital taking into cognisance the national and possibly international laws need to be made by the technical staff and stakeholders. The effective operation and maintenance of the system need to be done regularly by the right staff. The staff should have the right capacity to operate the facility and sufficient knowledge in environmental management. Acquired knowledge through organised training and mentoring sections needs to be demonstrated at this functional level.

Individuals are those who work in the healthcare facilities that perform various roles for the facility to achieve its main goals. The healthcare facility has to build the capacities of these individuals to perform efficiently to enhance the common good of the institution and the society. This notwithstanding, the individual should be ready to learn new things and innovatively apply the acquired knowledge and skills to improve their performance. The willingness of the individuals to be trained and mentored as well as readiness to change bad and old behaviour for recommended and acceptable behaviour are fundamental to the success of healthcare waste management. Stigmatisation of lower staff can instigate hatred and avoidable conflicts.

The output function indicates the results of the implementation of the other functions in the framework. If the National, Administrative, Technical and Individual functions are present and implementation is well done the output should be positive. The positive output should contribute to the reduction in occupational accidents, high morbidity and mortality rate among hospital staff and the general public, reduced the threat to public health and environmental pollution from the management of healthcare waste activities. This implies that the effects of improper hospital waste management will be curtailed whiles failure will aggravate the disease outbreak situation.

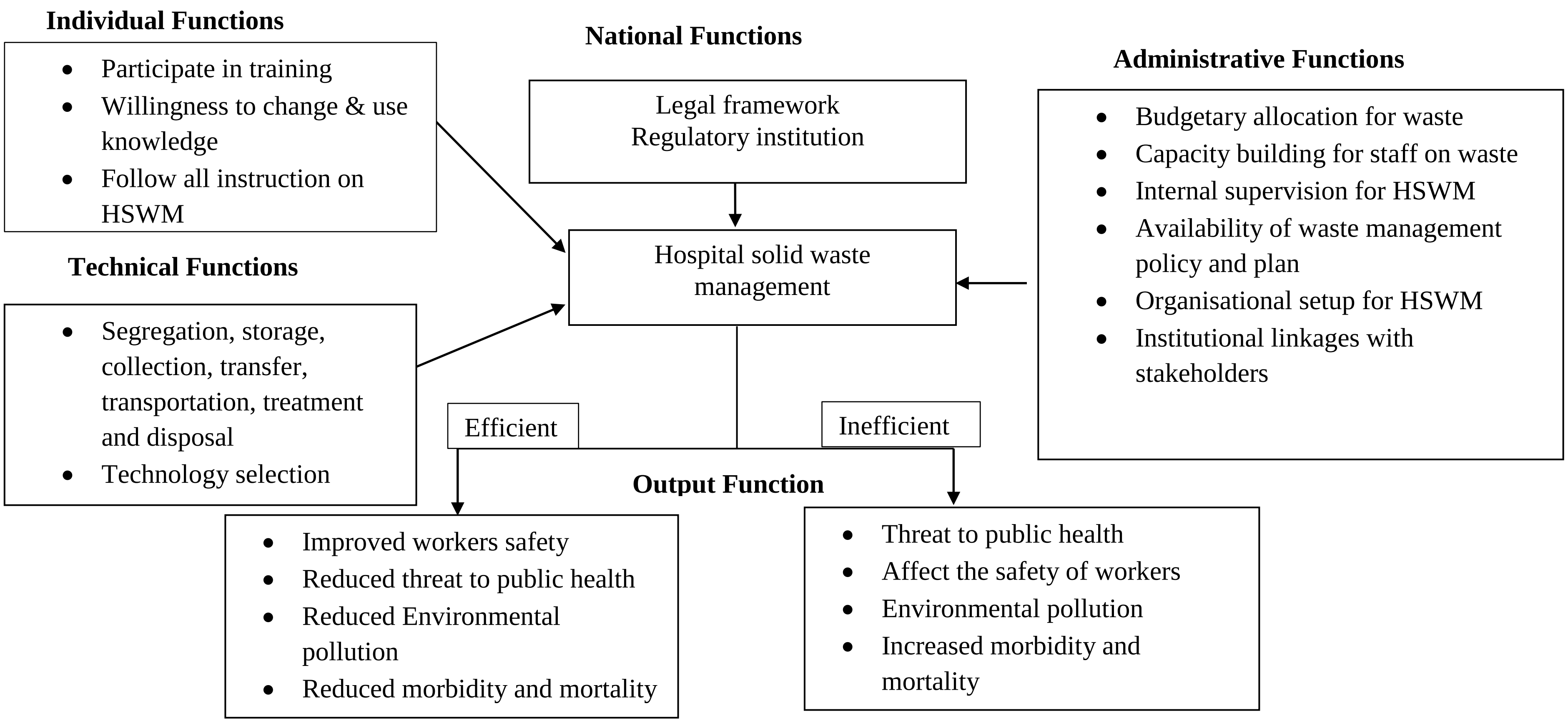

Figure 5: Functional concept for efficient hospital solid waste management (HSWM) adapted from ISWM concept by van de Klundert & Anschütz (2000)

CHAPTER THREE

RESEARCH METHODS

Introduction

A methodology is very crucial in research since it stipulates how the study was conducted to guide others who would like to replicate such studies (Ellis & Levy, 2009).According to Gray (2014), the choice of research methodology is determined by what the researcher believes about the existence of “truth” or “reality” (ontology) and how it can be discovered (epistemology).This will indicate whether the research is inclined towards a positivist, interpretivist, or other perspectives. This chapter is dedicated to deal with the description of the research setting, research approach, study design, data sources, target population, sample size, sampling procedure and data collection instruments used for the study. It captures the tools and methods used for analysing the data gathered. Furthermore, issues on pre-testing of the data collection, ethical issues have been discussed.

Description of Research Setting

The study area is critical for every research process and the kind of information that will be produced to inform decision making. The study was conducted in five selected hospitals in the Eastern region of Ghana. It is, therefore, appropriate to describe the features and some characteristics of the region and the organisational set up of the selected public hospitals. The profiles of the selected healthcare facilities are also described to give a clear overview of the facilities.

Geographical and Demographic Features of the Region

The Region is the sixth largest region with respect to total land area (19,323 kilometres square) and constitutes 8.1 per cent of the total land area of Ghana. It is located between latitudes 6^o and 7^o North and between longitudes 1^{o}30’ West and 0^{o}30’ East (GSS, 2012). The region shares boundaries with the Greater Accra at the south, Central at the west, Ashanti at the north-west, Brong Ahafo at the north-east and Volta Region at the east. There are 15 districts and 6 municipal assemblies in the region with Koforidua as the regional capital. According to Ghana Statistical Service (2012), the region has an estimated population of 2,633,154, which constitutes 10.7 per cent of the total population of Ghana. It is the third highest populated region after Ashanti (19.4%) and Greater Accra (16.3%) regions.

Table 3: *Type and Ownership of Health Facilities in Eastern Region of Ghana*

Type of Health Facilities	Number of facilities
Government Hospitals	17
Mission Hospitals	7
Private Hospitals	7
Government Clinics	88
Missions Clinics	8
Private Clinic/Maternity	62
Government Health Centre	58
Missions Health Centre	4
Polyclinics	1
Private Health Centre	0

Source: Eastern Regional Health Directorate (2014)

Healthcare Issues in the Region

The Eastern Region hosts about 24 hospitals which include the Eastern Regional Hospital, St. Joseph's Orthopaedic Hospital, seven from Christian health associations of Ghana (CHAG institutions) and 17 district or municipal hospitals for the government of Ghana (see Table 3). District or Municipal hospitals serve as the first referral hospital and are responsible for clinical care at the district level. The selected hospitals for this study were located in six different districts and municipalities as shown in Figure 6.

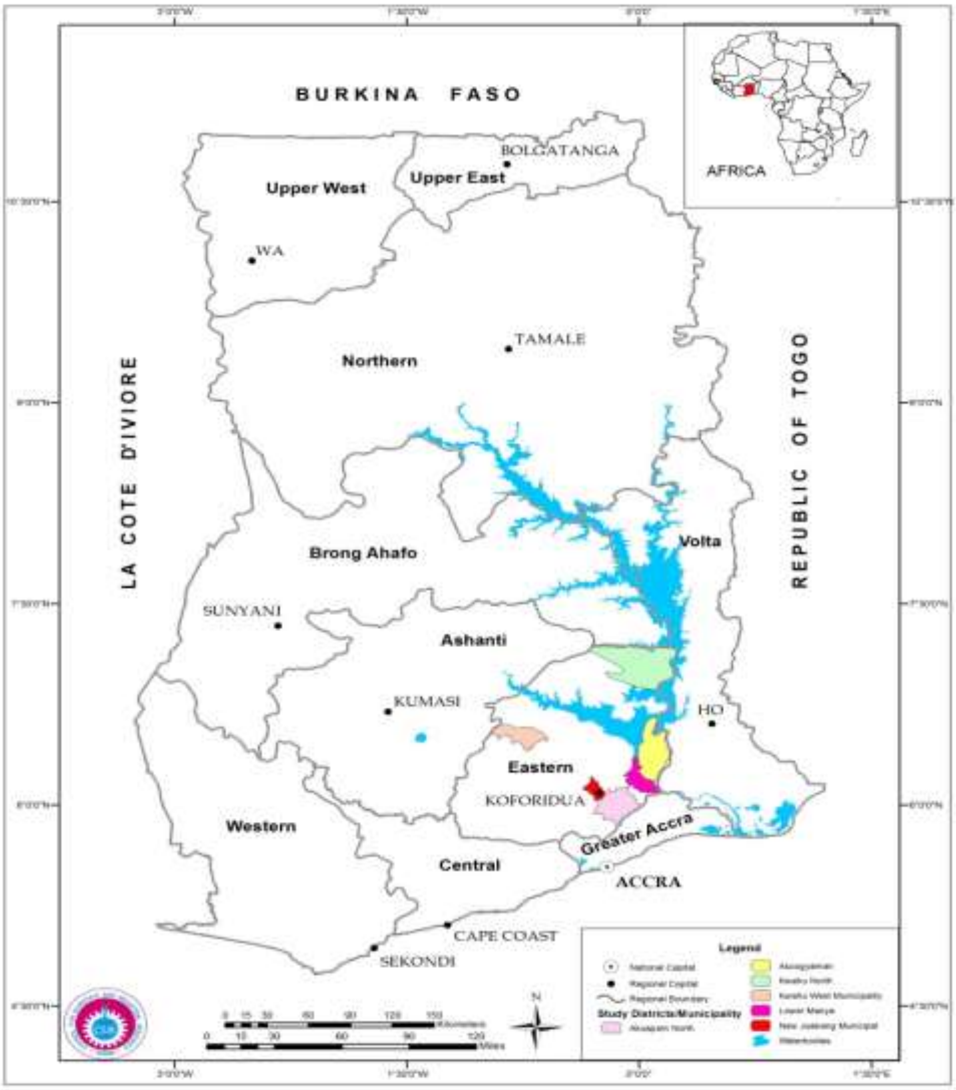

Figure 6: Map of Ghana showing the studied districts

Source: CSIR-INSTI (2016)

Description of Characteristics of Hospitals

Table 4 shows the number of beds and daily OPD attendance at the hospitals. These data give an idea about the number of users visiting the facilities for health care services, nature of services provided and the likely quantities of waste to be generated by each facility.

Table 4: *Characteristics or Profile of the Hospitals Studied*

Name of Hospital	Number of Beds	Bed Occupancy Rate (%)	Average OPD Attendance per day
Regional Hospital, Koforidua	350	65.0	700
Holy Family Hospital, Nkawkaw	211	68.5	270
VRA Hospital, Akosombo	63	66.7	204
Presbyterian Hospital, Donkorkrom	117	46.0	127
Atua Government Hospital, Atua	135	58.0	157
Bryan Lowe Orthopaedic Hospital, Mampong – Akuapem	95	60.0	110

Sources: Field Survey, Amfo-Otu (2015)

Hospital Solid Waste Management in the Region

Healthcare solid waste data for the region is not readily available at the health facility or regional administrative level. Some healthcare facilities have contracted their solid waste management activities to the private sector service providers' whiles others handle their own waste. Most of the hospitals are responsible for their own waste with most of them using De Montfort incinerators for incinerating sharp waste (GHS, 2008). However, using the generation rate of 1.2 kg/bed/day as indicated in EPA guidelines (EPA, 2002) and the bed utilisation rate of 56 percent of the total beds (2,675 beds) in the region (GHS, 2010), the quantity of healthcare solid waste can be estimated at 1,797.6 kg/day (1.8 tons). This will amount to about 657 tons per year, of which about 131 tons (20%) is expected to be hazardous. In situations where the hazardous component is not separated and are mixed with the municipal domestic waste then all the waste will become potentially hazardous.

More so, the most practised solid waste disposal method in most communities in the region is open dump (40.0%) at publicly demarcated dumping sites whilst about 22.8 per cent dumped their waste into communal containers (GSS, 2012). There are no engineered landfill sites in the region, therefore most of the final waste disposal facilities being used are open or controlled dumpsites. Other methods of waste disposal by households include indiscriminate dumping at unauthorised places (10.0%), services from private waste companies (4.1%), open burning (16.2%), burying (5.9%) and others (1.0%).Therefore, disposal of healthcare waste at the municipal or district assembly dumpsite may pose some public and environmental health challenges to the society.

Research Philosophy

Philosophy has played important roles in social academic research (Pring, 2012) to the extent that various ideological wars are perceived to exist among academicians. This is evident in how the entire inquiry is fashioned out, its mechanics and conclusions. At the academic front, two major traditional groups with different epistemology and ontology about reality, nature of knowledge and how to inquire have been identified. These philosophical paradigms are the positivist (positivism) and the interpretivist (interpretivism). These ideologies have opposed each other intensely that no space has been given for a middle ground. The positivist believes in objective reality whilst the interpretivist believes in subjective reality of inquiry. Guba

(1990, p 31) is often quoted to have said that "the one (paradigm) precludes the other just as surely as belief in a round world precludes belief in a flat one". Howe (1988) indicated in the "incompatibility thesis" that positivism and interpretivism are two incompatible paradigms because of the different conceptions about reality-truth, the relationship between the researcher and the object of investigation.

These two groups have dominated the research field with respect to how to make inquiry and the nature of the knowledge so acquired. The positivist philosophy is rooted in empiricism, neutrality in methodology which is deductive (Quantitative). This philosophical group contends that the observer should be separate from the entities that are being observed (the subject of observation) to ensure objectivity and eliminate biases and emotional attachment with the object of study (Howe, 1988). Nagel, (1986) (as cited in Johnson & Onwuegbuzie, 2004) indicated that time and context-free generalizations are desirable and possible, and real causes of social scientific outcomes can be determined reliably and validly. Tashakkori and Teddlie, (1998) argued that positivist researchers emphasise "rhetorical neutrality", which involves a formal writing style using the impersonal passive voice and technical terminology in establishing and describing social laws.

The interpretivist upholds the philosophy of constructivism, idealism, relativism, humanism, hermeneutics, and, sometimes, postmodernism (Guba & Lincoln, 1989; Lincoln & Guba, 2000; Schwandt, 2000). The interpretivists paradigm (qualitative) argues that multiple-constructed realities abound, that time and context-free generalizations are neither desirable nor possible, that research is value-bound, that it is impossible to differentiate fully causes and effects, that logic flows from specific to general. They also contend that the observed and the observer cannot be separated because the subjective observer becomes the only source of reality (Guba, 1990). The interpretivists prefer detail, rich description, writing directly with some level of informality but abhor detached and passive style of writing (Johnson & Onwuegbuzie, 2004).

A third paradigm is the pragmatism philosophy of reality, nature of knowledge and how to know, have been identified. Historically, Barnes (2008) linked pragmatism to John Dewey (1859–1952), Oliver Wendell Holmes (1841–1935), William James (1842–1910), and Charles Sanders Peirce (1839–1914). These philosophers conceived knowledge as "constitutively social; beliefs as collective products, hammered out on the social anvil, a response to the peculiar conditions, and human needs found within a given social environment" (Barnes, 2008). Therefore, the characteristic idea of philosophical pragmatism is that ideas and practices should be judged in terms of their usefulness, workability, and practicality and that these are the criteria of their truth, rightness and value (Reason, 2003). It is a perspective that stresses the priority of action over principles.

The pragmatism philosophical standing has been linked to mixed method research approach (Johnson & Onwuegbuzie, 2004) in which this work is situated. It has been argued by Sale et al. (2002) that one cannot be both positivist and interpretivist and that a middle position is an indication of some level of confusion. However, Lin (1998) argued that to create more clarity about mechanism and relationship in a research, the combination of positivist and interpretivist work helps to correct for biases that each approach suffers from separately. Johnson and Onwuegbuzie, (2004) further acknowledged the importance of both positivist and interpretivist philosophies and stated that pragmatism is not to replace these two paradigms. They contend that epistemological and methodological pluralism should be promoted in educational research so that researchers can conduct more effective research.

There are various sects of philosophers among the pragmatic paradigm of research. Teddlie and Tashakkori (2010) identified about six different types of paradigmatic stances. The study is well situated within the dialectic stance of the pragmatism. According to Teddlie and Tashakkori (2010), this stance "assumes all paradigms offer something and that multiple paradigms in a single study contribute to a better understanding of the phenomenon being studied" (p, 15). This is truly so because standing afar posture of the positivist and observing the phenomenon can reveal many attributes of the phenomenon whilst blurring the actual characteristics. The interpretivist position of getting richness may obscure the sense of good judgement, lead to exaggeration of the phenomenon and prohibit critical objective thinking about the phenomenon. These deficiencies are rightly corrected by adopting a middle position where you can critically evaluate both sides of the phenomenon of study.

Research Approach

The study employed the mixed method paradigm of knowledge acquisition. This paradigm as philosophised by critical theory adopts both quantitative and qualitative methods as and when necessary for the subject of enquiry. The adoption of the mixed method approach to this study is justified by the research questions embedded in the topic. A definition given by Johnson et al. (2007) state that "Mixed methods research is the type of research in which a researcher or team of researchers combine elements of qualitative and quantitative approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purpose of breadth and depth of understanding and corroboration". A mixed method study involves the collection or analysis of both quantitative and/or qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research (Creswell et al., 2003, p. 212).Despite the argument against the mixed method, it bridges the weakness in the qualitative with the strength of quantitative and vice versa.

Study Design

A cross-sectional survey and descriptive designs were used for this study. In a cross-sectional study, data is collected from either the entire or part of the population at a point in time (Oslen & George, 2004). This gives a quick overview of what is happening in a population with respect to the subject under study. In most cases, cross-sectional designs employ questionnaire to solicit information from the population. It is cheap in terms of time and cost, it allows for the study of associations of variables and hypothesis (Babbie, 2005). Since the behaviour of the hospital staff will be assessed within a limited time frame, the cross-sectional becomes appropriate for this study.

According to Grimes and Schulz (2002), the most basic element of descriptive studies is that reporting is clear, specific and measurable definition of the condition in question. The challenge with this method mostly is that it is inadequate to address issues of causal relationship or hypothesis and rigorous inferential statistics. It is however, easy to conduct with less cost and ethical complications (Grimes & Schulz, 2002). It is applied in most cross-sectional studies and can be applied in qualitative, quantitative and mixed method of inquiry (Babbie, 2005; p 253).

Target Population

The target population is the population that the researcher has in view to study a phenomenon about. In this study the target population include the staff of the selected hospitals as Medical staff (e.g. doctors, nurses, midwives, pharmacist, and physician assistants) paramedical staff (e.g. laboratory technicians, radiologist, physiotherapist, psychologist, administrators, cooks, statisticians), orderlies, hospital administrators, occupational health officers and heads of environmental health unit of the hospitals. The Heads of District or Municipal waste management/environmental health department, the head of Environmental Protection Agency of the assemblies, the District or Municipal health Director and private companies that might have been contracted for waste collection and transportation services will be included in the study.

Sample Size and Sampling Approach

Sampling is very critical for any research because the outcome of the study may largely depend on the sample size used. A sample is the part of the population selected to provide responses to research questions or to participate in a research. In real the world, it is almost impossible to study the entire population in one study for a given phenomenon to be studied. For this reason, a sample is selected which should be representative of the study population so that the findings of such research would be acceptable to all. Creswell (2003) indicated that sample size is a very important issue in quantitative research paradigm since in most cases the findings are projected or generalised to the entire population. Two major sampling approaches which are the probability and non-probability sampling techniques (Babbie, 2005) were used in the selection of respondents.

Several arguments have been made for large sample sizes before findings can be generalised. Whilst others have maintained that it is not too important. Babbie (2005) argued that the larger the sample size the more accurate it is an estimation of the population from which it was drawn. Kothari (2004) emphasised the need for optimum sample size which fulfils the requirements of efficiency, representativeness, reliability, and flexibility. However, Creswell (2003) indicated that sample size is a big issue to the positivist or for quantitative research but not for qualitative studies.

Since this study is using the mixed method approach, the population to be studied was selected based on the desired attributes. The sample size representativeness was considered in selecting respondents for the quantitative aspect of the work using Krejcie and Morgan (1970) formula for sample size determination. The qualitative part of the study selected specific persons with the required knowledge and in this case the sample size was not a critical consideration.

The Eastern region was selected purposively and conveniently. This is because the region was rated 8th in hospital waste management practices in 2011 by Ghana Health Service Annual Review and it recorded the highest HIV cases in Ghana from 2005-2011 and 2014 (Addo, Yawson, Addo, Dornoo, & Seneadza, 2014). It is therefore important to assess how hospital solid wastes are managed in the region since the HIV affected people may receive health care services from health facilities in the region. Waste from providing health care to these people becomes very important to track to know how the system can be improved. The stratified sampling approach was adopted to select hospitals for the study using Ministry of Health (2006) classification of hospitals based on ownership as government, private, faith-based or quasi-government. In all, six hospitals were selected from a total of 24 hospitals for the study. The regional hospital was selected purposively, three district hospitals (one government-owned and two faith-based own), one private hospital and one quasi-government hospital were selected randomly. Proportional sampling was used to select workers as study participants from the hospitals. The Staff of the hospitals were grouped according to their profession or specialities as medical, paramedical and orderlies. They were then selected randomly from each group to respond to the questionnaires on staff awareness and behaviour towards waste management, safety practices and health hazards associated with healthcare waste management.

The sample size was determined using the formula developed by Krejcie and Morgan (1970).

$$s = \frac{X\,2NP(1-P)}{d\,2\,(N-1) + X\,2P(1-P)}$$

s = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size (1555).

P = the population proportion (since there is no information available to approximate p, then p=0.5 can be used to generate the most conservative, or largest, sample size possible (Rose, Spinks, & Canhoto, 2014; Browner, Newman, & Hulley, 2007).

d = the degree of accuracy expressed as a proportion (0.05).

Therefore for a population of 1,555 from the selected hospitals, the sample size (S) is estimated as follows:

$$S = \frac{3.841*1555*0.5\ (1-0.5)}{(0.0025)(1555-1)+3.841*0.5(1-0.5)}$$

$$S = \frac{3.841*1555*0.5\ (0.5)}{(0.0025)\ (1554)+3.841*0.5(0.5)}$$

$$S = \frac{1493.18875}{3.885+0.96025}$$

$$S = \frac{1493.18875}{4.84525} = 308.175791$$

S = 308.0

Therefore the sample size (S) for the study was 308.

Even though the sample size is 308, it was approximated to 320 (addition of about 6%) hospital staff to cater for margin of error and non-response (Desa et al., 2011). The respondents were drawn from various departments and units in the five selected hospitals to respond to the questionnaire. Respondents were selected from the various hospitals through proportional sampling as shown in Table 5. In each hospital, workers from all the units in the hospital were drawn to respond to the questionnaire using quota and simple random sampling methods. The proportional sampling was used to allocate the number of respondents from the various units. The total number of staff in the unit was obtained as the sample frame. Though simple random method was used, for convenience, the lottery method was adopted to randomly select 320 of the hospitals' staff as the respondents. Responses retrieved from various hospitals are captured in the last column representing a total of 87.2% response rate.

Table 5: *Sample Distribution among Hospitals*

Name of Hospital	Staff Strength	Sample Size	Retrieved responses
Koforidua Regional Hospital	600	124	91
Holy Family Hospital, Nkawkaw	250	51	48
Volta River Authority Hospital, Akosombo (VRA)	190	39	37
Atua Government Hospital, Atua	250	51	50
Presbyterian Hospital Donkorkrom	195	41	40
Bryan Lowe Orthopaedic Hospital (BLOH)	70	14	13
Total	1555	320	279

Source: Field survey, Amfo-Otu (2015)

The sample size in Table 4 excluded the Hospital administrators, private sector actors, EPA officials, Environmental Health officials at the various Assemblies and Environmental Health Officers or Estate Officers who were responsible for waste management at the hospitals. These were purposively selected for the in-depth interviews to assess the stakeholder's contribution towards the safe, efficient and effective management of solid waste in the hospitals as well as at the disposal sites. In all, a total of 15 officials of the hospitals, Assemblies, private company, and EPA were interviewed. Some of them were interviewed due to the speciality of their role and the information related to their activities. These included Store or Supply Officers, Laboratory Heads, Heads of Pharmacy and Occupational Health Coordinators.

Sources of Data

Primary and secondary data were used for the study. Primary data collected from the hospitals included profiles of the hospitals (such as the number of beds; average occupancy rate, average daily operation attendance (OPD), the level of hospital), the quantity of waste generated and collected. Moreover, information on existing institutional linkages for healthcare waste management activities, organisation of healthcare waste management in the hospital, occupational health practices and safety training records were collected. Information on awareness of health hazards associated with healthcare waste as well as attitudes of other health workers towards waste management department and activities were collected.

Secondary data that was needed in both the qualitative and the quantitative aspect was collected from technical reports, official hospital records, published and unpublished thesis. The structured questionnaire was used to gather data for the quantitative aspect of the study whiles the interviews and observation were used to gather primary data for the qualitative aspect.

Data Collection Methods

Interviewing, observation and questionnaire administration methods were adopted for the data collection. This was to achieve triangulation of results and reduce researcher bias. In order to have first-hand information on the actual waste management activities at the hospital, data collection was done by the researcher with no research assistant. The hospitals were visited and after obtaining management approval the data collection instruments were used to gather both qualitative and quantitative data.

Questionnaire administration

The self-reported and self-administered methods of questionnaire administration were used. This was because most of the workers could read and write, well-educated with only few who were assisted to respond to the items. In the case of those who could read and write, questionnaires were left with them for responses, of which some were able to complete the same day whilst others did so later within two days and one week. These groups normally complained of not having time to respond to the item immediately. Those who could not read and write certain items were interpreted into the local language (TWI) for them to get a better understanding of the item and to provide correct responses that truly represent their individual views. The unit heads helped in the gathering the list of staff and encouraged them to complete the questionnaire. Some staff returned their responses to the in-charge of their units' since they were the focal persons at the wards. This helped in obtaining a high response rate of 87.2% (Table 4).

The items on the questionnaire were both closed and open-ended questions. Some researchers have outlined the weaknesses of the close and open-ended questions though they are still relevant in the domain of qualitative and quantitative research. For instance, it has been said that open-ended questions are hardly used in large surveys because of the difficulty in coding and analysing them (Artstein & Poesio, 2008; Schuman & Presser, 1996). Respondents easily refuse to respond to open-ended questions when they are not eloquent in the language of the questions or have no idea or knowledge of the issue. Respondents may also give ideas that do not reflect their real attitude about an issue (Geer, 1988).

However, close-ended questions are easy to answer and analysed within the shortest possible time but the predetermined answers give clue to the respondents. They may affect the responses since respondents can give answers just to satisfy the researcher. This type of questions does not allow respondents to express their opinion even if they do not want the fixed answers. This notwithstanding it provides good and acceptable ways for data collection in many social science researches. The close-ended questions had a range of answers that respondents were free to select from whilst the open-ended questions allowed them to provide further information and give their own account of issues or thoughts about a particular practice.

The close-ended questions used in the study were in the form of Likert scale where respondents were made to select their level of agreement to a statement. The study adopted the forced choice Likert scale (Bertram, 2007) with a four-point scale. The subject matter in the hospital concerns every staff, hence it was important to get their positions on the matter, and therefore, the forced choice Likert scale was used. Some of the items had yes/no or don’t know responses whilst others had responses that were particularly related to the respondents work and solid waste management at the hospitals. The integration of open and close-ended questions was adopted in this study to minimise the bias or weakness in each of them and to help collect critical information relating to the research questions.

The administration of questionnaire was used to solicit information on demographic data, core business and knowledge in waste management at the hospital, availability of information on hospital solid waste management, participation in waste management, awareness of health hazards, safety precautions and practise, staff training on waste management and perception about current waste management situation in the hospital from sampled hospital staff (Appendix 2).

In-depth interviews

In-depth interviews were conducted in all the hospitals, the private company providing waste collection services, Environmental Protection Agency (EPA) and District Assemblies that had the connection with the hospital waste management. The interview with the hospitals covered issues on institutional profile, waste management regulations, quantity of waste generated, waste management scheme or plan, institutional linkages with other stakeholders, workers training, provision of safety equipment, financing of waste management, challenges and recommendations (Appendix 1a).

With the private sector, it covered the company's profile, role in hospital solid waste management, service arrangement, safety practices for collection crew, conditions of hospital solid waste disposal site, environmental and health implications, relationship with other stakeholders and suggested recommendations for improvement (Appendix 1b). Interview with EPA officials concentrated on the Agency's role in hospital solid waste management, permitting and inspection of waste management activities at the hospitals, guidelines, and standards available and their enforcement. It also focused on their relationship with other actors in the sector and exercise of their jurisdictional powers for environmental and public health protection (see Appendix 1c). Similar questions were asked the assemblies that had collaborated with the hospitals in managing the hospital waste (appendix 1d). Moreover, direct quotations from interviewees were captured and pseudo names were used to reference them to ensure anonymity of respondents.

The statistical units, stores, and the administration provided information that was on records as the secondary data. Data collected included out-patient attendance (OPD), number of beds and average bed occupancy rate, number of units and departments, contract details and staff strength were collected. These were used for analysing healthcare waste generation at the hospitals. Documented regulations on solid waste management within the hospitals and regulatory institutions were identified and collected.

Pre-testing of Data Collection Instrument

The developed data collection instruments (questionnaire and interview guide) were pre-tested before administering to selected respondents. The pretesting was done using a municipal hospital in the region which has similar characteristics like the studied hospitals. This was to ensure construct validity and reliability of the responses and to make it easy for the respondents to understand (Babbie, 2005; Presser & Blair, 1994).

Ethical Consideration Issues

Research activities have many legs that are equally important and needs the attention of all researchers. One of such legs is the ethical or moral considerations that need to be observed and accorded to the respondents. Some authors have documented the importance of ethical consideration to execution or implementation of a research protocol. For instance, Singleton et al. (1993) indicated that:

> *Ethics may prohibit researchers from using experimental treatments that could harm research participants from asking questions that would prove extremely embarrassing or threatening, from making observations that would deceive or place subjects under duress, and from reporting information that would constitute an invasion of privacy.*

These considerations are very important in a social survey where humans are involved so that they would not feel bastardised during the process of data collection or after participating in the research. The research questions were designed such that respondents did not feel embarrassed or feel uncomfortable responding to an item.

Another way to ensure that research participants are protected is to obtain their voluntary "informed consent" to be part of the research activity. According to Kulik (2011), to obtain participants informed consent, the researcher should provide enough information about the study to the participants for them to make an informed decision to be part of the research. This disclosure of information to participants will certainly make them open up to provide all the necessary information needed by the researcher. It also provides confidence in the researcher to the respondents by clearing all doubts in the mind of the research respondent. In this study, ethical clearance was taken from the University's Institutional Review Board (IRB) before the data collection and all the ethical details were addressed. This was complemented with a letter from the Institute for Development Studies to the hospital Administrators and in some cases the Medical Director.

At the hospital level, permission was taken from the Medical Director or the Administrator before proceeding with the data collection. Information about the study was shared with the wards in-charge and other nurses available to indicate the purpose of the study. They were made to ask questions if anything was not clear to them. At five of the hospitals, the administrators assigned a staff to assist in the visit to the wards to introduce the researcher to the staff and to assure the staff of hospital management approval of the study. However, at the remaining hospital, the Clinical Director signed an approval letter which was distributed to all in-charge and heads of units before the data collection. At some wards, nurses inspected the consent given by the hospital before participating in the study. Informed consent of the respondents was obtained before administering the questionnaire to them.

Apart from the face to face information sharing with the unit heads and the respondents, the first page of the questionnaire provided further clarity to the purpose of the study and their right to participate in the study. They were given the option to decide to respond to an item or decline response if they were not comfortable with any of the items on the questionnaire. For those who were interviewed, they only inspected the letter from the institution and department the researcher was coming from and whether management has approved of the study. In most cases, the administrator called whoever was assigned to at the hospital to handle waste related activities to inform him to provide the needed information and to declare their approval and support for the study.

With the private company, a visit was first made to the regional office for a personal introduction to the regional manager and a copy of the letter given by the Institute for Development Studies was given to them to introduce the study and the researcher. Information about the districts where waste management at the hospitals has been contracted to the company was asked. Moreover, the contact details of the Municipal and District Operations Managers were collected to foster proper discussions and collaboration in the research. The regional manager also informed the district managers of the permission to undertake the study and this approach made it easy for the officers to give information through some were withheld.

Field Activities

Preliminary visits to the selected hospitals were made to acquaint and establish a relationship with the facility. This was done after submitting the application for ethical clearance from the Institution Review Board (IRB) of the University. The visit was made to the hospitals between March and May 2015. The actual data collection work was done after receiving the ethical clearance in July 2015. It started from July to November 2015.

Disposal sites of the hospitals were visited as part of the assessment and to observe how hospital waste is managed at the disposal points. The disposal sites were classified as either engineered, controlled or open dump sites. Identified disposal sites and areas were marked using geographical information system (GIS) and an appropriate map was developed considering their proximity to dwelling places, surface water sources, and other environmental entities. General conditions prevailing at the sites were captured with a camera in the form of photographs to depict the management situation and conditions of the sites.

Data Processing and Analysis

Data from the questionnaire were analysed using computer-aided software called Predictive Statistical Software version 20.0. Questionnaire items were coded into the software for the analysis. Demographic data such as age and years of work experience were open-ended and therefore were entered as numeric or string except for the sex of the respondents which was categorical and therefore was nominally entered as male = 1 and females = 2. Other categorical responses were coded as No =1 and Yes = 2. The items were coded as strongly disagree = 1, disagree = 2, agree = 3, strongly agree = 4 for the Likert-items. On the Likert-type analysis, items were analysed individually to generate descriptive information of the responses. The constructs of staff awareness about the health hazards associated with hospital solid waste and attitudes of staff towards waste management activities were measured as an index using the Likert-items and this is discussed in Chapter Six.

The results of the analysis were displayed using tables and charts to give descriptive information in the form of percentages and numbers. Cross-tabulations were used to provide descriptive information and to check for some difference in response to items on the questionnaire. The chi-square statistics were used to measure the differences in the responses as against using socio-demographics such as gender, the location of hospital, and category of staff. Descriptive statistics were done to assess the normality of the continuous variables generated from the combination of Likert-items as an indexed scale. The variables passed the reliability test with Cronbach alpha values of 0.892 and 0.729 for staff awareness of health hazards associated with hospital solid waste and staff attitudes toward waste management activities at the hospitals, respectively.

These two major variables in the study (staff awareness and attitudes) were not normally distributed; therefore non-parametric analysis type of inferential statistics was selected for the study. According to Allen and Seaman (2007), indexed variables from Likert-scale can be analysed as interval and continuous scale if they are normally distributed otherwise Kruskal-Wallis test can be used for the same analysis of variance. Moreover, since the other variables used in checking for the differences of awareness and attitudes in the stated hypotheses were categorical, and had more than two categories, the Man-U Whitney test was not appropriate. Hence the study used the Kruskal-Wallis to test for the hypotheses in the study. The Man-U Whitney test was used in the post-hoc analysis to determine the groups with significant difference after the Kruskal-Wallis test using some of the socio-demographic characteristics and awareness, as well as attitudes of respondents.

The responses provided by the interviewees were collected through handwritten and audio recordings. The audio files were transcribed and compare with the handwritten versions. Where there were gaps, information from the audio files was transcribed to fill the gap. The responses were presented in themes and common themes from different facilities were merged to generate specific headings for the thesis. The results from the in-depth interviews and observations were presented in descriptive form under identified themes. Verbal quotations by staff were translated into English and were attributed to them using pseudo names. The description took the form of narration and comparisons in discussing the findings under specified themes from the management practices, institution arrangements, and health and safety practices. This was then supported by the observations made at the facilities about waste management practices, pictures or photographs, and prevailing conditions at the hospitals. Some questionnaire items were used to triangulate the findings and to aid the discussions of the findings.

Field Experiences

There were a number of challenges during the data collection periods on the field. At the hospitals, it was difficult getting attention from medical and paramedical staff to respond to the questionnaire items promptly. Most of them gave excuses that they were busy or the questionnaire items were too many. This was partially addressed through the use of the unit heads that coordinated the collection of the completed questionnaire items. Moreover, more visits to the hospitals to request for the responses were done. For instance, at Donkorkrom in the Afram Plains, the researcher had to stay for one week to obtain about 40 responses. This approach increased the budgeted amount (accommodation and transportation cost) for the data collection.

Some participants openly requested for incentives before participating in the study. This was minimised by the presence of the assigned administrative staff and the introduction that the study was being jointly done by the hospital and the researcher. In one of the hospitals, a senior nurse indicated that "*I will not respond to any questionnaire for somebody to get a degree without appreciating me*" (Adwoa Frempong, personal interview).

The next challenge was the non-availability and reluctance to give the financial information required for the study. At both the private and the public hospitals they were reluctant to release information on financial expenditure on hospital solid waste management as against the budgeted activities. An attempt to get a copy of their annual budget proved futile as well as contract document with the private sector because they considered them as high-security documents.

Some expressed their displeasure for asking their age directly and suggested that next time it should be categorical so they can choose from. Upon explanation that they do not need to disclose their names so their responses will not be matched to their identity and that the study required a continuous data to know the age distribution. After such explanations, they responded to the item whilst some left out the open-ended questions unanswered. Some even wondered why studying hospital solid waste management instead of domestic waste which was in large quantity. An administrator indicated that the issue about hospital solid waste has been over hipped or exaggerated by the media and environmentalist in terms of their handling and effects.

Limitation of the Study

The study should have included all the environmental health officers at the Assemblies but the interviews conducted at the hospitals were used as a guide whether to involve a stakeholder or not. Only one Environmental Health Officer in one Municipal Assembly was interviewed. Their involvement in the study was premised on the role they play in the hospital solid waste management at the hospitals. Therefore, where they were found not to have played any role they were not bothered. Some respondents did not complete all the items on the questionnaire making it difficult to get equal respondents to all items. This was checked and if the respondent was present, he/she was made to provide some information if they were comfortable but those who refused were not coerced. Data on the quantity of waste were not available so they were estimated using the capacity of the waste storage bins and the frequency of emptying. This approach might have led to either over or underestimation of the quantity of solid waste produced by the hospitals.

CHAPTER FOUR

DESCRIPTION OF HOSPITAL SOLID WASTE MANAGEMENT SYSTEMS ADOPTED BY THE HOSPITALS

Introduction

This chapter focuses on the demographic characteristics of the respondents and the description of waste management practices at the selected hospitals as indicated in the specific objective one. It captures the waste generation, categories, storage, collection, transfer and transportation, treatment and disposal practices.

Demographic Characteristics of Respondents

The demographic characteristic of the respondents varied widely in terms of age, years of experience, designation, and qualification. The sex distribution of respondents showed that the males constituted 42.3 percent (118) and females were 57.7 percent (161) out of the valid responses. Females were more than males and this is not out of place since the health profession is dominated by females especially in the nursing profession. All age categories of staff were duly represented from the youth to adult with the mean age of 34.75 years. This indicates a youthful working force within the hospitals as indicated in the national youth policy as those from 18-35 years (Ministry of Youth and Sports, 2010). The minimum age was 20 years whilst the maximum was 60 which is the retirement age for most public sector workers as shown in Table 6. This also means that most of the workers have not worked for long which reflects the youthfulness of the working group.

Table 6: *Descriptive Statistics for age and Years of Working Experience of Respondents*

Item	N	Range	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Age	279	40	20	60	34.75	.645	10.770
Years of experience	276	38	1	39	7.83	.533	8.850

Source: Field Survey, Amfo-Otu (2015)

The educational status of the respondents varied but was dominated by those who had attained tertiary level education (69.2%) with only three (3) having no formal education as shown in Table 7. This is so because medical staff such as doctors, nurses, and pharmacists are normally graduates from tertiary institutions. Those with lower level education were the orderlies, labourers, and cooks who provide support services. Those with no formal education were the sanitary workers which reflect the clear situation among sanitation workers in the country who have been observed to be either school dropout or illiterate (personal observation).

Table 7: *Categories of different Staff and their educational level within the Hospitals*

Categories of Staff	Highest educational level of respondents					Total
	None	Basic	Secondary	Post-Secondary	Tertiary	
Medical (N)	0	0	0	40	134	174
Paramedical (N)	0	0	0	12	59	71
Orderlies (N)	3	22	9	0	0	34
Total	**3**	**22**	**9**	**52**	**193**	**279**

Source: Field Survey, Amfo-Otu (2015)

The result further shows the dominance of medical staff (62.4%) in the hospitals (Table 7). This is because they are the primary or core workforce for health facilities whilst others are the supporting staff.

Quantities of Hospital Solid Waste Generated

All the six hospitals studied did not keep records on daily quantities of waste generated. Even though they all had categories of waste they produced, they could not provide any information as to the quantities of each category generated per day or total per month. This practice is contrary to the national policy requirement that health facilities should keep records of the amount of waste generated daily (MoH, 2006). This finding is similar to what was reported by Wilson et al. (2006), Bamfo-Tanor and Owusu-Agyei (2013) that most of the hospitals they studied did not keep records about the quantity of waste generated. This implies that it will be difficult for hospitals management to properly plan for waste management activities due to unavailability of data on waste quantities.

Table 8: *Estimated Amount of Solid Waste Produced by the Hospitals based on the Number of Trips made*

Name of hospital	Quantity of waste generated per month (Kg)
Koforidua Regional hospital	48,000
Atua Government hospital	12,000
Nkawkaw Holy Family Hospital	8,640
Donkorkrom Presbyterian Hospital	7,560
Volta River Authority hospital	7,680
Bryan Lowe Orthopaedic Hospital	6,720

Source: Field Survey, Amfo-Otu (2015)

The study estimated the quantities of waste generated by the hospitals based on the number and capacity (volume) of waste storage containers, the number of times they are emptied per month and volume to weight equivalent (1 ton = $2m^3$). The results shown in Table 8 indicate both sharps and all other waste produced monthly by the hospitals.

Table 8 suggests that the quantity of solid waste produced by the large hospitals were more than the small ones. The Koforidua regional hospital produced about four times more waste than the district hospital at Atua and about six times of those produced by the other hospitals. The private hospital produced the least waste. This variation can be linked to the number of beds which reflect the capacity of the hospital as well as the services they offer. A similar situation was found in Istanbul (Turkey) where private hospitals generated less waste than the public hospitals (Alagoz & Kocasoy, 2008). This implies that more resources will be required by the regional hospital to properly manage the waste compared to the other hospitals. The private hospital will require minimal resources to manage its solid waste.

Categorisation of Solid Waste by the Hospitals

The hospital used different terms to describe same components of the hospital solid waste as shown in Table 9. General waste was described as any waste produced from any activity apart from the clinical activities while clinical waste was from clinical activities and can be infectious. These categorisations used by the hospitals do not exactly conform to the categorisation stated in the national policy as general/normal waste, infectious waste (sharps, pathological and patient specimen), chemical waste, pharmaceutical waste, radioactive waste and the by-product of waste treatment (MoH, 2006).

Table 9: *Categorisation of Hospital Solid Waste by the Hospitals*

Name of hospital	Waste Categorisation used
Koforidua Regional hospital,	Sharps, infectious and domestic waste
Atua Government hospital	Clinical and normal waste
Nkawkaw Holy Family Hospital	Infectious, sharps and general
Donkorkrom Presbyterian Hospital	Sharps and General, clinical
Volta River Authority Hospital	Sharps and General, clinical
Bryan Lowe Orthopaedic Hospital	Biohazard, general and sharps

Source: Field Survey, Amfo-Otu (2015)

Waste categorisation is normally important to inform the number and type of waste storage bins to be provided for effective and efficient separation of waste at the point of generation and aid in the proper management of waste. The use of different categorisation implies those responsible for waste management do not have adequate information about the classification in the national policy on health care waste management. This may affect the behaviour of hospital staff toward managing the waste as indicated by the Pred’s Behavioural matrix (1967), that availability of information aid in proper behaviour. Categorising the waste correctly is a technical function and providing the required logistics for managing same is an administrative function which should complement each other. The two functions are important for efficient management of the waste as shown in the conceptual framework for this study (Figure 5).

Waste Separation, Colour Coding, Labelling and Storage

Wastes generated were separated and kept in containers with different capacities, colour codes and labelling for storage at different stages in the hospitals. The first stage of the storage occurred at the wards where wastes were generated and separated into specified colour coded containers (Figure 7 &8). It was therefore expected that at the wards sharp boxes or container, yellow and black coded bins should have been available for the separation. From the interviews, four out of the six hospitals indicated that they separated their waste based on the categorisation in Table 9 whilst the two indicated only sharp wastes were separated from the others.

It was however observed that all the six studied hospitals kept only sharp boxes and a bin with black or yellow coded plastic liners without labelling to indicate which type of waste to be kept in the bin. Therefore they separated the sharps from the other types of waste probably due to the availability of storage facility. This availability could have facilitated the separation of sharps easily as indicated by the perceived behaviour control component of the theory of planned behaviour and amplified by the resource dependency theory. It may also mean that the sharps were separated due to their ease and capacity to cause injury. Moreover, pathological waste was also separated for ethical reasons.

Figure 7: Sharp box and waste bins for 1st stage of waste storage at the ward

All the hospitals studied did not have a formal training programme to train staff on hospital waste segregation including the supervisors. There was no scheme or poster to demonstrate to workers the various steps to follow in segregating the generated hospital solid waste into their respective categories as recommended by the national policy (MoH, 2006). At Koforidua regional hospital's laboratory, it was observed that hospital waste storage bins were labelled to reflect the type of waste as shown in Figures 8 and 9. The laboratory staff adhered to the separation practices. The colour codes for the liners were correctly fitted as recommended by WHO (2013) that black liner should be used for non-infectious waste and yellow for biohazard or infectious waste.

Figure 8: Correctly labelled waste storage bin for storing infectious waste

Figure 9: Correctly labelled plastic waste bin for storing non-infectious waste

An interview with the Head of Laboratory indicated that:

The laboratory is going through international standardisation for accreditation. This means that if we are able to complete the accreditation successfully our laboratory test results will be internationally accepted and replicable in other facilities. Therefore as part of the process, we were required to have good waste management system in place which includes proper waste separation. Staff have been trained on the separation and storage bins well labelled so that we do not make the mistake of losing out in our bid (J. Narh, personal communication, April 9, 2015).

This implies that the quest for the international accreditation served as an incentive to control their waste separation attitude as explained by the theory of planned behaviour (Ajzen, 1985). Observation made at the laboratory confirmed that waste separation practices were better than all the other units in the hospital. Other wastes like unused blood and cultured Figures were autoclaved before disposal. However, after all the separation at the laboratory, the wastes were mixed with the content of the central storage container for disposal, which is not the best because laboratory waste is one of the most potentially infectious

All the six facilities, however, mixed all the solid waste and even those who made an attempt to separate the waste at the wards (1st stage) ended up mixing them in the either at the second or third stage of storage except the sharps and pathological parts. In a study by Alagoz and Kocasoy (2008) in Istanbul (Turkey) it was reported that most of the hospitals mixed the non-hazardous waste with the infectious waste and even some households dumped their domestic waste in the waste container at the hospital. On the contrary, Dehghani et al. (2008) found that infectious and non-infectious wastes were kept in separate containers and were not mixed in the hospital's temporary storage area at Tehran University hospital.

The use of colour coded plastic bags or liners and the labelling were to aid the separation practices even if waste containers were not colour coded. The plastic bag was meant to help prevent the waste from having direct contact with the waste bins and enhance the safe collection of the waste. The yellow coded bins were to be used for storing infectious waste, black or green for normal domestic waste and brown for pharmaceutical and chemical waste. It was however observed that in all six hospitals black plastic liners were used in most of the colour coded bins which did not match the expected content of the storage bins as shown in Figure10 and 11. Some of the hospitals used yellow liners at times but did not restrict the content to infectious waste as indicated in the national healthcare waste management policy (MoH, 2006). This really defeated the purpose of using colour coded bins and liners for storing the different categories of waste which can contribute to mishandling of the waste and spread of infections.

Figure 10: Different coloured bins with different coloured plastic liners

Figure 11: Green colour coded bin with yellow liner for storing domestic waste.

For efficient and effective waste management especially when separation is an integral part of the waste management system, labelling of the various storage bins is very critical. Respondents were asked to indicate their agreement with the statement that labelling of healthcare waste bins was not important. Most of the respondents (66.2%) strongly disagreed with the statement as shown in Table 10. This shows that staff did agree that labelling of waste storage bins was very important for healthcare waste management activities at the hospitals.

The bins were not labelled to indicate infectious, hazardous or general waste in most of the hospital according to their categorisation except at one of the laboratories. It was observed that waste storage bins were however labelled to show hospital ownership as “Atua Government Hospital”, or “VRA Hospital” at almost all the hospitals studied (Figure 13). According to Ministry of Health (2006) waste should be appropriately packaged and labelled as general waste (black liners), infectious waste (yellow liner) and hazardous waste (brown liners) including hazard symbols. The finding confirms the findings of Abor (2007) in South Africa that hospital does not label infectious waste with a biohazard symbol.

Table 10: *Staff agreement with the Importance of Labelling Waste Storage Bin*

Name of Hospital	Strongly disagree	Disagree	Agree	Strongly agree	Total
Atuah Gov Hospital	37	2	7	4	50
Donkorkrom Hospital	4	10	18	7	39
Holy Family Hospital	40	2	4	2	48
Kof Regional Hospital	74	7	5	5	91
Orthopaedic	2	2	8	1	13
VRA Hospital	27	4	3	3	37
Frequency	184	27	45	22	278
Percent	66.2	9.7	16.2	7.9	100.0

Source: Field Survey, Amfo-Otu (2015)

Though most of the respondent (75.9%) either strongly disagreed or disagreed that labelling of waste bins is not important, their position does not support the normal practices at these hospitals. This implies that people may have the information or knowledge but do not have the right capacity and the enabling environment to practice it as indicated by the Pred's behavioural matrix and the theory of planned behaviour. This means that about 24.1 percent of the staff from the hospitals have a different view about the need for labelling waste storage bins probably due to possible differences in information on health care waste management available to them. It may also be due to weak implementation of health care waste management guidelines or rules.

Storage container capacities for the first stage of storage varied from smaller waste bins which are either foot paddled or handheld container with capacities ranging from 20 to 60 litres at the wards, OPD, and walkways (Figure 12). These were collected in the morning before 8:00 am (08:00 GMT) and before 6:00 pm (18:00 GMT) in the evening. None of the hospitals kept the waste at the ward for more than 24 hours. They were emptied into larger storage bins of capacities 120 or 240 litres as the second stage of the storage which occurred outside the ward (see Figure 13). Three of the hospitals emptied (Holy Family, Donkorkrom and VRA hospitals) them every other day by the collection crew for disposal whilst the private hospital did it on weekly basis for final disposal. At the private hospital, these storage containers were kept in an open space with no restriction to hospital users even though they were covered and located 100 m away from operating areas.Two of the hospitals (Atua and Koforidua hospitals) emptied their 120 or 240 litres bins into larger storage containers with capacity of 12 m^3 as the third storage stage (Figure 12).

Figure 12: Waste storage bins used at the wards and walkways

Source: Field Survey, Amfo-Otu (2015)

Figure 13: 240 litre bins used for secondary waste storage outside the wards.

Source: Field Survey, Amfo-Otu (2015)

The storage at the third stage usually lasted for three days and two weeks at the Koforidua and Atua hospitals, respectively. The 12 m^3waste storage containers or receptacles at these two hospitals (Figure 14) were made of metal materials which were opened at the top and expose the content to the open environment. The storage areas were not fenced or secured from unauthorised people. This means people who may be scavenging in town may have access to the storage container ones they enter the hospital premises.

Keeping the waste within the hospital premises for more than three days or 72 hours is not an acceptable practice. From the national policy (MoH, 2006), storage of waste at the wards should not exceed 24 hours and within facilities should be reduced as much as possible. However, WHO (2013) gave a more stringent measure that infectious waste should not be stored for more than 24 or 48 hours for warm regions. They can, however, be stored for a week or more if the temperature is regulated at 3 – 8 °C. The waste storage duration of not more than 24 hours at the wards is consistent with a similar research by Dehghani et al. (2008) in Tehran Hospital which showed that the storage time was 12 – 24 hrs. However, the storage at the temporal storage sites before collection to disposal differed from the findings of Dehghani et al. (2008) in Tehran Hospital where the storage time was between 12-24hrs (75%) and 24-48hrs (25%).

Figure 14: Secondary metal storage container used by some hospitals.

Source: Field Survey, Amfo-Otu (2015)

Sharp waste such as needles and syringes were stored in puncher proof or improvised paper boxes at the wards (see Figures 7 and 15) till they are one-third full before collection to disposal. One hospital used a plastic container with a biohazard symbol for storing sharps in addition to the improvised paper boxes. Sharps stored in an improvised or used packaging box posed a possible health threat to orderlies and waste collectors. Improvised boxes were used when the prescribed puncher proof boxes are not available indicate the resource constraint and improper planning for managing the waste partly due to lack of data. The practice is at variance with the national policy and best environmental practices.

Figure 15: Improvised sharp boxes for storing sharps in some of the hospitals.

Source: Field Survey, Amfo-Otu (2015)

One of the supervisors said "… *the sharps were kept in separate containers; I mean everything sharps, because they are troublesome, they can easily prick you* ..." (Mary Akomah). This statement indicates the consciousness of the supervisor about the possible health hazards of sharps. Sharps are known to contribute to infection among hospital staff through accidents (WHO, 2011b). Apart from contributing to spread of infection, it can inflict pain and harm on people who are pricked. The pain and harm could provide incentives for generators and orderlies to be careful in its handling.

From the survey responses, most (62%) of the respondents strongly agreed that sharp wastes were stored in puncher proof boxes, 22.8 percent agreed, 4.3 percent disagreed and 10.9 percent strongly disagreed to the statement. This indicates that most of the staff were aware that sharp waste from the wards were stored in puncher proof safety boxes in line with the responses from those supervising waste management activities in the hospital. This finding is similar to that of Alagoz and Kocasoy (2008) who reported that sharps were kept in specialised puncture proof boxes in Istanbul. Those who responded that they disagree and strongly disagree to the statement referred to the point that at times the hospitals used improvised storage boxes which were not puncher proof. This finding is similar to what was reported by Manyele and Mujuni (2010) that health facilities in Tanzania used improvised sharp boxes.

From the ensuing discussion, it is clear that there were challenges with colour coding, labelling, and waste separation practices at all the six hospitals studied. Some of the Administrators and Environmental Health Officers indicated that one of their challenges was about non-availability of the right coloured plastic liners for the various colour codes being used. One Head of Stores indicated that *"… you only get the black on the market not the yellow and brown, occasionally when you are lucky you get the yellow*" (Razark Musah). This meant that mostly the black liners were available but the other colours were hard and difficult to find even though the prices were not the same. At Atua hospital, the head of stores indicated that,

> "… *the nurses at the maternity ward and orderlies have complained of the yellow coloured liners because it made the content visible and when soiled with blood it's easy to see through unlike the black which is opaque, therefore we don't buy any other colour except the black*" (Razark Musah).

This implied that, they could actually get different colours for different categories of waste as prescribed by the national policy but due to the objection from users they have stopped procuring them. The users may have genuine concern if the waste contains heavily blood-stained waste products that pose psychological problems to them.

Waste collection and transportation to disposal sites

Collection of the waste from the various wards to the secondary storage points and subsequent transportation to the disposal sites differed from hospital to hospital. One common feature of the waste collection was the transfer of the waste from the wards to the secondary storage bins outside which was the primary duty of orderlies. At Donkorkrom, waste was collected and transported by handcart method to the disposal point. This was done on daily bases as early as 4:00 am (4:00 GMT) by the assigned labourer.

At Nkawkaw Holy Family hospital, the collection was done by the assigned waste management staff of the hospital with dedicated pickup vehicle. Collection and transportation of the stored waste for disposal was done every other day (every two days) amounting to three times per week collection frequency. The collection practice was very interesting since the workers did not pour the content of the waste nor the liners into the truck but were kept in the storage bins and transported to the disposal site directly. This was to prevent direct contact between the truck, personnel, and the waste. This practice is an important preventive measure for the workers and community members. After the disposal, the bins and the truck were all washed with sodium hypochlorite to disinfect them before using them again. This mode of transportation is similar to the recommended method by WHO (2013) to use a separate and airtight truck for transporting hazardous waste from hospitals, though the truck was not airtight.

At the Volta River Authority's (VRA) Hospital, waste collection was done on daily bases by the Environmental Health outfit of the Community Management Department, which has the responsibility of managing the community's waste. At the hospital, the orderlies normally collected the waste from the wards and stored them in the secondary storage bins placed at vantage points outside the buildings whilst the staff of the Environmental Health Unit collected them to the incinerator site or disposal site. All solid waste from the hospital was sent to the incinerator except the kitchen waste for treatment. In situations where the incinerator was not functioning wastes were dumped at the community's dumpsite.

Three of the hospitals (ie Orthopaedic, Atuah, and Koforidua) have contracted waste collection to final disposal services to Zoomlion Ghana Limited. The collection frequency was twice a month, twice per week and once per week for Atuah, Koforidua and Orthopaedic hospitals respectively. This means none of the hospitals kept the waste within the hospitals' premises for more than a month. Alagoz and Kocasoy (2008) found in their study in Istanbul that some hospitals kept their hospital solid waste at the temporary area for two weeks or more before collection to final disposal site whiles three of them collected them daily. The finding of this study is different from what was reported by Alagoz and Kocasoy (2008) that one hospital kept the waste for more than a month in Turkey.

The frequency of collection depended on the quantity of waste generated and the terms agreed with the company which was largely influenced by the service charge. The private collection agreement however excludes sharp waste, pathological and pharmaceutical waste. However, occasionally some pathological waste was found in the mixed waste by accident. Two of the supervisors (at Akuapem North and Koforidua Regional office) for the private company reported that *"…the drivers have complained at least once that they found human parts in the waste they dumped at the dumpsite* (E. Bonsu, personal communication, May 7, 2015). This may be a pure accident or confirming poor waste separation in the hospitals.

A question to probe if they reported the matter to the hospital administration, one of them said that "*yes, I told the administrator that my workers have reported that some human parts were found in the waste so please check it but I was told it was a mistake"* (E. Bonsu, personal communication, May 7, 2015). The other supervisor at Koforidua indicated that it was verbally reported but not in writing. However, an official from the said hospital indicated that they have not received any verbal or written complaints from the private company about human part mixing with the waste before. At VRA hospital, the head of the environmental unit indicated complain about human parts being mixed came to him only when the hospital's incinerator was faulty. This implies that whether by some mistake or intentionally some pathological waste can be mixed with the others for disposal at communal dumpsites. This is possible especially when waste separation, labelling and staff training are poor. This can have some major health implications for scavengers and operators of dumpsites. Moreover, seeing the human part in the waste can instigate some psychological trauma in anybody who comes into contact with it.

Management of Specific Hospital Solid Waste

The hospitals adopted different methods to manage some classes of solid waste in their facilities.

Pharmaceutical waste management at the hospitals

One of the components of solid waste produced by hospitals is the pharmaceutical waste from the pharmacy departments. This waste comprises packaging materials, damaged drugs, and expired drugs of different composition and states (syrup, capsules or tablet). This type of waste is not added to the normal waste except the packaging materials which were mostly papers, plastic materials, and cartons. The critical component which is the expired drugs was disposed of by an established board within the hospital by following laid down protocol or procedure in all six hospitals. The board in most cases had a composition of about five officers from the hospital which was chaired by the Internal Auditor with a representative from EPA and Food and Drugs Authority where applicable. The other members include the Pharmacist, Accountant, Administrator and the Environmental Health Officer. In places where there was no Food and Drugs Authority, the Environmental Health Officer was assigned for the board to deal with the waste. Atua Government Hospital indicated that sometimes they did the destruction in consultation with the Regional Medical Stores.

Expired drugs were destroyed by burying or burning at a designated disposal site outside the hospitals under the strict supervision of these officers. This was done to prevent making the drug available for people to have access to them at their dumping places. The liquid or syrups were broken and buried whilst the tablet and capsules were burnt and buried. However, disposal of pharmaceuticals was not a usual practice within the hospitals because they kept to prudent procurement measures and operated on "first come first go or out" principle. It means that the first drugs that get into the pharmacy stores were used first when they are the same or could be substituted in combination. One Pharmacist indicated that "*…we had expired drugs because they were donated by development partners to us and we did not need them or have a use for it…*" (J. Effah, personal communication, April 9, 2015).This shows lack of consultation of donors with hospitals before supplying such drugs to them.

These disposal practices are good in-terms of preventing people from having access to the expired drugs but have environmental challenges. For instance, burying drugs in an unlined disposal site will definitely contribute chemical contaminants to the soil and possibly leached into groundwater which may in the near future affect public health. Burning such waste in an open environment (dump site) may contribute various pollutants to the air for inhalation by community members (Amfo-Otu et al., 2015). This indicates a gap in the destructive practices that need to be reviewed and properly done to contain the chemical contaminants to be produced from the drugs.

Pathological waste management

Separated pathological waste like placenta from maternity wards was dumped into placenta pits within the hospitals in six hospitals. This was found to be in line with the recommendation by WHO (2013) that placenta can be dumped in a lined pit. The placentas were normally soaked in sodium hypochlorite so as to aid the decomposition. In some cases, the placenta was buried or given to family members of patients for burial upon request. Precautions were given to family members in such instances in order to protect the general public from possible infections. In one of the hospitals (Holy Family Hospital, Nkawkaw), it was found that the placenta pit was connected to the wastewater system to generate biogas.

Hospital solid waste treatment at the hospitals

There was no pre-treatment of waste at the wards or generated points before storage and disposal at all the studied hospitals. It was the surgical equipment that were treated at the Central Sterilisation and Supply Department (CSSD) at all the hospitals. Table 12 shows that the treatment method adopted by the hospitals to treat their waste was the high thermal treatment technologies. The presence of De Montfort incinerators in three of the studied hospitals is an indication of what Pickens (2007) and Gulyurt (2012) said that 'De Montfort' incinerators were developed to provide a cheap but effective healthcare wastes treatment for developing countries. Adama (2003) also reported that about 44 De Montfort types of incinerators were constructed in 2002 in Kenya.

Table 11: *Type of Hospital Solid Waste Incinerator used by the Hospitals*

Name of Hospital	Type of Hospital Solid Waste Treatment Technology	Frequency of Use
Atua Government Hospital	De-Montfort single chamber	Weekly
Koforidua Regional Hospital	De-Montfort single chamber	Weekly
VRA Hospital	Dual chamber incinerator	Every other day
Nkawkaw Holy Family Hospital	None	Not applicable
Mampong Orthopaedic Hospital	Modified De-Montfort single chamber	Out of use
Donkorkrom Presbyterian Hospital	De-Montfort single chamber	Out of use

Source: Field Survey, Amfo-Otu (2015)

The De-Montfort incinerator technology at the public hospitals was funded through collaboration between Ghana Health Service and World Health Organisation (WHO) in 2002. The funding sources for the technology in these hospitals also corroborate the statement that the initial design of the De Montfort' incinerator has been built in many African countries through the support of WHO, UNICEF and national governments (Pickens, 2007). At the private hospital (BLOH) the funding was done by the owner of the hospital. Even though the private facility did not receive any funding from government or any development agency, it is not so different from the normal practices in the country with private ownership of facilities.

Most of the development agencies normally direct their support to government agencies which will benefit society as a public good than to support private ventures which are profit-oriented and embedded in capitalist ideas. If all the government hospitals are supported to effectively treat their hospital solid waste and private hospitals fail, the consequences will come back to affect the entire society. Therefore, it calls for the attention of international development agencies to support private hospitals providing healthcare services at places where government hospitals are not available with waste treatment facilities.

Apart from the VRA incinerator which was used to incinerate pathological and other infectious waste all the other hospitals used the technology only to incinerate sharp waste. At the time of the research, two of the incinerators (i.e. Donkokrom and Orthopaedic) had broken down for well over six months without repairs (Figure 16). One of the responsible maintenance officers' indicated that "*I have been submitting an estimated budget for repairs but management has not been responding*" (E. Tanko, personal communication, March 25, 2015). This shows how frustrated he was with the system.

Figure 16: A De-Montfort incinerator used by Donkorkrom hospital

Source: Field Survey, Amfo-Otu (2015)

When the officers in-charge of the incinerators were asked about the existence of maintenance schedule for the incinerator none was able to produce any schedule to that effect. It was however indicated that the only thing done to maintain the incinerator was to remove the ash and residues from the bottom to the disposal site. This confirms what was reported by Agenda for Environment and Responsible Development (2009) that there are broken incinerators, poor standard of operation, maintenance and management of incinerators in many African countries. One officer indicated that the maintenance work have been contracted to a private company but could not produce any evidence and even the name of the company to support the claim.

The dual chamber incinerator used by VRA hospital operated on diesel and electricity as the sources of fuel (Figure 17) at very high temperatures between 800 - 1200 ^{0}C. The dual chamber incinerator had a primary chamber for the placement of the feedstock (materials to be incinerated) and a secondary chamber for destruction of gaseous pollutants which is one of the best treatment options (UNDP & GEF, 2009). The secondary chamber is designed to have a minimum of 2 seconds residence time, high turbulence, higher temperatures to deal with waste containing chlorine related compounds that produce furans and dioxins (UNEP, 2012). Providing this treatment technology as an administrative function and technically operating well is important to ensure efficient waste management and reduce the potential threat to health and environment as indicated in the conceptual framework.

Figure 17: Dual chamber air-controlled incinerator used by VRA hospital

Source: Field Survey, Amfo-Otu (2015)

At VRA, the incinerator was operated by an assigned environmental health unit staff at 4:00 am. This was to help reduce the effects of the heat emitted by the incinerator. The staff said "*I do it at dawn because at that time the weather will be cool and the heat will not be too much"* (K. Kyem, personal communication, February 10, 2015). This means the operator is aware of the possible effect of the incinerator and observed some precaution. Operating incinerators could be costly depending on the technology type, frequency of use, and chemical and physical characteristics of the waste to be incinerated. It was found that dual chamber incinerator operated on diesel and electricity whilst the De-Montfort incinerators were operated on paper cardboard and occasional kerosene to initiate the burning. Koforidua regional hospital shared the incinerator with other hospitals and clinics within the metropolis for treating their sharp waste.

It was reported that "*normally before burning, the sharps were stored in a room attached to the incinerator and locked to allow for more quantity before burning which helped to dry the waste before the burning*" (K. Annor, personal communication, April 9, 2015). This means that the storage contributed to drying of the content of the sharp boxes to make it feasible and easy to combust within the incinerator. The use of fuels such as diesel and electricity in the incinerator is likely to raise the cost of the waste treatment method used by the hospitals. This also means that operators of the incinerators have to observe proper safety precautions to avert any fire incident especially when using petrol.

Combustion of a waste of any kind without energy recovery but volume reductions may be good for landfill operators and waste managers but not natural resource managers. In this era of technology, sharp waste from the hospitals could be separated and treated using technologies that ensure complete sterilisation of the sharps to destroy pathogens and allow for reuse of the materials for the manufacturing of other products. For instance, combining chemical treatment with microwave, autoclave or hydroclave technologies could help make the sharp waste safe for recycling. The metal components (needles) can be melted at very high temperatures and processed to produce different metals for the construction and the automobile industries (such as the iron rod, wheel cap, etc.).The plastic component can be recycled by using different recycling methods such as chemical treatment or feedstock treatment for the building and automobile industries as well.

Residues such as ashes of different kinds produced from the incinerators can be potentially toxic to humans, fauna, and flora in the environment as well as a threat to soil and water quality. Therefore waste managers were asked to explain how ashes from the incinerators were managed. It was found that hospitals with incinerators dumped the ashes in a hand-dug pit, on bare soil (see Figure18) or sometimes in their metal waste storage container. Some indicated that the ash from the incinerator was not much because it normally takes a long time to get high quantity of ash for disposal, because the quantities of sharps were not much. One officer reported that "…*we normally get high volumes of sharp waste during immunisation programmes by the public health department which demands continuous burning, in such cases, the ash become more*" (I. Koomson, personal communication, April 9, 2015). It was observed that the sharps that were incinerated only had the plastic components burning leaving behind the metal components in the ash. These sharps though decontaminated through the incineration processes can still prick the fingers to cause injury if handled with bare hands without proper care.

Figure 18: Disposal of ash residues from incinerator at the Regional Hospital.

According to Thompson and Anthony (2008), incineration of waste produces a large amount of ash (30%) of the weight of the original waste. Racho, (2002) indicated that incineration can concentrate inorganic toxic materials such as heavy metals in the waste in the ash residues (bottom ash and fly ash). A study by Amfo-Otu et al. (2015) found that the concentrations of heavy metals (total chromium, cadmium, lead, and mercury) from incinerated ash were higher than the counterpart from the open-pit ash, and they exceeded the maximum allowable concentrations. Analysis of bottom ash samples taken from two hospital incinerators in Kenya showed higher concentration of total chromium, cadmium, lead, silver, and mercury which exceeded the maximum levels (Nkonge et al., 2012). These are all indicating that proper disposal of the incineration residues is a must to protect the environment and reduce the risk or threat they pose to the environment and public health.

Hospital solid waste disposal practices

At Donkorkrom hospital, the solid waste disposal site was located about 500 m from the hospital building and about 150 m from the nearest accommodation within the hospital's compound as shown in Figure 19. This practise is though recommended by the national policy on health care waste management under the proximity rule (MoH, 2006); it is potentially dangerous to children within the vicinity of the hospital especially when waste is dumped on the bare soil or floor.

A visit to the dumping site indicated that sharps were all dumped and burnt at the same site as shown in Figure 20. The wastes were supposed to be dumped in a dug pit but the current location for the dumping had a bedrock which made it difficult to dig a pit, therefore the wastes were dumped on the bare soil for burning. The dumping site was not fenced which means that all animals and children can have access to the waste at the site even though part of the hospital is fenced. The location of the dumpsite was also close to a waterlogged area which used to be a stream but had dried up. It only got flooded during raining season.

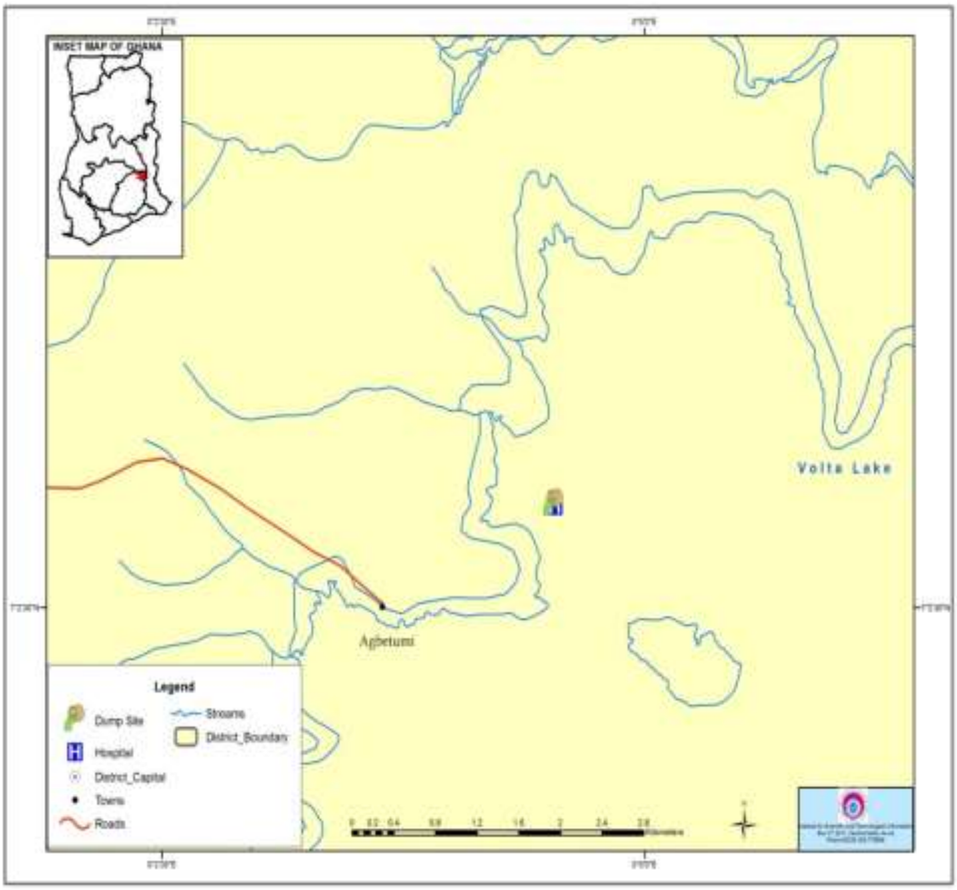

Figure 19: Map of Kwahu North showing Donkorkrom Hospital and dump site

Source: CSIR-INSTI, 2016

Figure 20: Dumping site at Donkokrom hospital showing scatted sharps

Source: Field Survey, Amfo-Otu (2015)

At Holy Family Hospital, the disposal site was located about 10 km away from the hospital but about 800 m away from the village where the site was located. The site was acquired by the hospital for the dumping purpose and operations started a month before this study. A big pit was dug with the help of a backhoe machine, to receive the waste. This was normally burnt on a weekly basis so that people cannot access the content and also prolong the lifespan of the pit. The pit was not lined to protect the groundwater from being polluted through infiltration of leachate from the waste. Moreover, the facility was exposed to precipitation and therefore some drains were made to reduce runoffs that could enter the pit. This open type of dumping in a dug hole creates high threats to the groundwater system around the communities through infiltration of leachate.

UNEP (2005) noted that despite the crudeness and the health hazards, open dumping in pits, vacant lands, or water bodies is prevalent practice in developing countries. This is because open dumping is initially less expensive and easier than adopting an environmentally sound waste disposal system but the ultimate environmental cost to society may be more expensive. Therefore open dumping and burning of the hospital solid waste by these two hospitals can pose a major health risk to all and the environment. Ali, Pervaiz, Afzal, Hamid and Yasmin (2014) found high heavy metal contamination of soil close to open dump site.

At VRA hospital, it was found that the Akosombo community had its own solid waste dumping site and so waste from the hospital was dumped there whenever the incinerator was not working. The dump site is located at about 800 m away from the hospital but in a valley. The location may encourage washing away or transport of leachate from the site into the Volta River as shown in Figure 21 because of the proximity the dumpsite to the Volta River.

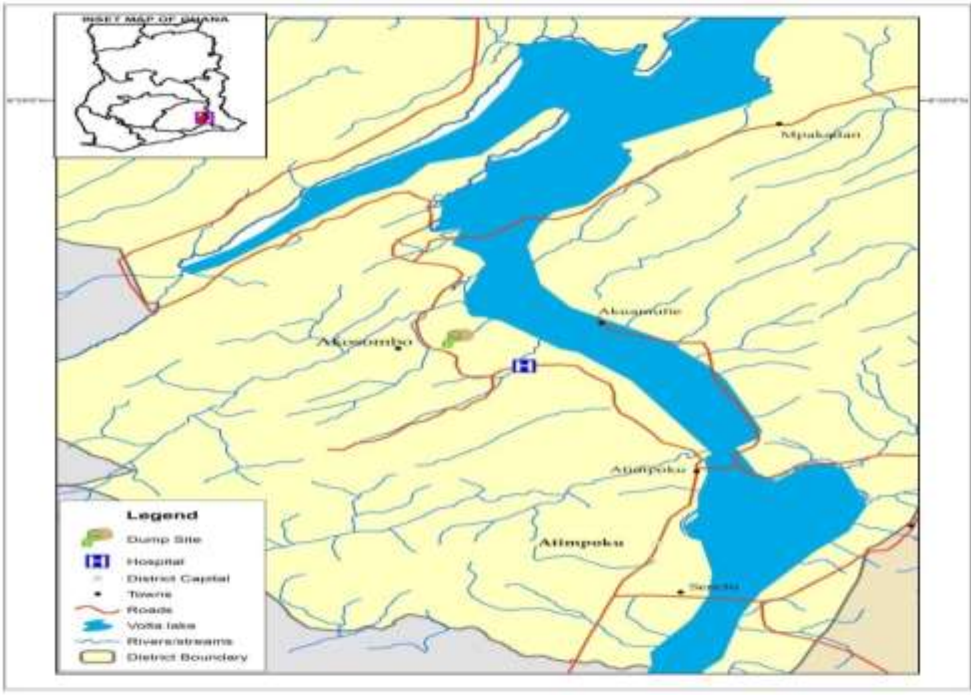

Figure 21: Map of Asuogyaman District showing the location of VRA hospital and the dump site.

Source: CSIR-INSTI, 2016

A visit to the site showed that scavenging activities had been going on. Some of the yellow liners used by the hospital to pack waste were found among the dumped waste as shown in Figure22. This implies that the potentially hazardous waste from the hospital was mixed with the normal domestic waste from residential areas at the dumping site. There was no proper management at the dump site even though its use is limited to the Community Management Department. The waste was used to fill a pit created during the excavation of materials for the construction of the Akosombo Dam. Pushing, levelling and covering of the waste were done occasionally to allow for easy access and to keep the place neat according to the Environmental health officer.

Figure 22: Dumping site for VRA showing yellow liners from the hospital.

Source: Field Survey, Amfo-Otu (2015)

: Field Survey, Amfo-Otu (2015)

Three of the hospitals using the services of the private waste company indicated that dumping was done at the disposal sites of their respective Municipal and District Assemblies. These disposal sites were located at the outskirt of the communities where the dumping took place. It was observed that the nearness of the dumpsites to dwelling places/community ranged from 700 meters to about 2 kilometres. All the three disposal sites were not engineered, two were open dumpsites and one was controlled dumpsite. The dump site used by Zoomlion Ghana Limited for dumping of waste from Atua government hospital is located about 1.5 km from nearest community as shown in Figure 23.

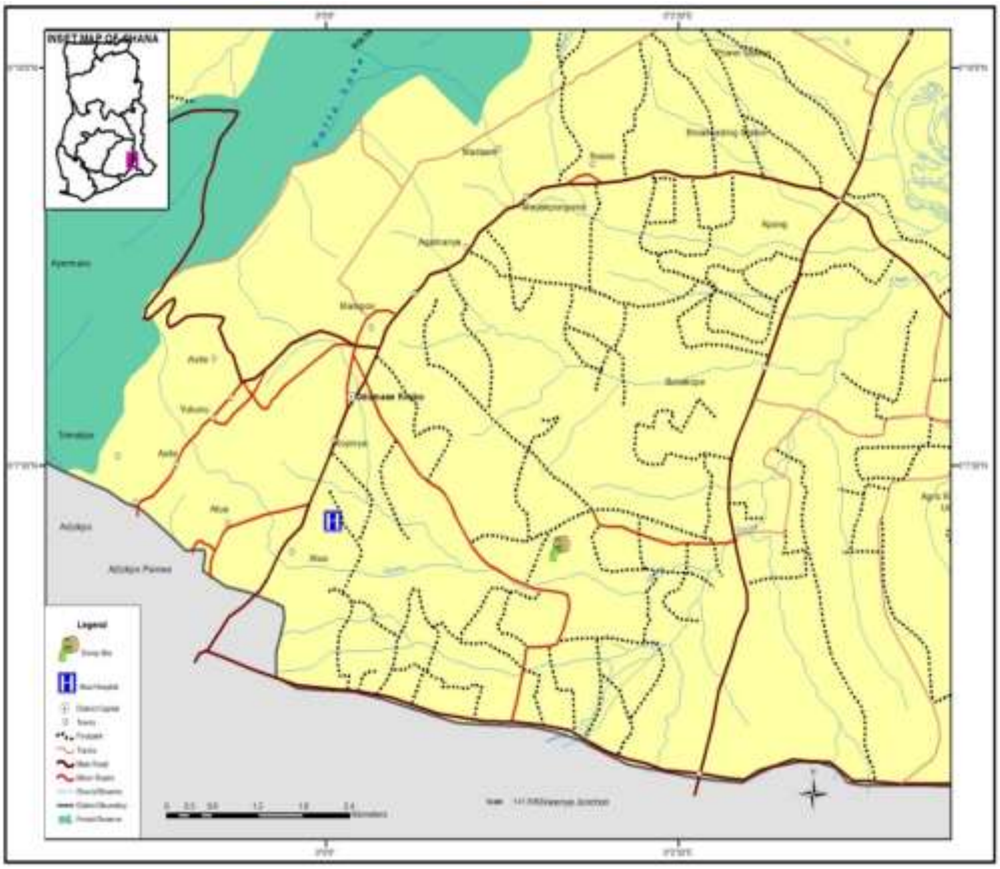

Figure 23: Map of Lower Manya showing the location of hospital and disposal site.

Source: CSIR-INSTI, 2016

Open dumping is the least preferred option of the land disposal practices because of its environmental and consequent public health effects. International Solid Waste Association (2015) indicated that waste in open dumps often becomes a breeding ground for vermin, flies, and other potential carriers of communicable diseases. Management activities at the dumpsites were limited to occasionally pushing of waste at these sites to create an access road for the dumping trucks and make it easier for dumping. It was observed that covering of waste with laterite was not done except the Koforidua site where it was done as and when needed, usually over two months. The importance of applying daily covering materials cannot be ignored in this current age. According to Nolan (2014), daily cover application help to minimize negative effects of landfill operation such as odours, nuisance, waste blowing, and prevent vector populations' from having direct access to the waste.

None of the dumpsites was fenced or protected against unauthorised entry by scavengers (see Figures24). Scavenging activities were found at two of the sites where various materials such as metal, tin cans and polyethylene phthalate (PET) bottles were recovered for sale to recycling companies.

Figure 24: Unfenced open dumpsite with burning at Akuse used by Zoomlion Gh Ltd.

Source: Field Survey, Amfo-Otu (2015)

It has been said that in developing countries, scavengers play an important role in the solid waste management system, (Moreno-Sanchez, Maldonado & Sheldon, 2003). Scavenging is a very important informal activity that reduces the volume of waste at the dumpsite, to recover recyclables for the recycling industries as well as providing livelihood to the scavengers. According to Owusu-Sekyere, Osumanu and Yaro (2013), scavenging for plastic wastes and scrap metals is a lucrative business for many residents at Dompoase and the surrounding communities in the Kumasi Metropolis due to the monetary incentives associated with it. This should be encouraged but should be well-structured and organised to enhance the operations of the dumpsites and protect the dignity, right, and health of those involved.

The scavengers occasionally set the waste on fire to facilitate their scavenging activities as shown in Figure 24. In some cases, burning could be done by the operating company to reduce the volume of waste at the site especially when new land for dumping is difficult to acquire and attribute the practise to scavengers. The practice of burning waste leads to the production of smoke at the sites which is blown by the air into the nearby communities and the environment. These actions at the dumpsite present imminent danger to the health of communities, scavengers and the general public especially when hospital solid waste is mixed with the municipal waste. Smoke produced from dumpsites has been cited to contribute to the level of unintentional persistent organic pollutants (UPOP) such as dioxins and furans in the environment (EPA, 2007). This implies that the burning activities at the dumpsites by whoever is contributing UPOPs as pollutant into the communities.

According to WHO (2002), UPOPs can affect the nervous and immune systems, causing developmental disorders and development of cancerous tissues. Moreover, Akpofure (2014) indicated that when open burning of solid waste is practiced, it emits toxic substances and fumes such as nitrogen oxides (NOx), sulfur oxides (SOx) and heavy metals into the air. The implication is that, it is not only UPOPs that are released from such open burning of waste into the atmosphere but the heavy metals of a different sort. The nitrogen oxides and sulphur oxides can contribute to climate change effects being experienced globally. All these will affect the quality of life in the environment with resultant outcome of high morbidity and mortality.

Burning of waste at the dumpsites indicate the need to manage scavengers at these dumpsites. This will help to ensure proper integration of stakeholders of waste management at the dumpsite to foster proper sustainable waste management at the dumpsites as advocated for by the integrated sustainable waste management concept (van de Klundert & Anschütz, 2001). Taking measure to address open burning at these sites will help protect the health of the nearby communities and by extension the larger society as argued for in the conceptual framework. This will help to promote the philosophy of environmental justice and equity for all such that while people are making economic gains others right to health will not be jeopardised. In another dimension, the scavengers are depending on the recyclable materials recovered from the dumpsite for their socio-economic needs. Other companies also depend on the recyclables recovered by scavengers as a resource for their production as amplified in the resource dependency theory.

Summary

From the conceptual framework of this study, it can be said that the solid wastes were not pre-treated before storage, collection and transportation, and it can contribute to the increased population of pathogens of different kinds in the waste. Exposure to such waste present health threat to waste collection crews and all those who may come into contact with it.

Scavenging at the dumping sites where such waste have been dumped can pre-disposes one to these pathogens and serve as a route of exposure to disease-causing agents from the waste. This may be the means through which pathogens could be spread within the society. Waste management practices at the hospitals, in general, could affect the life and welfare of the society.

Moreover, since most of the disposal practices of the incinerated ash by these hospitals were not properly done it could create an environmental threat to public health and contribute to environmental pollution. The combustion of the waste either in the open or in a De Montfort incinerator poses imminent health and environmental danger to nearby communities. This can affect their right to live in good and serene environmental conditions. Non-segregation of all infectious waste at the wards as well as the mixing of healthcare and municipal solid waste can greatly contribute to environmental pollution.

Furthermore, lack of adherence to a proper coding system for waste storage and collection indicate either lack of or inadequacy of training for staff on the subject matter. Poor maintenance culture which can be attributed to lack of resources can affect the waste handling processes and procedure which will lead to a compromise in the waste management situation at the hospitals. Non-availability of different colours of plastic liners on the market may affect waste separation practices and stifle the efforts of staff that are willing to ensure proper separation of hospital solid waste.

Therefore it can be argued that since the segregation is not well practiced due to inadequate logistics, the administrative, individual and technical functions as specified in the conceptual framework for the study are not working efficiently to produce the safe and clean environment. Hence the current hospital solid waste management practices are inefficient, ineffective, and can pose threat to the environment and public health. This may contribute to high morbidity and not checked may increase mortality in the affected towns.

CHAPTER FIVE

INSTITUTIONAL FRAMEWORK FOR MANAGING HOSPITAL SOLID WASTE

Introduction

This chapter focused on analysing the legal, organisational structure, and stakeholders involved in managing hospital solid waste in the region as captured by specific objective 3. It focused on the structural arrangement in the hospital, regulatory framework for managing healthcare waste, private sector participation in the healthcare activities, the role of other important stakeholders and how they are interconnected.

Institutional and Legal Framework for Managing Healthcare Solid Waste

In Ghana, there is a multi-sectorial arrangement for managing waste of all kinds including hospital solid waste. This multi-sectorial arrangement is between the Ministry of Local Government and Rural Development and the Environmental Protection Agency, the technical wing of Ministry of Environment, Science, Technology and Innovation (MESTI). These two have the regulatory and legal framework for managing waste as implementer and regulator respectively. The Ministry of Local Government has the decentralised District, Municipal and Metropolitan Assemblies through which it undertakes the implementation of its functions. Until 2017, the local government had the legal mandate to undertake storage, collection, transfer and transportation, treatment and disposal of waste in the country. In performing these functions, the national environmental policy has given the Assemblies the opportunity to engage private sector actors through contracting arrangements. However, the establishment of the Ministry of Sanitation and Water Resources in 2017 implies that this function may be transferred to the new ministry.

The Environmental Protection Agency also undertakes its regulatory work through its regional offices by setting out standards and guidelines for environmental activities. These regulatory guidelines and standards are normally expected to conform to international treaties and conventions that Ghana has signed on to and any other relevant regulation peculiar to the country's situation. They also undertake monitoring activities to ensure that people and organisations are complying with the environmental quality standards as an enforcement mechanism. In effect the promoted regulation of standard is expected to promote best environmental practices that will ensure environmental justice for both environmental quality and public health reasons.

With respect to healthcare waste management, the Ministry of Health which is the sector ministry has an oversight responsibility to develop policy for its management and Ghana Health Services has the implementation functions. However the Ministry plays a supervisory role to ensure that policies are implemented through other agencies of the ministry (Health Facilities Regulatory and Administrative Services). The ministry of Health has clearly stated that a performance agreement shall be between the Ministry of Health and all Agencies which include Ghana Health Service Which has direct responsibility for the management of the hospitals (Ghana Health Sector, 2014). An annual performance review has been instituted for the health sector to monitor performance of the sector. Ghana Health Service has been conducting this annual review which is used to rank the hospitals.

Ghana now can boast of a specific legislation or law that addresses the management of health care waste as Hazardous and Electronic Waste Act of 2016 (Act 917). There are guidelines and policies to guide hospital waste management practices. These include guidelines for health care and veterinary waste management developed by EPA in 2002, health care waste management policy and guidelines (MoH, 2006) and revised national environmental sanitation policy (MLGRD, 2010). Moreover, since this is an environmental issue, there are other laws in the country that touch on waste management practices which are equally important for health care waste management.

The Constitution of Ghana which guarantees the liberties and freedoms of all citizens also obliges them (section 41(k)) to exercise and enjoy their rights and freedoms in a way that protects and safeguards the environment. A portion of the Criminal Code, 1960 (Act 29) 296(1) indicates that it is a criminal offence for whoever places or permits to be placed, any carrion, filth, dirt, refuse, or rubbish, or any offensive or otherwise unwholesome matter, on any street, yard, enclosure, or open space, except at such places as may be set apart by the local authority or health officer for that purpose. The National Building Regulations, 1996 (LI 1630) provides that a building for residential, commercial, industrial, civic or cultural use shall have a facility for refuse disposal with a standardised dustbin or other receptacle approved by the District Assembly in which all refuse generated shall be stored temporarily. It also provides for transfer stations to be located within reach and preferably protected from rain and the prevention of spreading, pest infestation and scavenging activities (EPA, 2002; MoH, 2006).

It was found that Ghana developed healthcare waste management guidelines in 2002 through the Environmental Protection Agency (EPA) (EPA, 2002). These guidelines were informed by the World Health Organization's guidelines for healthcare waste management (Pruss et al., 1999). The national guidelines therefore became the basis for the Ministry of Health to develop a national policy in 2006 for healthcare facilities in the country. The aim of the policy was:

> *To ensure that healthcare waste is managed effectively in compliance with existing national laws and regulations and others to be passed in future in order to protect healthcare workers, their clients (patients, caregivers and visitors) and the environment from potentially disease-causing waste materials* (MoH, 2006, p 5).

The policy and guidelines were to be the standard operating procedure and for institutional monitoring and performance evaluation. Therefore all health institutions whether public, private, quasi-governmental, non-governmental or faith-based, that operate in the country at all levels are expected to use or comply with it (MoH, 2006). The main focus was to manage the hazardous component of the waste safely.

The institutional arrangement are very important for achieving good hospital solid waste management practices as advocated for by the integrated sustainable waste management concept (Van de Klundert & Anschutz, 2000). This ensures that the institutions roles are well defined to foster collaboration in managing hospital solid waste. The existence of a national policy and guidelines for hospital solid waste management is therefore appropriate to bring sanity in the system. This is in line with the position of the conceptual framework for the study.

The national policy classified waste into hazardous and non-hazardous and gave the steps to be followed in handling health care waste from generation, separation, coding, primary and secondary storage, collection, transportation, treatment and final disposal. It emphasises the need to keep records on waste management, train staff at all levels considering the low capacity of staff on the subject. Moreover various equipment, tools and technology requirements were mentioned but were left to each health facility to decide on which option to use considering their financial strength and other resource requirement for the adoption of the said technology. The policy recognised the need to operate incinerators in accordance with national and international regulations to reduce emission of gaseous pollutants (MoH Policy, 2006).

This was developed to operate on "Polluter Pays Principles (PPP) and Proximity Principles". The polluter pays principle states that the person who generated the waste has the responsibility to pay for the collection and cleaning up of the waste. In this regard, the onus lies on the institution in ensuring that waste is disposed of in accordance with laid down guidelines and regulations. Therefore, health care institutions are not exempted from this principle and as such they are responsible for the waste that is generated from their operations. The Proximity principle requires hazardous waste including health care waste to be disposed of at the closest possible location to its source of generation in order to minimise the risks involved in its transport. This can however be done with support from the private sector, the Ministry of Local Government and Rural Development as well as EPA (MoH, 2006).

Solid Waste Management Policy and Plans at the Hospitals

The national policy provides the broad framework for the management of health care waste from all health care providers in the country. The study expected that since the national policy existed and these hospitals had their own peculiar situation, they would have adapted this policy framework to guide them on their waste management practices but that was not the case. This is because the classification and policy requirments were not being followed. Four of the hospitals (Koforidua, Atuah, VRA and Orthopaedic hospitals) were able to produce copies of the national policy as exhibits whilst two (Donkorkrom and Holy Family) could not, though the document is available in both hard and soft copy form and could be accessed from the Ministry of Health's website.

On whether the hospitals have written policy for waste management activities, 148 (53%) of the respondents indicated that 'yes' whilst 131 (47%) said 'no' as shown in Table 13. This means that most of the staff either know for a fact or might have heard that the hospitals have policies to guide waste management activities. The 'no' response implies that either they were not aware of this document, have not been made available to them or it does not exist. Policies that are meant to help staff in waste management should normally be made available to staff to promote proper and safe practices. The responses from the interviews conducted pointed to the fact that the hospitals do not have their own policies but made reference to the national policy on healthcare waste management developed by Ministry of Health, which was not available to staff. This is actually conflicting with the responses given by the staff, which may mean that the respondents were giving responses to protect the image and the name of their hospitals or to make it look good.

Table 12: *Responses of Hospital Staff on Availability of Hospital Solid Waste Management Policy*

Name of Hospital	Yes	No	Total
Koforidua Regional Hospital	69	22	91
VRA Hospital	1	36	37
Donkorkrom Hospital	31	9	40
Atuah Gov Hospital	37	13	50
Holy Family Hospital	0	48	48
Orthopaedic Hospital	10	3	13
Total	148	131	279

Source: Field Survey, Amfo-Otu (2015)

Methodically, this affirms the strength of mixed method approach to research to find what the true picture of the situation is. Theoretically, since the policy was not available to them information on solid waste management was limited, and this will affect the behaviour of hospital staff according to Pred’s behavioural matrix. Mariwah (2012) indicated that farmers did not make rational decisions because of poor and inadequate information available to them on bank loans. From the conceptual framework, providing policy at the hospital level is an administrative function and an integral part of efficient hospital solid waste management which should not be neglected.

From Table 14, majority (69.2%) of the respondents were of the view that the hospitals did not have documented waste management plans. This means that either there were no plans indeed or people were not made aware of the existence of such plans. The interview results also indicated that some of the studied hospitals have conceived plans but not written them down. For instance the administrator for VRA hospital indicated that, management had taken a decision to buy and install new incinerators for both the hospital and domestic waste from the Akosombo community. More so the administrator at Holy Family Hospital said "… *we are planning to build our incinerator, so we have contacted Mechanical Engineering Department of Kwame Nkrumah University of Science and Technology (KNUST) to help us with the designs, and very soon we will get it finalised*" (F. Amo, personal communication, March 11, 2015).

Table 13: *Responses of Respondents on whether Hospitals have Written Waste Management Plans or not*

Name of Hospital	Yes	No	Total
Koforidua Regional Hospital	47	44	91
VRA Hospital	3	34	37
Donkorkrom Hospital	11	29	40
Atuah Gov Hospital	19	31	50
Holy Family Hospital	0	48	48
Orthopaedic	6	7	13
Total	86	193	279

Source: Field Survey, Amfo-Otu (2015)

It was found that hospital management members verbally discussed plans but there were no documented plans. Just as they plan to do certain activities in the next five years, the same principles should guide their waste management plans. Developing a waste management plan with the aim of reducing the volume of waste generated through waste minimisation practices will help reduce potential health risk to workers and societies, and the associated cost to make funds available for other use. For instance, if ten years ago they were burning hospital waste in an open pit, a five year plan can aim at autoclaving waste to recover valuables for the recycling industries.

Unit Responsible for Managing Hospital Solid Waste

Waste management activities are normally undertaken by a unit that has been assigned with this responsibility to plan, coordinate and implement policies and strategies to ensure safe management of waste of all kinds. Table 15 shows disparity in what unit handles hospital solid waste activities at different hospitals. Waste management activities may do well when handled by people trained for that purpose and have the technical expertise to plan and implement such plans. One of the unit heads (Environmental Health Officer) said "*I did not have any formal knowledge but have been learning on the job. The Ministry organised some training for us some time ago*" (R. Adzogu, personal communication, February 4, 2015). This means that some of the assigned officers do not have the knowledge and technical expertise to plan and supervise waste management activities at the hospital. As argued for in the conceptual framework, the head of waste management unit at the hospital should have the capacity to undertake the technical functions of, supervision and advising on technical matters.

Table 14: *Units Responsible for Solid Waste Management at the Hospitals*

Name of Hospital	Units responsible for Waste Management
Koforidua Regional Hospital	Environmental Health Unit
VRA Hospital	Environmental Health Unit
Donkorkrom Hospital	Maintenance Unit
Atuah Gov Hospital	Estate Management Unit
Holy Family Hospital	Hospital Administration
Orthopaedic	Estate Management Unit

Source: Field Survey, Amfo-Otu (2015)

From Table 16, majority (51.3%) of respondents either disagreed or strongly disagreed that the waste management departments were well resourced to conduct their work well. This means that staff were of the view that resources required by the healthcare waste management department were not adequately provided for. This indicates how administrative roles are being neglected among studied hospitals, and this will affect any effort of managing hospital solid waste efficiently as indicated in the conceptual framework. The departments depend on hospital administrations for resources and therefore if they are not supplied with the required resources, the departments cannot properly function. This phenomenon of dependency of the department on resources is well articulated by the resource dependency theory.

Table 15: *Hospitals with Staff Responses on Resourcefulness on the Environmental Department*

Name of Hospital	Strongly disagree	Disagree	Agree	Strongly agree	Total
Koforidua Regional Hospital	21	24	30	16	91
VRA Hospital	8	9	16	4	37
Donkorkrom Hospital	7	12	6	14	39
Atua Gov. Hospital	13	11	5	20	49
Holy Family Hospital	2	29	11	6	48
Orthopaedic Hospital	3	3	2	5	13
Frequency	54	88	70	65	277
Percent	19.5	31.8	25.3	23.5	100.0

Source: Field Survey, Amfo-Otu (2015)

The chi-square results from the cross tabulation of the type of hospital and the statement that healthcare waste management department was under resourced was significantly different [X^2(15, n = 277, = 53.2, p = .001, V = .253]. This implies that staff from different hospitals held different views as to the resourcefulness of the departments supervising the waste management activities. The result from the interviews show that some of the officers were of the view that management of the hospitals were doing their best to supply them with the resources needed by their units but could do more. Some expressed their frustration at getting their broken incinerators fixed which was affecting their operations. The reality is that the units are not well resourced from human resources to logistics due to limited resources available to administrators and also priority given to patient care issues.

Linkages between Hospitals and other Stakeholders in Waste Management

It was found that the hospitals had one or more links with other institutions in managing their solid waste. These institutions include the Municipal and District Assemblies, EPA, Private Company (Zoomlion Ghana Limited), World Health Organisation (WHO) and other community based organisations (CBOs). The collaboration between the hospitals and their District Assemblies on solid waste management was not strong. This is because the hospitals managed their waste themselves or have contracted it out to private companies. The Metropolitan, Municipal and District Assemblies normally sent the Environmental Health Officers to inspect communities and in the process visited these hospitals once a while. This was mostly applied to those who did not have Environmental Health Officers attached to them. Four of them indicated that they have not had any query or issue with the district assembly on their waste management activities whilst two indicated that they once came in to advise them on their wastewater system but not on solid waste.

This means that the role of the municipal and district assemblies in managing waste at the hospitals was limited. This may be due to the peculiar nature of hospital waste, the fact that most of them were government agencies or because of the position of the national policy on healthcare waste management. The policy position is that hospitals or healthcare facilities which do not have the capacity to transport and treat their waste can contract healthcare waste management company licenced by the District Assembly to offer such services (MoH, 2006). This may be stemming from the fact that Ghana is operating on the principle of polluter pay principle in waste management. Zoomlion Ghana Limited as the private company had contracts with all the Assemblies where the hospitals were located but there was nothing to show certification to collect hospital waste.

The contract arrangement was between their regional or district office of the company and the hospital administration. There were no other waste management companies in these areas to compete with the private service provider and therefore they had no alternative than to sign on the same company. Dependency of three hospitals on the only private company within the districts may create some power imbalance between the hospitals and the private company as explained by the dependency theory. For hospitals to manage their dependency, they need to install appropriate waste treatment technologies, have alternative service providers, and reduce their waste generation rate.

The metropolitan, municipal and district assemblies provided dumping site for the disposal of waste within their jurisdiction. These sites were found to be managed by the private company (Zoomlion Ghana Limited) on behalf of the assemblies. As already indicated in chapter four, two of the sites were open dumps with occasional pushing of waste at the site whilst the other was a controlled dumpsite. However, the Assemblies expressed their frustration at the way sometimes the hospital solid waste was dumped.

The Municipal Environmental Health Officer for Akuapem North indicated that "…*in the past some health facilities dumped sharps and other infectious waste at unauthorised places, therefore bringing it to the municipal dump site is better for us though the site is not the best for handling such waste*" (S. Agyemang, personal communication, March 26, 2015). This statement means the hospital solid waste management situation in the area is improving, despite the existing challenges. This agrees with the report by AERD (2009) that in Ghana disposal at municipal dumping sites is commonly practised. It was indicated that though they did not have any documented criteria for certifying the companies to collect hospital waste, once they have waste collection contract with the Assembly it should suffice for these companies to provide similar services to the health care facilities.

Environmental Protection Agency's role in Hospital Solid Waste Management

Hospitals were asked about their relationship with EPA in their waste management practices. It was revealed that EPA did not have problems with them as far as their waste management was concerned. It was only at the private hospital where it was indicated that representatives of EPA occasionally visited them to inspect their waste management practices. Such inspection concentrated on the secondary storage and treatment technology used and the possible environmental and public health consequences. It was said that "*they normally give us recommendation to improve on our practices and management also adhered to such recommendations and therefore we do not have any problem with EPA"* (E. Tanko, personal communication, March 25, 2015). These findings imply that the representatives of the EPA do not visit the government, Christian Association and quasi-government hospitals but rather the private hospitals, mostly per year.

An interview session with the officer responsible for the Built Environment Unit of the EPA Eastern regional office in Koforidua confirmed their visits only to private health care facilities. It was indicated that before a hospital begins operation, they were required to complete environmental screening forms. As part of the environmental screening for issuance of permit an assessment of their waste management plan and strategies was done. If a hospital did not have such a plan they were not allowed to operate until they have put in place all the required facilities which should have been well spelt out in the plan submitted to the Agency. Sometimes they were asked to seek for help from professionals to assist them develop such plans. It was found that EPA had some criteria for assessing the plans and any one that failed to meet the criteria was rejected. The content of waste management plan was expected to address issues on objectives of hospital's activities, description of the activities, description of waste to be generated (type and quantities), method of collection, mode of disposal, waste monitoring plans and any other relevant information.

The plans were assessed using the above listed criteria for evaluation as to whether the facility merited the permit or not. Moreover, environmental impacts of the undertaking were to be identified and appropriate mitigation measure proposed at the screening stage. Occupational health and safety related to waste and environment with their corresponding mitigation measures were expected to be addressed by the applicant. These actions by EPA are important for protecting and safeguarding the health of the public and the environment. This emphasises the importance of enforcement of permitting processes among all public hospital facilities because they generate more volumes of solid waste. This will help in avoiding selective environmental justice among the health care facilities.

As to whether EPA has any major role in the work of the private waste management company, the Build Environment Officer indicated that they do not play any major role. The reason was that the private waste management companies are working under contract with the metropolitan, municipal and district assemblies. It emerged that EPA only participated and assisted the assemblies to acquire their final disposal sites for their waste management activities. The day to day management of the dumpsite is the responsibility of the assemblies therefore EPA did not interfere with such activities. However, they occasionally cautioned the assemblies when they are not complying with environmental regulations governing the operations and management of dumpsites.

EPA is not satisfied with the management of dumpsites in the region, because the region has no engineered landfill for dumping of waste. All the waste from different sources are dumped at the same place which does not conform to best environmental practice. She mentioned that practices such as open burning of waste, non-collection of leachate for treatment, non-application of daily or weekly cover material at the dump poses major environmental and public health threat to all as alluded to in the conceptual framework. These practices are inimical to the right and liberty of people living near the dumpsite and everybody in the society because of the toxic emissions that is associated with such practices (ISWA, 2015). The environmental effects of leachates, for instance, on both groundwater and surface water quality cannot be over emphasised (ISWA, 2015; David, & Oluyege, 2014).

As to how to deal with the bad environmental practices and to ensure proper management of hospital solid waste, it was revealed that the EPA believes in addressing the issues from regulatory and practical perspective. It came up that EPA developed guidelines for the management of health care and veterinary waste in Ghana in 2002. This was to promote proper management of health care waste in the country. This was done in consultation with other relevant stakeholders such as the Ministry of Local Government and Rural Development, Ministry of Health, World Health Organisation, and many others. With regard to the practical perspective, the

Agency have in place guidelines for landfill design, operation and management. These two documents including the impact assessment requirements have been developed to ensure proper management of health care and other related solid waste management in the country.

The built environment officer of EPA in Eastern Region indicated that, the agency has challenges in dealing with some of the public entities just as the Assemblies have their own challenges. "… *I must say that the metropolitan, municipal and district assemblies have numerous challenges in dealing with health care waste management and the proper operation and management of dumpsites just as we do*" (J. Mortey, personal communication, April 22, 2015). Some of the major challenges mentioned as confronting the agency have to do with the staff strength at the regional and district levels because the agency only have staff at the regional level. All the Assemblies are supervised with the scanty staff from the regional office and national service personnel are sometimes used at the assembly level to monitor situations on the ground. It was indicated that the time has come for the agency to plan and operate offices at the various assembly levels.

The Environmental Protection Agency also has some challenges dealing with the Assemblies when they fail to manage their dumpsites well, and steps are taken to close such sites down. The question that normally comes up is where the assembly should dump their waste since land acquisition for such purpose is difficult now. The officer indicated that "…*some state institutions think that we all belong to the same government so we should understand their plight, which does not allow us do our work in the best way as we should*" (J. Mortey, personal communication, April 22, 2015). Sometimes the directors of the Assemblies and EPA are able to discuss any difficulty they face and solutions are found to them. The Assemblies have challenges in addressing the dumpsite management issues which include the equipment and human resources required to manage the sites, and the bad attitudes of waste management practices of the citizens. For instance where some people add all kinds of materials including fire residues or ash into waste storage facilities for dumping which normally contribute to fire outbreaks at the dumpsites. Considering all these difficulties, the agency sometimes has to consider the national interest and the immediate need of the Assemblies to allow them to operate the dumpsites. This may explain the findings by Wilson et al. (2006) that stakeholders like EPA and municipal assemblies did nothing to check bad waste management practices at the hospitals and dumpsites.

These difficulties reflect the dependency of the hospitals on the Assemblies to manage their solid waste safely at the dumpsites. The probable alternative is for them to apply the proximity principle and dump it close to their operational areas. As indicated by the resource dependency theory, the hospitals may have to look for better alternatives of managing dumping of waste at the Assemblies dumpsites. Proper collaboration between the hospitals, Assemblies, EPA and possibly the private sector can provide the answer to the resource constraints as a way of modifying their resource dependency indicated in the resources dependency theory (Pfeffer & Salancik, 1978) and integrated sustainable waste management concept (ISWM) (van de Klundert & Anschütz, 2001). EPA can provide technical support, private sector can mobilise logistical resources and the Assembly can provide operational staff for dealing with the hospital waste management challenges. Engaging the private sector to provide waste management services at the hospital can be a way of diversifying dependency of hospitals in managing their solid waste.

Reference made to the bad attitudes of the citizenry in dealing with waste management issues emphasise the role of individual attitudes in managing waste. The attitudes are shaped by culture, beliefs and information on expected attitudes of society members as indicated (Agwu et al., 2012). Desa et al. (2012) reported bad attitudes of students toward waste management using the theory of planned behaviour among students in Malaysia.

Interferences experienced occasionally by EPA from some state officials may not be in the best interest of protecting community members and the environment. This will stifle the effort of the EPA in ensuring compliance with environmental regulations. As indicated in the conceptual framework (Fig. 5) EPA (regulatory agency) needs to work freely without interferences to protect the environment through enforcement of environmental quality regulations. The national function need to be performed with the focus of protecting public health and the environment otherwise the output function will be negative and the consequences may not be acceptable.

Private Sector involvement in Managing Hospital Solid Waste

Private sector participation has been argued to be beneficial because of efficiency in service delivery and reduced bureaucracy but not a panacea for solving solid waste management challenges generally (USAID, 2009).

The health sector acknowledges the role of private sector to augment their waste management activities. Therefore the national policy on health care waste management indicated the need to engage the private sector where the hospitals do not have the capacity (MoH, 2006).

The study examined the role of the private sector in the hospital solid waste management and the working relationships with the hospitals, assemblies and EPA. It was found that the private company collecting hospital waste within the region is Zoomlion Ghana Limited. The company which was established in 2006 to undertake waste management activities in the country has offices at each regional and district capital. The company dealt more with the metropolitan, municipal and district assemblies in managing waste. This was so because the laws of the country empower the Assemblies to manage the waste on behalf of the people as public goods. The assemblies have jurisdictional power over all waste management activities and issue licences to companies to operate.

Moreover, all waste management contracts in the Assemblies were awarded by the Assemblies through the Chief Executives and the Coordinating Directors, except those agreements with individual institutions. In situations where a private company is providing solid waste management services to households or institution, the Assembly has to issue business operating permit and sign contract with the waste company before they can operate. The working relationship between the private company and the Assemblies gave them the privilege to have contracts with various kinds of institutions to provide waste management services, including health care institutions.

The services provided by the private company to the hospitals differed and these were spelt out in the contract terms. The private company did not have its own disposal site or special facility to manage the healthcare waste collected from the health facilities, but dumped at the metropolitan, municipal and district assemblies' dumpsites. The company however assisted the Assemblies occasionally with equipment and resources to push and compact waste to manage the dumpsite. The resource assistance given by the private company reflects the strength in stakeholder collaboration as emphasised by the ISWM concept (van de Klundert & Anschütz, 2001). Moreover, the use of the Assemblies dumpsites by the private company indicates resources dependency of stakeholders. It was pointed out that during raining seasons the trucks find it difficult to access the dumpsites which affected their operations. This difficulty was attributed to the poor conditions at the dumpsites. This implies that there is inadequate infrastructure and resources to manage the waste dumpsites, which affected operations at the dumpsites.

The supervisors indicated that "…*sometimes we have to do disinfection at the site to reduce the smell and flies to make the place conducive for our staff to work*" (R. Tetteh, personal communications, April 21, 2015). Smell, flies, leachates production are the characteristics and weakness of open dumpsites (ISWA, 2015; Remigios, 2010). The smell and flies from the dumpsites can contribute to spread of diseases in the nearby communities (ISWA, 2015). Disinfection activities that are occasionally done at the dumpsites are an important measure to reduce any health threat to the communities. The statement further underscores the relevance of ensuring occupational health and safety of the workers at the dumpsites in order to protect them.

For the effects of the dumpsites on the environment, it was indicated that since the dumpsites were not engineered and the operations were not up to standard as expected and this can affect groundwater quality, some leachate can affect soils and surface water bodies. These effects are truly associated with operation of open dump as reported by UNEP (2013) that improper hospital waste management at the open dumps can lead to land, surface and groundwater pollution, create contaminated sites and emit toxic gases.

According to the operations supervisors of the private company, challenges associated with hospital solid waste management at the dumpsites included deflating of tyres of the dump trucks by sharps objects, infection of workers with infectious diseases and psychological effects when human parts are mixed with the waste. Deflating truck tyres normally increases the operational and maintenance cost. Adoption of an appropriate separation and treatment system for such waste in order to reduce hazards to the environment and public health cannot be ignored. This indicate the need for proper training on health care waste management to the staff of the private company as well as the management of the hospitals to help deal with some of the challenges.

On the question of the effects of scavenging on the health of scavengers since hospital waste were mixed with the domestic waste at the dumpsites, the supervisors indicated that it can have negative effects on their health. This can be possible due to exposure of scavengers to possible infectious waste from the hospitals at the dumpsites, and generally to the domestic waste (WHO, 2004). The supervisors of the private company indicated that since the locations of the dumpsites were within 1.5 - 2.5 km from main communities they cannot pose any major danger to public health, but to the environment. A resident living near the dumpsite at Koforidua complained about the ordeal they have been going through that:

> "…*The dumpsite is creating problems and worrying us, scent from the place is too much for us to bear especially when it rains. Almost every time there is fire burning in the dumped waste, this brings smoke to our homes and the entire area which sometimes makes it difficult for us to stay here*" (K. Kumi, personal communication, April 8, 2015).

The current practise is not only a threat to the residents in the area but even motorist since the dumpsite is close to the road side. It has been reported that health risks may be generated through the release of toxic pollutants during dumpsite open burning or accidental fires (WHO, 2004). The statement by the resident indicates his exposure to the emissions from the dumpsite. Meanwhile it has been reported that exposure to hazardous wastes in dumpsites are a real threat for the lives of the workers and the nearby residents, and accounts for 19% of cancer incidence worldwide (Vineis & Xun, 2009).

In terms of the collection and transportation practices, it was observed that the collection company mixed the waste from the private hospital to domestic waste collected from the community to disposal site. However, the government owned containers were rotated by the waste collection company which

Service agreement between hospitals and service providers

There was no comprehensively written contract between the hospitals and the private collection company but had to complete service provision form designed by the company for the domestic waste collection purpose in two of the hospitals. Two of the officers responsible for the waste management at the hospitals did not have copies of the signed contract with them. It was indicated that due to the financial matters, copies of the agreements were given to the finance directors of the hospitals so it could aid in processing of payment to the contractor. The implication is that information in the contract may not likely be communicated to staff of the hospitals and therefore they will not know what they are required to do in the contract. Sharing information on the contract is important for decision making among workers as amplified in the Pred's behavioural matrix. In some circumstances, inadequate information can spark role conflict among the staff of the waste company and the hospitals.

The duration of the agreement with two of the hospitals was for about five years but could be abrogated by each partner upon written notice indicating the reasons for the abrogation. As part of the contract arrangement the private company provided 240 litre waste storage bins at a vantage point for the regional hospital, provided seven (7) sanitation labourers to empty the waste in 240 litres into a bigger metal container (12 m^3) located within the hospital premises. This skip container was emptied twice per week amounting to about three and half storage at the hospital. The total haulage therefore amounted to eight collection times per month. They were to ensure the general cleanliness of the compound and timely emptying of the waste bins at the appropriate disposal places. The Hospital was charged based on the number of bins supplied and haulage service, the cost of maintaining and managing the labourers and rental of the 12 m^3 communal container.

At the Atua government hospital a number of the 240 litres containers were placed at vantage points and one 12 m^3 metal communal container which was rented out to the hospital on monthly basis by Zoomlion Ghana limited. The company did the haulage of the communal container to the disposal sites every two weeks amounting to twice a month collection to disposal site. It was indicated that the volume of waste produced by the hospital was not so much to warrant per week collection service since that will increase the service cost. The district supervisor however indicated that they made recommendation to the hospital to either buy the covered container so that the company will only offer haulage service but the hospital management thought that would not be the best option.

At these two hospitals, the rental charges were the same (Gh¢ 150 per month) and haulage fee of two hundred Ghana cedis (Gh¢ 200) per haulage. This means that the more haulage the company make the higher the service charge, therefore the decision to limit the haulage frequency was informed by the cost which invariably related to the quantum of waste produced. As to whether the hospitals were satisfied with the services of the private company, it was indicated that "yes" as far as there was no alternative.

A complaint was made at Atua hospital of occasional delay in haulage of waste on agreed date, contributing to overflow and spill of the waste around the container. However, the agreement did not cover who was responsible for managing the container site (cleaning the site). This means that overflow of waste occasionally occurred at the hospital and there were some role conflicts. The spillage can contribute to spread of infectious agents through exposure. The hospital however admitted that they also sometimes delayed payment to the company for services delivered. The delay was linked to National Health Insurance Authority not paying for services rendered to card bearers promptly. This complaint was made across all the hospitals studied.

At the private hospital it was found that Zoomlion Ghana Limited gave out 10 of the 240 litre waste bins to the hospital and serviced them once per week. The collection was done by using compaction trucks which provided services to other domestic and private institutions within the municipality. The hospital was charged based on the number of bins provided by the private company at a rate of twenty Ghana cedis (GH¢ 20) per month per waste bin which amounted to two hundred Ghana cedis (Gh¢ 200) per month. The contract duration was two years renewable. When asked if the hospital has been performing their part of the agreement, it was indicated that the hospital complied in terms of washing of storage bins but payments have always been delayed for at least two months. This means delayed payment by the National Health Insurance Authority, affected the hospitals ability to pay for waste management services and subsequently the operations of the private company was affected. This can affect investment in infrastructure, technology and supply of resources by the hospital for managing hospital solid waste efficiently.

It was observed that those who had contracted the services of the private waste company had more waste bins for storage outside the wards compared to those who managed their own waste. This means resources for managing waste outside the wards were born by the private company which depicts clear case of resources dependency theory. However, service frequency was better among those who managed their own waste than the privately managed which reflected the complaint made by Atua Government Hospital. It however took of the burden of employing casual labourers from the administrators of the hospital. In terms of the collection and transportation practices, it was observed that the collection company mixed the waste from the private hospital to domestic waste collected from the community to disposal site. This means if the hospital waste contains infectious material it will affect the domestic waste so mixed with.

Support from International Development Partners, NGO's and CBO's

Another private entity that supported the hospitals with some infrastructure for hospital waste management activities was the World Health Organisation (WHO). This service support was given to the hospitals through the Ministry of health and Ghana health service such as construction of De-Montfort incinerator. This means that they did not deal directly with the hospitals for the treatment of sharp waste. This implies that no direct contract was signed between the hospitals and WHO. The incineration facility was provided to the public hospitals to deal with the sharps from vaccination or immunisation activities carried out within the assemblies.

When asked if other non-governmental organisations (NGO's) have offered support or have any arrangement with the hospitals to assist them, the responses were varied. At the regional hospital, it was indicated that UNDP through the Ministry of Health and Ghana Health Service have pre-selected them to benefit from healthcare waste management project yet to be implemented. They were however not sure if they were going to be finally selected to benefit from the project. Interventions from the project were installation of non-incineration technology for treating infectious waste and capacity building for staff on hospital waste management. This implies that some international development agencies have taken the initiative to help address the challenges confronting hospital facilities in managing their generated solid waste. Installation of non-incineration treatment technology is in line with the current global trend to use best environmental techniques that sterilised waste and aid in resource recovery (WHO, 2013; UNEP, 2012). No other local NGO has approached the hospitals to assist in hospital waste management. This may mean that, either funding agencies or NGO's do not consider hospital waste management as a problem.

At the Christian health association of Ghana facilities, it was indicated that the churches do offer support to them when there are critical needs. The administrator at Nkawkaw indicated that "when *the hospital started, services were free to patients and the Catholic Church paid all the bills, so we had more patients and even now some still come for health care services without paying any fee*" (F. Amo, personal communication, March 11, 2015). The import of the statement is that, in the past the hospital was receiving support from the Catholic Church but this has stopped, therefore patients pay for health care services. At VRA and the Orthopaedic hospitals, it was indicated that they have not had any support from either NGO or international development partners to deal with waste management and its related issues. This confirms the need to support the private health care facilities because if anything goes wrong with the waste management in the private hospitals, the spill over will affect the whole society.

At Atua government hospital other community based organisations (CBO's) such as youth groups, churches, keep fit clubs, political party groups and schools have supported the hospital in maintaining clean environment. These groups normally carried out clean-up exercises at the hospital premises occasionally to improve the aesthetics beauty of the hospital. Sometimes donations of cleaning tools and equipment were made to the facilities by some of these groups. Though this is not directly related to the hospital solid waste generated at the hospitals it is an environmental activity that can increase the generation of solid waste produced at a time.

Inter-hospital linkages for Hospital Solid Waste Management

From the studies it was found that the studied hospitals did not prove direct support to each other but for other facilities. For example, Koforidua hospital was receiving waste from two other health facilities (SDA Hospital and Polyclinic in the New Juabeng Municipality) for treatment by incineration. Furthermore, Atua Government Hospital indicated that they had a mobile incinerator which they were using to support other smaller health facilities though at the time of the study it had broken down and was on repairs. These two cases mean that there is an interdependence of some health facilities on others that have the required waste management resource to treat their waste. This is in line with the resource dependency theory underpinning the study as well as integrated sustainable waste management concept. The practice can yield positive results when facilities share waste treatment technology to leverage on high investment cost of procuring treatment technology.

Financing of Waste Management Activities in the Hospitals

The activities of the public hospitals were financed by Government through the Ministry of Health, Ghana Health Service and National Health Insurance proceeds as well as internally generated funds. Health care facilities had financing difficulties, from budgetary problems and payment for services rendered to National Health Insurance Scheme beneficiary. These financial challenges affected the infrastructural drive and provision of the required logistics for hospital solid waste management. This was clearly visible at the hospitals where funds were not available for maintaining damaged incinerators. This finding is similar to Bamfo-Tanor and Owusu-Agyei (2013) who reported that in Ghana hospital waste have been managed without the appropriate infrastructure and financing.

It was found that all the facilities did not have separate budget lines for hospital solid waste management activities but operated a general housekeeping budget for environmental cleaning services. This cleaning service comprise of procurement and supply of janitorial cleaning related tools and equipment, chemicals, detergents, implement for weeding of compounds, cess-pit emptying and hospital solid waste management equipment, tools and accessories. Budgetary challenges faced by hospitals is similar to the findings of Alagoz and Kocasoy (2008) in Istanbul that low budgetary allocation affected the ability of the hospitals to employ staff for waste management. The conceptual framework for this study indicates that proper budgetary allocation for hospital waste management is a critical administrative function that can affect availability of financial resources for waste management activities.

Since heath care facilities prepared composite budgets for bulk activities and not based on single unit activities it was difficult to easily isolate solid waste management cost and expenditure. This may contribute to the neglect of the logistics required for managing health care waste once no specific budget is made for such an important service. Funds meant for waste management activities could easily be used to address other seemingly important and prioritised needs of the hospitals. It is therefore imperative and prudent to have separated budget lines and dedicated (available) funds for managing hospital solid waste. For instance maintenance of incinerators which are not working can be partly attributed to lack of funds for maintaining waste management technologies and equipment.

CHAPTER SIX

HOSPITAL STAFF AWARENESS OF HEALTH HAZARDS AND ATTITUDES TOWARDS WASTE MANAGEMENT ACTIVITIES

Introduction

This chapter assessed hospital staff awareness of health hazards associated with hospital solid waste, attitudes towards waste management activities and the department. Moreover, it examined the waste management practices of the staff considering their awareness level and attitudes.

Hospital Staff Awareness of the Health Hazards Associated with Exposure to Hospital Solid Waste

Most of the hospital staff (63.6%) were aware of health hazards associated with their work at the hospital whilst 36.4 percent were not aware as shown in Table 28. This finding is different from what was reported in Hawassa city of Ethiopia, where most (56%) waste handlers did not have knowledge of the potential health hazards of hospital solid waste (Haylamicheal, 2011). Those who were not aware though in the minority conveyed very important message about the need to sensitize workers of the health hazards embedded in their work so that the necessary safety precautions can be adopted. Close to half (44.2%) of those who indicated that they were not aware of the health hazards were workers of Holy Family hospital and a little over one third were from VRA Hospital (34.7%) (see Table 16). This implies that the awareness of staff on health hazards associated with their work is low in these facilities which are not government owned. The may also means that not all the hospitals have trained or provided information to staff on hazards related to their work or such trainings did not adequately address occupational hazard from hospital solid waste or they were not done at all.

Table 16: *Respondents Awareness of Health Hazards linked to their Work*

Name of hospital	Responses		Total
	No	Yes	
Atuah Gov Hospital	4	43	47
Donkorkrom Hospital	3	32	35
Holy Family Hospital	42	2	44
Koforidua Regional Hospital	11	78	89
Orthopaedic	2	8	10
VRA Hospital	33	3	36
Frequency	95	166	261
Percent	36.4	63.6	100.0

Source: Field Survey, Amfo-Otu (2015)

A total of 95 (36.4%) of those who are aware of the health hazards linked to their work were females and 71 (27.2%) were male staff whilst 40 (15.3%) and 55 (21.1%) males and females respectively said they were not aware of these hazards (Table 17). A chi-square test for independence indicated no significant association between the sex and awareness of health hazards linked to the work of hospital staff, χ^2 (3, n= 261) = .001, p=1.0, phi = -.006. This implies both males and females staff members were privy to either the same information, training or none which related to their work and the hazards they face. Therefore the level of risk of exposure due to unawareness of the health hazard associated with their work will be the same for both males and females.

Table 17: *Respondents Awareness of Types Hazards linked to their Work*

Sex of the Respondent	Responses		Total
	No f(%)	Yes f(%)	
Male	40 (15.3)	71(27.2)	111(42.5)
Female	55 (21.1)	95 (36.4)	150 (57.5)
Total	95 (36.4)	166 (63.6)	261 (100.0)

Source: Fieldwork, 2015

Respondents listed types of hazards linked to their work to include infections due to exposure to microorganisms (21.3%) (HIV, hepatitis, tuberculosis, etc.), needle pricks (38.6%), cuts from sharp objects (15.2), injury due to splash of harmful fluids (5.3%), chemical hazards (10.2%), electrical hazards (3%), exposure to radioactive substance (3.1%), slip and fall (1.5%), physical attack by patients (1.2%) and exposure to bad odour and scent (0.6%). These hazards listed may reflect the task people are performing in the hospital and the possible dangers that confront them. These results indicate that hospital staff recognises the danger associated with exposure to potential infectious agents, needles and other sharp objects as the most probable predominant hazards at their work place. This implies that information about health hazards at work is probably concentrated on sharps. According to Manyele (2004), the only publicized health hazard to workers is the spread of disease from contaminated sharps.

Table 18: *Respondent's association of Hazards related to Hospital Solid Waste*

Name of hospital	Responses on type of hazards: sharps	infectious organisms	chemical hazards	radioactive hazards	cytotoxic and genotoxic	all of the above	none of the above	Total
Atuah Gov	13	4	3	1	0	28	1	50
Donkorkrom	8	2	2	0	1	24	3	40
Holy Family	21	5	2	0	9	10	1	48
Kof Regional	31	4	4	1	2	47	2	91
Orthopaedic	3	0	2	0	0	6	2	13
VRA	7	2	2	0	0	24	2	37
Frequency	83	17	15	2	12	139	11	279
Percent	29.7	6.1	5.4	0.7	4.3	49.8	3.9	100.0

Source: Field Survey, Amfo-Otu (2015)

On type of hazards that can be related or ascribed to hospital solid waste management, responses ranged from hazards from sharp objects (29.7%), with most of them (49.8%) indicating all the hazards listed in Table 18. However, some of them lacked the necessary knowledge and therefore indicated that none of these hazards (3.9%) can be linked to solid waste management in the hospital. There was significant difference between the hospitals and the staff attribution of type of hazards to solid waste management ($\chi^2(30, n=272) = 57.4, p= .002, V = .205$). This difference indicates that not all the hospitals have introduced their staff to the health hazards of hospital solid waste.

There were various ways through which people got to know of these hazards. Table 19 shows how 273 (97.8%) valid respondents got to know these hazards from different sources with 69 (25.3%) of them being through on the job training and 93 (34.1%) through all the three modes.

Table 19: *Source of Information to Respondents on Hazards associated with Hospital Solid Waste*

Name of Hospital	Responses					Total
	Personal reading	Formal education	Job training	All the above	None of the above	
Atuah Gov	10	20	10	10	0	50
Donkorkrom	6	4	8	20	0	38
Holy Family	10	12	12	13	0	47
Kof Regional	18	19	26	28	0	91
Orthopaedic	2	0	4	5	0	11
VRA Hospital	7	2	9	17	1	36
Frequency	53	57	69	93	1	273
Percent	19.4	20.9	25.3	34.1	0.4	100.0

Source: Field Survey, Amfo-Otu (2015)

However, six (2.2%) of the respondents did not answer this item whilst one (0.4%) indicated that none of these sources helped them to know these hazards. Those who got to know it through on the job training were nurses (29.0%), orderlies (24.6%) and midwives (13.0%). It was found that 49.1 percent and 64.7 percent of those who got to know these hazards through personal reading and formal education, respectively, were nurses. This is in line with the conceptual framework that formal and on the job trainings are important in building staff capacity on hospital solid waste.

It implies that not all the hospitals have introduced the staff to the occupational hazards associated with their work. This implies that when on the job training is structured well for staff, it helps them to sufficiently become informed of their work environment which can help avert or reduce exposure to possible health hazards. It has been found that some health care staff demanded for regular educational program/training on biomedical waste management to improve on their awareness about disease transmission from hospital solid waste (Chudasama et al., 2014). Hospitals that do not make deliberate effort to train their staff on the job are likely to expose these workers to hazards that they may not be aware of, which could ultimately affect their health and productivity at work. It could be that others had alternative ways of knowing these hazards which were not necessarily linked to hospital solid waste management.

Out of the total respondents of 279, 116 (41.6%) agreed that they were trained on hospital solid waste management during their formal education as health professionals, whilst 36 (12.9%) strongly disagreed with the statement (Table 20). This implies that most of the workers have actually obtained their knowledge and information on health care waste management during their schooling time. This gives the idea that the curriculum of the health training institutions covers issues on health care waste management.

Despite all the challenges with waste management practices, about 36.9 percent of the respondents agreed that the level of training they have received so far on hospital solid waste management was adequate and that they have been well trained (Table 27). However, most of them (59.8%) either strongly agreed or agreed and the rest (40.1%) disagreed or strongly disagreed.

Table 20: *Education of Respondents on Hospital Solid Waste Management during Professional Training in School*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	7	4	19	20	50
Donkorkrom Hospital	7	3	20	10	40
Holy Family Hospital	2	8	22	16	48
Koforidua Regional Hospital	14	17	30	30	91
Orthopaedic Hospital	3	1	6	3	13
VRA Hospital	3	2	19	13	37
Frequency	36	35	116	92	279
Percent	12.9	12.5	41.6	33.0	100.0

Source: Field Survey, Amfo-Otu (2015)

This is different from what was reported by Haifete, Justus and Iita, (2016) where only 43(43.0%) staff were trained and 57(57.0%) were never trained on waste management. The level of agreement of staff from different type of hospital with the adequacy of staff training on hospital solid waste management was however not statistically different [χ^2(15, n =279, = 22.0, p = .107, V = .162]. This means that whether hospital is private, government, quasi-government, and located in rural or urban centre they have been trained well on hospital solid waste management or the reverse is true.

Table 21: *Staff Agreement that they have been well trained on Hospital Solid Waste Management by their Hospitals*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	14	8	20	8	50
Donkorkrom Hospital	8	13	15	4	40
Holy Family Hospital	6	6	18	18	48
Kof Regional Hospital	18	23	27	23	91
Orthopaedic	2	1	7	3	13
VRA Hospital	5	8	16	8	37
Frequency (N)	53	59	103	64	279
Percentage (%)	19.0	21.1	36.9	22.9	100.0

Source: Field Survey, Amfo-Otu (2015)

On whether hospital solid waste management can contribute to the spread of nosocomial infection, it was found that 39.4 percent of the respondents strongly agreed to this assertion with 30.5 percent strongly disagreeing (Table 21). This means most of the staff agreed (58.8%) and were aware that outbreak of infection within the hospital can be attributed to hospital solid waste management practices.

The finding of this study is consistent with the study done in South Africa which indicated that most of the health care workers (98.5%) agreed that improper management of health care waste could lead to transmission of infections among hospital staff and patients (Ramokate & Basu, 2009). Moreover, other studies have reported that most staff (92.1% - 98.0%) were aware of improper hospital solid waste management contributing to infections (Wesee, Hassan, Baba, Kadri, & Nazi, 2007).

Table 22: *Respondents Agreement on Hospital Solid Waste Contributing to Nosocomial Infection*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Hospital	3	2	11	34	50
Donkorkrom Hospital	6	3	8	21	40
Holy Family	36	11	1	0	48
Kof Regional Hospital	12	5	28	46	91
Orthopaedic	1	1	4	7	13
VRA Hospital	27	4	2	2	37
Frequency	85	26	54	110	279
Percent	30.5	9.3	19.4	39.4	100.0

Source: Field Survey, Amfo-Otu (2015)

Even though respondents who either disagreed or strongly disagreed were in the minority (39.8%) it is still high. This is important for management to make deliberate effort to create the necessary awareness among staff about the possibility of hospital solid waste management practices contributing to infection in the hospital. If the respondents agree that the hospital solid waste can contribute to the spread of nosocomial infection, then it can as well be inferred that the same waste can contribute to infection wherever it is found. The result also implies that the awareness of staff on potential of hospital solid waste contributing to nosocomial infection is different among the staff of the different hospitals. This means some staff of some hospitals are more aware on the subject than others. The implication is that those who are not aware may not exhibit good waste management practices at the hospital and their action may contribute to increase in nosocomial infections in those hospitals.

This finding is consistent with the conceptual framework for the study that if administrative function of providing training and information to staff fails, individuals will be exposed to the threat of infections of all kinds. More so, it is consistent with Pred's behaviour matrix (1967) that adequate information contributes to awareness creation for proper decisions to be made on waste management practices to prevent possible infection. Chudasama et al. (2014) report that some health care staff demanded for regular educational program/training on biomedical waste management to improve on their awareness about disease transmission from hospital solid waste.

Hospital solid waste management can negatively affect the health of staff and clients of the hospital if not properly managed. A total of 45.7 percent of the respondents strongly agreed with the position that hospital solid waste can endanger the health of hospital staff with 37.8 percent strongly disagreeing (see Table 22). This indicates their awareness on the negative effects of improper hospital solid waste management on the health system.

Table 23: *Hospital solid Waste can pose Danger to Hospital Staff*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	9	0	7	34	50
Donkorkrom Hospital	3	1	8	28	40
Holy Family Hospital	47	1	0	0	48
Kof Regional Hospital	12	5	20	54	91
Orthopaedic	1	0	2	10	13
VRA Hospital	33	2	0	1	36
Frequency	105	9	37	127	278
Percent	37.8	3.2	13.3	45.7	100.0

Source: Field Survey, Amfo-Otu (2015)

From Table 23, about 41.4 percent of the respondents strongly agreed that hospital solid waste management can contribute to the spread of HIV among hospital staff and the community at large. Those who strongly agreed or just agreed were about 60.5 percent of total respondents which is lower than what was reported by Yenesew, Moges, and Woldeyohannes (2012) in Ethiopia where 97.7 percent of respondents agreed that HIV/AIDS could be acquired through contact with infectious waste.

Table 24: *Hospital Solid Waste can contribute to HIV Infection*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	9	0	5	36	50
Donkorkrom Hospital	4	5	10	21	40
Holy Family Hospital	38	7	1	2	48
Kof Regional Hospital	11	7	30	43	91
Orthopaedic	0	0	5	8	13
VRA Hospital	24	5	2	5	36
Frequency	86	24	53	115	278
Percent	30.9	8.6	19.1	41.4	100.0

Source: Field Survey, Amfo-Otu (2015)

There was however significant difference between the responses of staff from different hospitals with regards to the ability of hospital solid waste to contribute to the spread of HIV infection among staff [χ^2(15, n = 278, = 145.7, p = .001, V = .418]. This means that not all staff are aware that hospital solid waste can contribute to the spread of HIV/AIDs. This may be due to availability of information to hospital staff, meaning some have more information on spread of HIV/AIDS, and therefore are more aware than others. Those who are aware can exhibit good attitudes in handling hospital solid waste as a precautionary measure. This underscores the importance of providing information as indicated by Pred's behavioural matrix (1967) through training in proper hospital solid waste management as indicated in the conceptual framework.

From gender perspective, it was found that about 51.3 percent and 48.7 percent of the females and males strongly agreed that healthcare waste management could contribute to HIV infection whilst 64 percent and 36 percent of them strongly disagreed to this assertion respectively. Akinboro et al. (2012) found that gender influences risk perception of HIV infections among health care workers with female having higher risk perception than their male counterpart.

It has been argued and proven with available data that healthcare waste can contribute to the spread of hepatitis B among hospital staff and community members (Prüss-Ustün, Rapiti, Hutin, 2005; Yao et al., 2010). About 36.6 percent of the hospital staff strongly agreed that healthcare waste management can contribute to the spread of hepatitis B among hospital staff and community members whilst 27.9 percent strongly disagreed (Table 24). Those who either strongly agree or just agree constitute about 60 percent of the respondents.

This is on the low side compared to what was reported by Yenesew et al. (2012) in Ethiopia, where (84.6%) health care workers agreed that hepatitis B could be transmitted through improperly managed infectious waste from hospitals. Those who strongly disagreed or just disagreed (39.5%)

to the statement are very significant when considering the kind of health risk that can emanate from healthcare waste. Yenesew et al. (2012) reported 4.6 percent of health care workers disagreed that the transmission of infectious hepatitis B can occur through infectious waste.

Table 25: *Respondents Agreement with Hospital Solid Waste contributing to Hepatitis B Infection*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	7	7	7	28	49
Donkorkrom Hospital	3	6	10	21	40
Holy Family Hospital	34	6	7	1	48
Kof Regional Hospital	8	6	38	39	91
Orthopaedic Hospital	1	1	3	8	13
VRA Hospital	24	6	1	4	35
Frequency (N)	77	32	66	101	276
Percentage (%)	27.9	11.6	23.9	36.6	100.0

Source: Field Survey, Amfo-Otu (2015)

The relatively high disagreement by the hospital staff may be due to lack of awareness on the subject that can be attributed to inadequate information or training to make them aware of health hazards related to hospital solid waste. As indicated by the Preds behaviour matrix (1967) information is important for awareness and proper decision making. The implication of not being aware is that they may not properly handle and manage hospital solid waste, and take the necessary safety precautions to protect themselves. The resultant effect is that they will become exposed to hepatitis B virus and possibly become infected in the process unknowingly. Moreover, this finding affirms the position of the conceptual framework that improper management of hospital solid waste can result in the spread of infectious diseases and pose health and environmental risks to the public.

However, there was significant difference between the level of agreement of staff from different hospitals and the possibility of hospital solid waste helping to spread hepatitis B infection among community members and hospital staff [χ^2(15, n = 276, = 134.9, p = .001, V = .404]. This means that the awareness of staff from different hospitals on hospital solid waste serving as transmission route for hepatitis B is not the same. Some are more aware than others probably due to their access to different level of information from different sources on the subject. The result underscores the need for proper training and awareness creation on hospital solid waste among all categories of staff at different hospitals regardless of being private, government or faith-based hospital facilities.

On whether hospital solid waste could contribute to hepatitis C among hospital staff and community members, 41.6 percent of the hospital staff strongly agreed, whilst 14.4 percent disagreed as shown in Table 25. The responses clearly indicate that most (71.9%) of the staff either agreed or strongly agreed that hepatitis C can be spread through hospital solid waste management among hospital staff and community members. This is similar to what was found in Ethiopia where most of the staff (58.8%) were aware that hospital waste can contribute to the spread of Hepatitis C infection (Yenesew et al., 2012).

Table 26: *Hospital Solid Waste Management can contribute to Hepatitis C*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	8	10	10	21	49
Donkorkrom Hospital	4	5	10	20	39
Holy Family Hospital	10	8	17	13	48
Kof Regional Hospital	12	12	36	31	91
Orthopaedic	1	0	4	8	13
VRA Hospital	3	5	7	22	37
Frequency	38	40	84	115	277
Percent	13.7	14.4	30.3	41.6	100.0

Source: Field Survey, Amfo-Otu (2015)

This may mean that training on hepatitis C infection probably mentioned hospital solid waste management as possible source of infection. There was no significant difference from the agreement of staff from the different hospitals and the spread of hepatitis C through hospital solid waste management [χ^2(15, n =277, = 22.1, p = .105, V = .163]. It implies that information on spread of the disease is commonly known among the staff. It is therefore, expected that staff will adopt proper precaution to protect themselves in that regard.

When discussing hospital waste management, the environment plays a major role in such discussions. On staff agreement with the fact that hospital solid waste treatment and disposal method can affect the health of community members and the environment at large it was found that about 35.1 percent of the respondents strongly agree whilst 32.3 percent strongly disagreed to this assertion (Table 26). This may mean that they lack the necessary information or the training they have received so far did not cover that. However, those who either strongly agreed or agreed were in the majority (55.2%) which emphasis the fact that people are actually aware that it could affect the health of community members and the entire environment.

Table 27: *Hospital Solid Waste Treatment Methods can affect Health and Environment*

Name of Hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Hospital	6	5	7	32	50
Donkorkrom Hospital	4	5	11	20	40
Holy Family Hospital	40	5	3	0	48
Koforidua Regional Hospital	10	13	33	35	91
Orthopaedic	0	2	2	9	13
VRA Hospital	30	3	0	2	37
Frequency	90	33	56	98	279
Percent	32.3	11.8	20.1	35.1	100.0

Source: Field Survey, Amfo-Otu (2015)

Those either disagree or strongly disagree (44.1%) means some hospital staff have not come to terms with the effects of hospital solid waste on communities and the environment. The implication is that those who are aware may contribute to proper management of the same whilst those who are not aware may encourage improper practices. It has been already reported that Ghana and other African countries rely on unsafe methods of treating and disposing hospital solid waste and hence constitute high potential for the spread of infections through runoffs during rains and contamination of underground water (AERD, 2009; Bamfo-Tanor & Owusu-Agyei, 2013).

Overall Staff Awareness about Health Hazards associated with Hospital Solid Waste

The staff awareness was measured by using an index from the Likert scale. A total of seven (7) items were put together to measure the general staff awareness about the health hazards that could be linked to hospital solid waste management. A total of 272 valid responses were obtained from the total respondents of 279 and this was used to compute the Cronbach's Alpha value to find the reliability of the measurement. This test helps to understand the internal consistency of the scale to measure the desired construct (Pallantt, 2007). It has been reported that a Cronbach's alpha value above 0.7 is normally preferred in such cases (DeVellis, 2003).

George and Mallery (2003) however provided rules of thumb for alpha values as: "> 0.9 - Excellent, > 0.8 – Good, > 0.7 – Acceptable, > 0.6 – Questionable, > 0.5 – Poor, and < 0.5 – Unacceptable" (p. 231). In this study, the result from the reliability test yielded an alpha value of 0.892, which means that the seven items (Table 28) put together actually measures the awareness of the hospital staff about health hazards associated with hospital solid waste management.

Table 28: *Item Statistics for Measuring Staff Overall Awareness*

Description of Items	Mean	Std. Deviation	N
• Healthcare waste can contribute to HIV infection (Q1)	2.7022	1.28987	272
• Healthcare waste management can endanger health of hospital staff (Q2)	2.6507	1.37696	272
• Healthcare waste management can contribute to nosocomial infections in the hospital (Q3)	2.6765	1.28219	272
• Pricks, cuts and pinch are the most common injuries associated with healthcare waste management (Q4)	2.7316	1.16753	272
• Healthcare waste can contribute to hepatitis B infection among staff and community members (Q5)	2.6949	1.22952	272
• Healthcare waste can contribute to hepatitis C infection among staff and community members (Q6)	2.9890	1.05734	272
• Treatment and disposal of healthcare waste can affect the health of community members and the environment (Q7)	2.5772	1.26605	272

Source: Field Survey, Amfo-Otu (2015)

Inter-item correlation showed very good correlation among items for measuring the awareness of staff. These values were checked for negative correlations and items with negatives were excluded from the scale because it gives an indication that the item is measuring something different (Pallant, 2007). The highest correlation between the items was r = 0.853 whilst the least was r = 0.123 as shown in Table 29. According to Pallant (2007), items with corrected item-total correlation less than 0.3 may be removed if the alpha value is less than 0.7, but in this study the smallest value recorded was almost 0.3 with an alpha value of 0.892 as shown in Table 30, therefore all the items were maintained. All these results gives credence to the scale used for measuring the awareness of hospital staff about hazards linked to hospital waste.

Table 29: *Inter-Item Correlation Matrix*

Items	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Q1	1.000						
Q2	.695	1.000					
Q3	.631	.853	1.000				
Q4	.572	.697	.652	1.000			
Q5	.780	.634	.562	.585	1.000		
Q6	.292	.200	.218	.123	.392	1.000	
Q7	.560	.664	.609	.577	.628	.134	1.000

Source: Field Survey, Amfo-Otu (2015)

Transforming questionnaire items into awareness

To measure the general awareness of the respondents, the seven items in Table 40 were transformed into one item as an index to measure the awareness of staff. Items were transformed using the Predictive Analytical Software version 20.0. The items were added to each other to generate a new variable called staff awareness (STAwareness) and the overall score was divided by the seven items to generate the overall cumulative awareness of the staff on the health hazards of hospital solid waste (ActualAwareness = STAwareness/7). Descriptive statistics was run for the newly transformed variable and the results were divided into two categories as strong awareness (mean score value above 2.0) and weak awareness (mean score value below 2.0). The mean value obtained from the descriptive statistics which was 2.7 as shown in Table 48 indicated strong awareness of hospital staff about the health hazards associated with hospital solid waste management.

Table 30: *Item Analysis for Measuring Staff Awareness of health hazards*

Scale Statistics	Mean	Variance	Std. Deviation		N of Items
	19.0221	45.793	6.76704		7
	Mean	Minimum	Maximum		Range
Item Means	2.717	2.577	2.989		.412
Item-Total Statistics	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1	16.3199	32.750	.771	.679	.865
Q2	16.3713	31.127	.831	.798	.857
Q3	16.3456	32.758	.776	.741	.865
Q4	16.2904	34.827	.697	.544	.875
Q5	16.3272	33.232	.779	.707	.865
Q6	16.0331	41.021	.270	.194	.917
Q7	16.4449	34.049	.686	.535	.876
Reliability Test for 7 items Alpha			Standardised item Alpha		
0.892			0.886		

Source: Field Survey, Amfo-Otu (2015)

Attitudes of the Hospital Staff toward Solid Waste Management in the Hospital

In waste management activities attitudes of stakeholders are very crucial for successful implementation of plans and policies especially those who are the generators and first handlers of such waste. Hospital solid waste management require concerted and good effort from all staff of hospitals to ensure efficient and effective management of such waste. In this study, the attitudes of staff of the studied hospitals toward hospital solid waste management were assessed using Likert-type items and Likert scale to measure the attitudes of staff.

On whether safe management of hospital solid waste was not an issue, about 39.4 percent of the respondents strongly disagreed whilst close to one fifth (24.7%) agreed to the statement (Table 43). This result means that the staff (39.4%) think that the hospitals have to institute good system to deal with the waste properly because it is an important issue to them.

Table 31: *Safe Management of Hospital Solid Waste is not an Issue at all*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	19	6	13	12	50
Donkorkrom Hospital	19	6	8	7	40
Holy Family Hospital	16	6	13	13	48
Kof Regional Hospital	42	18	18	13	91
Orthopaedic	4	1	4	4	13
VRA Hospital	10	3	13	11	37
Frequency	110	40	69	60	279
Percent	39.4	14.3	24.7	21.5	100.0

Source: Field Survey, Amfo-Otu (2015)

This result is similar to the findings of Sharma et al. (2013) who reported that 41 (29%) respondents agreed that safe management of health care waste was not an issue at all whereas 57 (41%) disagreed. Moreover, this finding is supported by results of other researchers in Iran and India (Lakbala, & Lakbala, 2013; Mathur et al., 2011). Those who agreed and strongly agreed (46.2%) may be of the view that there are already good structures to deal with hospital solid waste without any major challenges within the hospitals. It could also mean that they do not regard it as an important issue that should be given a priority.

Seeing hospital solid waste management as an issue can affect the general attitudes and attention given to its management at the hospital level. In instances where the system is poor, it connotes poor or bad attitudes on behalf of the staff. This may affect efforts directed at improving hospital solid waste management at the hospitals. There was no significant difference between the responses of the staff from the different hospitals and the assertion that safe management of the hospital solid waste was not an issue [χ^2(15, n = 279, = 15.7, p = .401, V = .137]. This means that if the general attitude is poor or good it will be the same among the staff from the different hospitals.

Table 32 shows that 36.9 percent of respondents agree that hospital staff segregate hospital solid waste at the point of generation whereas one fifth (20.1%) disagrees. The responses suggested that most of the staff either agree or strongly agree (61.6%) that hospital staff separated solid waste at the point of generation into specified storage containers. Madhukumar and Ramesh (2012) reported 82 percent of hospital staff were in favour of implementing waste separation. This was however, contrary to the real practice at the hospitals from the observations made at the facilities since only sharps and anatomical waste were the components separated by the staff. The finding that healthcare establishments were not involved in any form of waste segregation has been reported by some researchers (Ndidi, Nelson, Patricia, & Sunday, 2009; Bamfo-Tanor & Owusu-Agyei, 2013).

Table 32: *Staff Segregates Hospital Solid Waste at the point of Generation*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov. Hospital	7	8	17	18	50
Donkorkrom Hospital	19	6	5	10	40
Holy Family Hospital	5	10	21	12	48
Koforidua Regional Hospital	9	21	43	18	91
Orthopaedic Hospital	6	3	2	2	13
VRA Hospital	5	8	15	9	37
Frequency	51	56	103	69	279
Percent	18.3	20.1	36.9	24.7	100.0

Source: Field Survey, Amfo-Otu (2015)

The possible reason for this could be linked to acculturation of staff in the hospital by society which shapes the personal norms of individuals as captured by the theory of planned behaviour (Ajzen, 1991). From the theory of planned behaviour, it can be inferred that the subjective norms which includes normative beliefs are critical for proper waste separation attitudes needed by hospital staff. The limited separation observed could also be explained by the lack of required resources to practice the separation as captured by the perceived behaviour control component of the theory of planned behaviour and resource dependence theory.

The result was found to be statistically different between the responses of the staff from the different hospitals on the assertion that hospital staff separate the waste at the point of generation into specified storage containers [χ^2(15, n = 279, = 47.2, p = .001, V = .238]. This means some hospitals do not separate their waste whilst others do probably due to available resources and environmental conditions that make the practice possible as indicated by Ajzen (1991) in the theory of planned behaviour. It could also be due to trainings attained through formal education.

Close to half (48.7%) of the respondents strongly disagreed that separating waste at the point of generation was difficult with 20.1 percent agreeing as shown in Table 33. This is corroborating the point already made that staff normally separate sharps and pathological waste at the point of generation.

Table 33: *Different Hospitals and difficulty in Waste Separation*

Name of Hospitals	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atua Gov. Hospital	26	9	8	7	50
Donkokrom Hospital	17	14	3	6	40
Holy Family Hospital	29	5	9	5	48
Koforidua Reg. Hosp.	40	18	25	8	91
Orthopaedic Hospital	6	3	2	2	13
VRA Hospital	18	9	9	1	37
Frequency	136	58	56	29	279
Percent	48.7	20.8	20.1	10.4	100.0

Source: Field Survey, Amfo-Otu (2015)

The responses seem to suggest that staff understanding of the separation is limited to that of sharps which is the normal practices at all the hospitals. This indicates the difficulty hospital staff have about what to separate as reported by Ferreira and Teixeira (2010) that in Portugal, hospital staff practiced incorrect separation and lacked the knowledge about the importance of hospital solid waste separation. Therefore, their responses may be true in relation to separation of sharps and anatomical or pathological waste but not with the general and the infectious waste components. Those who indicated strong agreement or agreed may be telling the truth which reflected the reality at the hospitals. This is because while attending to a patient a nurse or doctor will still have the responsibility of making sure that various categories of waste are dumped into prescribed storage facilities.

These responses are important when considering waste separation programme and training for healthcare professionals in a hospital. According to Batelho (2012), delivery of education and training opportunities on all subjects of waste management should lead to better waste segregation procedures among hospital staff. The reality of the health care practice and the nature of work require proper structuring of activities and waste management to aid optimum separation and minimal loss of concentration of staff in attending to patients. There was no significant difference between the responses of the staff from the different hospitals and the assertion that separation of healthcare waste at the point of generation is difficult [χ^2(15, n = 279, = 19.7, p = .183, V = .153].

As to whether hospital staff regarded separation of solid waste into their specified categories as an extra work, it was found that about 127 (45.5%) of the respondents strongly disagreed to the statement whilst 94 (33.7%) agreed (Table 34). This means that almost three fifth (57.7%) of the hospital staff thinks that separating waste while working does not constitute an extra work to them. This finding contradicts the report that hospital staff considered safe management of hospital solid waste as extra burden (Sharma et al., 2013). It however confirms the report that safe management of healthcare waste is not an extra burden (Lakbala & Lakbala, 2013). The attitude of viewing safe management of hospital solid waste as not an extra work by the respondents is heart-warming because it can serve as self-motivation to have positive attitudes towards same as captured in the theory of planned behaviour (Ajzen, 1991). Those who strongly disagreed signify high number of staff who are ready to go extra mile to support the waste management system to function well.

Table 34: *Respondents Agreement with Waste Separation being an Extra Work*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov. Hospital	25	4	16	5	50
Donkorkrom Hospital	23	3	12	2	40
Holy Family Hospital	17	9	20	2	48
Koforidua Reg. Hospital	40	12	28	11	91
Orthopaedic Hospital	8	0	4	1	13
VRA Hospital	14	6	14	3	37
Frequency	127	34	94	24	279
Percent	45.5	12.2	33.7	8.6	100.0

Source: Field Survey, Amfo-Otu (2015)

The agreement by 118 (42.3%) of the respondents that safe management constitute extra work in a way corroborate the agreement of about 30 percent of respondents who agreed that separating solid waste while working was difficult. These respondents are not likely to exhibit good attitudes that will support safe management of hospital solid waste. From theory of planned behaviour (Ajzen, 1991), these staff do not have the self-motivation and personal belief to contribute towards safe management of hospital solid waste management. Chi-square result from cross tabulation showed that there was no significant difference between the levels of agreement of the staff from the six hospitals that waste separation is an extra work on hospital staff [χ^2(15, n = 279, = 13.8, p = .541, V = .128]. This implies that all the staff from the different hospitals have weighed their work load and considered separation as not being extra work.

About 40.9 percent of the respondents strongly agreed to support any effort aimed at ensuring segregation of waste at the hospitals whereas 19.6 percent disagreed as indicated in Table 35.

Table 35: *Respondents Readiness to Support Waste Separation Efforts*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov. Hospital	1	3	11	35	50
Donkorkrom Hospital	2	2	5	31	40
Holy Family Hospital	31	12	2	1	46
Koforidua Regional Hospital	4	13	36	38	91
Orthopaedic Hospital	1	2	2	8	13
VRA Hospital	13	22	1	0	36
Frequency	52	54	57	113	276
Percent	18.8	19.6	20.7	40.9	100.0

Source: Field Survey, Amfo-Otu (2015)

This implies that when management makes a decision to implement an effective solid waste management system they will obtain the support of the staff since most of them (61.6%) strongly agreed or agreed to the statement. Those who strongly disagreed would need to be properly oriented and whipped in line toward good waste separation by highlighting the pros and cons of the separation practices. Moreover, since staff have agreed that waste separation was not an extra work, it was expected that any effort to encourage and ensure waste separation at source would be successful and will obtain the support of most of the staff.

A total of 105 (37.6%) respondents strongly agreed that they are ready to participate in any training programme on healthcare waste management whilst 33 (11.8%) strongly disagreed as shown in Table 36. This implies that majority (71.7%) of the hospital staff have agreed to participate in hospital solid waste training should hospital authorities organise it. This result is in agreement with findings of other researchers where hospital staff expressed their willingness to be trained in medical waste (Sarsour et al., 2014). From the conceptual framework of the study, it was argued that efficient hospital solid waste management hinges on willingness of the staff to support the system through active participation in training and other important initiatives. Management can therefore leverage on the staff readiness to be trained and support efficient hospital solid waste management to institute the required systems to manage such waste.

Table 36: *Respondents Readiness to Participate in Waste Separation Training Programme*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	1	1	16	32	50
Donkorkrom Hospital	21	18	1	0	40
Holy Family Hospital	1	9	26	12	48
Koforidua Reg. Hospital	4	8	36	43	91
Orthopaedic Hospital	5	7	0	1	13
VRA Hospital	1	3	16	17	37
Frequency	33	46	95	105	279
Percent	11.8	16.5	34.1	37.6	100.0

Source: Field Survey, Amfo-Otu (2015)

Those who strongly disagree or just disagree (28.3%) emphasise the need for hospital authorities to develop proper measures to mobilise and encourage all to participate in hospital solid waste management training.

One of the marks to identify hostile attitude to a condition is the hatred or abhorrence for the condition in question. Therefore to further explore the attitudes of the staff of the hospital, they were asked to indicate their agreement about the fact that the role of the environmental health unit is not needed in the hospital. It was found that most (59%) of the respondents strongly disagreed to this statement as shown in Table 37. This means that most of the hospital staff (59%) agreed that the role of the environmental health is very important. One of the ward in-charge clearly stated that *"if they are not here who will clean all these waste for us, they are needed"* (J. Ayeree, personal communication, April 9, 2015). This implies that staff recognises the important role of each category of staff in the health care delivery system to be important and complementary. This should in a way help to change the attitudes of those who might have thought that the role the orderlies and cleaning workers play was not important.

Table 37: *Respondents Agreement with the Important Role of Environmental Department*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	38	5	2	5	50
Donkorkrom Hospital	2	0	11	26	39
Holy Family Hospital	33	13	2	0	48
Kof Regional Hospital	66	9	12	4	91
Orthopaedic Hospital	1	0	3	9	13
VRA Hospital	24	4	6	3	37
Frequency	164	31	36	47	278
Percent	59.0	11.2	12.9	16.9	100.0

Source: Field Survey, Amfo-Otu (2015)

Though those who indicated that they strongly agreed or just agreed together were in the minority (29.8%), they represent critical component of the staff and these can influence others to think like them. Once some staff consider their work as not needed, it may give rise to prejudices, abuse, disrespect, discrimination and neglect of those doing such kind of work. This is well captured by the conceptual framework for the study that any action to look down on other staff can instigate avoidable conflict at the work place.

Staff rated the functions of environmental health unit or the outfit managing the hospital solid waste on a scale of 1-10, where one was the highly rated and 10 was the least rated. The responses indicated that about 77 (33.0%) out of 233 valid responses rated the function of the environmental health unit as most important with 4.7 percent rating least important as shown in Table 38.

Table 38: *Staff Rating of the Importance of Environmental Department*

Ratings by Staff		Frequency	Percentage
Most important	1.00	77	33.0
	2.00	28	12.0
	3.00	20	8.6
	4.00	20	8.6
	5.00	28	12.0
	6.00	22	9.4
	7.00	10	4.3
	8.00	13	5.6
	9.00	4	1.7
Least Important	10.00	11	4.7
Total		233	100.0

Source: Field Survey, Amfo-Otu (2015)

This indeed confirms how the hospital staff value the work of the staff who are in the unit since most of them indicated that they were respected class of workers at the hospital.

One strong character trait that vividly shows one's attitudes to anything good is to jealously guard and protect it from detractors. It was expected that those who had good attitudes towards waste management activities and the department will report deviant characters whose practices are seen to be inimical to hospital solid waste management activities in the hospital to higher authorities. Therefore respondents were made to indicate their agreement with the statement that they will report colleagues who refuse to separate the hospital waste to higher authorities. It emerged that slightly less than one third (31.7%) agreed to report, whilst 23.7 percent strongly disagreed as shown in Table 39. This means that about 54.4 percent of them have either agreed or strongly agreed to report those who either deliberately or not refuse to separate their generated waste in the hospital.

In most communal community system, people are expected to report deviant character to authorities for corrections and respondents in the hospital who are living in a communal way have agreed to do so. This in itself is a sign of positive attitude for hospital solid waste management. Those who are so passionate that people do the right thing with respect to hospital solid waste management can be used as mentors and champions to propagate and promote the right attitudes among hospital staff. It can also be deduced that in waste management, those who are really interested in promoting environmental health, equity and justice are most likely to take action in favour of the environment for our common good. This has been clearly demonstrated by the respondents who agreed to do same in this study.

Table 39: *Staff Readiness to Report Non-compliance to Waste Separation Practices to Higher Authorities*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	19	8	12	11	50
Donkorkrom Hospital	3	2	12	22	39
Holy Family Hospital	12	16	16	4	48
Kof Regional Hospital	27	24	30	10	91
Orthopaedic Hospital	0	1	4	8	13
VRA Hospital	5	10	14	8	37
Frequency	66	61	88	63	278
Percent	23.7	21.9	31.7	22.7	100.0

Source: Field Survey, Amfo-Otu (2015)

The proportion of those who either strongly disagree or just disagree (45.6%) is quite high to ignore. It implies that some staff will cover others when they do not act right with respect to hospital solid waste separation. This could be partly due to acculturation of such people who may think that it is wrong to report people for wrong doing; lack of motivation to report wrong doing of colleagues, or they do not consider it as a serious issue to be reported. It may also mean that, such staff consider the separation activity as new and people need time to develop the attitude otherwise reporting them could be a disincentive to the separation practice. There was significant difference between the agreement of staff from the various hospitals and their readiness to report non-compliance to waste separation practices of staff to higher authorities [χ^2(15, n = 278, = 65.3, p = .001, V = .280]. The implication is that in some of the studied hospitals some staff will not report non-compliance of colleagues to hospital solid waste separation to higher authorities. This attitude will not auger well for proper hospital waste management at the hospitals.

As to whether hospital management had prioritised minimisation of hospital solid waste as management concept to pursue, 81(29.5%) of the respondents disagreed whilst 72(26.0%) agreed as shown in Table 40. These responses indicate that the staff are not very sure if that is what management is doing or intends to do or they are not aware what is really happening. Most of the respondents (54.6%) either disagreed or strongly disagreed suggest that hospital management have not prioritised healthcare waste minimisation as the waste management option or strategy to follow or communicated same. This indicate the need for management to be clear and open with some strategic decisions by making the information available to staff so that they can make a decision to follow suit (Pred, 1967).

Table 40: *Hospitals have Prioritised Solid Waste Minimization Activities*

Name of hospital	Responses				Total
	Strongly Disagree	Disagree	Agree	Strongly agree	
Atuah Gov. Hospital	14	15	10	9	48
Donkorkrom Hospital	6	6	16	12	40
Holy Family Hospital	13	16	6	11	46
Koforidua Reg. Hospital	24	33	24	10	91
Orthopaedic	2	2	5	4	13
VRA Hospital	10	9	11	7	37
Frequency	69	81	72	53	275
Percent	25.1	29.5	26.0	19.3	100.0

Source: Field Survey, Amfo-Otu (2015)

As staff make the effort to change their attitudes to support waste management in the hospital, it is important for managers to release information to staff to aid their practices. There was no significant difference between the type of hospital and the fact that hospital management have prioritised hospital solid waste minimisation as the option to follow [χ^2(15, n = 275, = 23.1, p = .081, V = .167]. This means that staff from different hospitals agree that management of their hospitals have not given priority to hospital solid waste minimisation. This reflects in the resources provided for separation and the kind of treatment systems in place.

One of the most important aspects of hospital waste management in an institution is about who is responsible for what. Staff were given the opportunity to indicate their agreement with the argument that hospital solid waste management is a shared responsibility and more than half (54.5%) strongly agreed to the statement (see Table 41). This means that majority (80.7%) of the hospital staff share the view that hospital solid waste management is a shared responsibility among all staff.

Table 41: *Respondents Agreement with Hospital Solid Waste Management being a Shared Responsibility*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	0	7	8	35	50
Donkorkrom Hospital	13	8	7	12	40
Holy Family Hospital	0	8	6	34	48
Kof Regional Hospital	1	3	38	49	91
Orthopaedic	4	4	2	3	13
VRA Hospital	1	5	12	19	37
Frequency	19	35	73	152	279
Percent	6.8	12.5	26.2	54.5	100.0

Source: Field Survey, Amfo-Otu (2015)

This finding conforms to the finding of Sharma et al. (2013) that 65 percent of health care personnel agreed that waste management requires team work and no single team member is responsible. It implies that no individual within the hospital facility can exempt her/himself from any activity related to management of hospital solid waste. However, it is contrary to what was reported in Nigeria where some hospital staff believe it is the duty of waste handlers to separate the generated hospital solid waste (Mokuolu, Akindele & Olawumi, 2016).

From Table 42, it was found that about 30.7 percent of the respondents disagreed with the assertion that hospital solid waste management increases the financial burden of management and 28.5 percent agreed. This means most of the respondents (56.3%) either disagree or strongly disagree that safe management of hospital solid waste creates financial burden on hospital management. Sharm et al. (2013) reported that health care staff (50%) agreed that safe management of hospital solid waste increases the financial burden of management. This is contrary to the findings of the current study. This attitude is good because this can make the workers to demand the right resources and logistics for safe management of the waste.

However those who strongly or just agreed (43.7%) were suggesting that indeed it will increase the financial portfolio of managing the hospitals. This assertion will be only true if the management of the hospital are keen to invest in appropriate technology for waste management without complementing it with best environmental practices such as waste separation and minimisation strategies. Such staff can take actions aimed at reducing the financial burden on management by adopting proper segregation practices, waste minimisation activities or refuse to demand for proper hospital solid waste management. There was no significant relationship between the type of hospital and whether hospital solid waste management increases the financial burden of management [χ^2(15, n = 277, = 14.4, p = .498, V = .131]. This means that the proportion of staff from the different hospitals who agreed that safe hospital solid waste management increases financial burden of hospital managers were not different across the selected hospitals.

Table 42: *Safe Management of Hospital Solid Waste Increases Financial burden of Management*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Atuah Gov Hospital	14	11	14	9	48
Donkorkrom Hospital	15	10	9	6	40
Holy Family Hospital	10	22	12	4	48
Koforidua Reg. Hospital	22	26	29	14	91
Orthopaedic Hospital	4	4	2	3	13
VRA Hospital	6	12	13	6	37
Frequency	71	85	79	42	277
Percent	25.6	30.7	28.5	15.2	100.0

Source: Field Survey, Amfo-Otu (2015)

On staff willingness to segregate healthcare waste for recycling, almost two thirds of the respondents (66.7%) were in agreement as indicated in Table 43. The response of the majority points to their support for any attempt to introduce proper waste segregation at the hospital level by management. Willingness of hospital staff to segregate the hospital solid waste is important motivation for them to behave appropriately as indicated by the theory of planned behaviour (Ajzen, 1991). Recycling of some critical component of hospital solid waste after segregation is very important to reduce the quantum of waste produced and the associated cost of management (HCWH, 2005).

Table 43: *Staff Willingness to Separate Hospital Solid Waste for recycling*

Name of hospital	Responses		Total
	No	Yes	
Atuah Gov Hospital	3	43	46
Donkorkrom Hospital	9	31	40
Holy Family Hospital	37	2	39
Kof Regional Hospital	16	75	91
Orthopaedic	2	11	13
VRA Hospital	19	10	29
Frequency	86	172	258
Percent	33.3	66.7	100.0

Source: Field Survey, Amfo-Otu (2015)

On the other hand, one third of respondents who said no to segregation and recycling may have some genuine concerns especially when healthcare waste products are to be recycled for use. There is bound to be fear and scepticism about such venture but this can be overcome thorough education of the staff to understand and appreciate that most of the waste produced by the hospitals (about 70%) are safe for recycling but it is only when they are mixed with infectious and hazardous waste (15-25%) that it becomes dangerous. There was significant difference between the responses of staff from the various hospitals about their willingness to segregate healthcare waste for recycling [χ^2(15, n = 258, = 109.0, p = .001, V = .650].

This means that some staff will undertake separation activities if introduced whilst others will not. From the conceptual framework, willingness of individual staff to change behaviour and participate in officially planned activities by hospital authorities is important for efficient management of hospital solid waste.

The overall staff attitude was measured by using an index from the likert scale. Three questionnaire items were put together to measure the general staff attitude towards hospital solid waste management. A total of 276 valid responses were obtained from the total respondents of 279. The three items (Table 44) were used to compute for the Cronbach's Alpha value to assess the reliability of the measurement of hospital staff attitude toward hospital solid waste management. Cronbach's Alpha value of 0.729 was obtained, implying that the three items (Table 45) cumulatively measured the attitude of the hospital staff toward healthcare waste management activities.

Table 44: *Item Statistics for Staff Attitudes*

Description of Items	Mean	Std. Deviation	N
• The role of environmental health unit not needed in the hospital (Q1)	1.8659	1.17247	276
• I will report colleagues who refuse to separate the hospital waste (Q2)	2.5217	1.08355	276
• Labelling of healthcare waste bins is not important (Q3)	1.6558	1.01677	276

Source: Field Survey, Amfo-Otu (2015)

Table 45: *Item Analysis for Measuring Staff Attitudes*

Scale Statistics	Mean	Variance	Std. Deviation		N of Items
	6.0435	6.973	2.64058		3
	Mean	Minimum	Maximum		Range
Item Means	2.014	1.656	2.522		.866
Item-Total Statistics	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1	4.1775	2.976	.648	.442	.516
Q2	3.5217	3.865	.454	.218	.754
Q3	4.3877	3.715	.568	.379	.628
Reliability Test for 3 items			Standardised item Alpha		
Alpha					
0.729			0.729		

Source: Field Survey, Amfo-Otu (2015)

According to Pallant, (2007), items with negatives should be excluded from the scale because those items are measuring something different. Therefore, initial items of seven were dropped to three by deleting the items with negative correlations. The highest correlation between the items was r = .611 whilst the least being r = 0.348 as shown in Table 46. According to Pallant (2007), items with corrected item-total correlation less than 0.3 may be removed if the alpha value is less than 0.7, but in this study the smallest value recorded was almost 0.3 with an alpha value of 0.729, therefore all the three items were maintained.

Table 46: *Inter-Item Correlation Matrix*

Items	Q1	Q2	Q3
Q1	1.000		
Q2	.459	1.000	
Q3	.611	.348	1.000

Source: Field Survey, Amfo-Otu (2015)

Transforming questionnaire items into attitudes

To measure the general attitudes of the staff, the three questionnaire items were transformed into one questionnaire item as an index. The three questionnaire items were transformed using the predictive analytical software version 20.0 to generate a new variable called staff attitude (Staff_Attitudes). The overall score was divided by the three, representing the number of questionnaire items used to generate the overall staff attitude toward hospital solid waste management activities (Overall_attitude_mgt = Staff-Attitudes/3). Descriptive statistics was run for the newly transformed variable to check if it was normally distributed.

Test for normality of transformed variables

The normal distribution test as shown in Tables 59 and 60 indicate that the variables (staff awareness and attitudes) were not normally distributed. In the case of staff awareness of health hazards the standard deviation showed a broad spread of the data from the mean. Field (2013) indicated that in checking for the normality of a variable, the skewness indicates the symmetic or asymmetric nature of the data whilst kurtosis indicate the flatness or peakness of the distribution. The results showed negative skewness (-0.237) and negative kurtosis (-1.373), meaning that the distribution of the data was toward the right of the mean whilst the kurtosis showed a flat spread of the distribution respectively. Again, the result from the normality test as shown in Table 47 indicated a Kolmogorov-Smirnov statistic of 0.177 with p = .000, which is significant. However, it has been said that a normal distribution should not be significant (ie. $p < .05$) (Pallant, 2007).

Table 47: *Descriptive Statistics for the Awareness and Attitudes of Respondents*

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Actual staff awareness of health hazards associated with hospital solid waste management	272	1.00	4.00	2.71	.96672	.953
Overall staff attitude towards waste management activities	276	1.00	4.00	2.01	.88019	.775

Source: Field Survey, Amfo-Otu (2015)

The standard deviation showed a broad or flat spread of the data around the statistic mean. The results in this study showed positive skewness (0.651) and negative kurtosis (-0.672). This means that the distribution of the data was toward the left of the mean value whilst the kurtosis showed a flat spread of the distribution. The result from the normality test as shown in Table 60 indicated a Kolmogorov-Smirnov statistic of 0.133 with p = .000, which is significant. Therefore the test confirms that the distribution was not normal. This suggests that the assumptions underlying normal distribution have been violated. This implies that only non-parametric analysis is possible with the variables but not parametric tests.

Table 48: *Test of Normality for Staff Attitudes*

Variable	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Overall staff attitude towards waste management activities	.177	276	.000	.897	276	.000
Actual staff awareness of health hazards associated with hospital solid waste management	.133	272	.000	.910	272	.000

Source: Field Survey, Amfo-Otu (2015)

To be able to classify the attitudes of the staff, a scale of good attitude (mean value above 2.) and bad attitude (mean value below 2.0) and normal (mean value of 2.0) was created to decide on the overall attitudes of the staff towards waste management activities. The mean value (2.0) obtained from the descriptive statistics indicated that the attitude of the respondents toward hospital solid waste management activities at the hospital is normal (see Table 47). This means that though hospital staff were aware of the health hazards associated with hospital waste management practices yet they have indifferent attitudes toward such activities. It implies that being aware of the health hazards did not influence the attitudes of the respondents. This finding is similar to what was reported by Desa et al. (2012) in Malaysia. This may mean that resources and ability to translate awareness into action is lacking in the hospitals as indicated by theory of planned behaviour, resource dependency theory and Pred's behavioural matrix underpinning this study.

Hypothesis Testing

The study tested the hypothesis on awareness of hospital staff toward waste management practices. The null hypothesis (H_0) was that the awareness of hospital staff of the hazards associated with hospital waste does not differ among different professionals in the hospitals. The result from Kruskal-Wallis shows that there was no statistical difference between the awareness of hazards across the three different categories of staff working in the hospitals [$\chi^2(2, n = 272) = 1.54$, $p = .463$], therefore the null hypothesis was retained and the alternative was rejected. This implies that the awareness level of the medical, paramedical and orderlies in the hospitals did not differ, hence they are well aware of the health hazards associated with hospital solid waste handling. The mean rank values in Table 49 clearly confirm that there is no statistical difference in the awareness of hazards among the categories of staff.

Table 49: *Results of Kruskal-Wallis Ranking*

Item	Staff category	N	Mean Rank
Actual staff awareness of	Medical	172	135.40
hazards associated with	Paramedical	67	131.77
hospital solid waste	Orderlies	33	151.85
management	Total	272	

Source: Field Survey, Amfo-Otu (2015)

The study tested the hypothesis on the attitudes of the hospital staff towards waste management do not differ among different professionals in the hospitals (H_0). The result from Kruskal-Wallis output shows that there was no significant difference between the attitudes of different categories of professionals in the hospitals towards waste management activities [$\chi^2(2, n =$

276) = 1.22, p = .542]. Therefore the null hypothesis was accepted and the alternative was rejected. This means that the attitudes of the medical, paramedical staff and orderlies in the hospitals did not differ towards waste management activities. From the mean rank result, the orderlies had the highest mean rank as shown in Table 50.

Table 50: *Results of Kruskal-Wallis Ranking for difference between Category of Staff and Attitudes toward Waste Management Activities*

Variable	Staff Category	N	Mean Rank
Overall staff attitude towards waste management activities	Medical	173	137.55
	Paramedical	70	134.36
	Orderlies	33	152.27
	Total	276	

Source: Field Survey, Amfo-Otu (2015)

Influence of Socio-demographic Variables on Staff Awareness and Attitudes

It was expected that socio-demographic characteristics of respondents will influence their awareness and attitudes toward hospital solid waste management. Therefore variables such as age, sex, location of hospitals and years of work experience were tested to assess how these factors influenced staff awareness of health hazards associated with hospital solid waste and attitudes towards hospital solid waste management.

It was expected that the young workers will have better awareness and attitudes than old workers because they are accustomed to the use of modern information technologies to access available information. Kruskal-Wallis test revealed that there was no statistical difference in the awareness of respondents about health hazards associated with hospital solid waste and five different age groups (Gp1, n = 59: below 26 years, Gp2, n = 52: 27-28 years, Gp3, n =57: 29-33 years, Gp4, n = 56: 34-48 years, Gp5, n = 48: 49 years and above) $X^2(4, n = 272) = 5.01, p = .287$. This means the age of the respondents did not affect their awareness level about health hazards associated with hospital solid waste management. This may be due to the fact that the respondents shared information about hazards linked to their job or training provided at different stages of their professional carrier exposed them to the same facts. It was found from the median score that the age group between 29 – 33 years had the highest median score (md = 3.14) with those below 26 years and those above 49 years having the same median score (md = 2.71) which was the least.

With respect to staff attitudes toward waste management activities it was found from the Kruskal-Wallis test that there was no statistical difference in the attitudes of respondents across five different age groups (Gp1, n = 60: below 26 years, Gp2, n = 52: 27-28 years, Gp3, n =56: 29-33 years, Gp4, n = 59: 34-48 years, Gp5, n = 49: 49 years and above) $\chi^2(4, n = 276) = 2.57, p = .633$. This means the age of the respondents did not affect their attitude towards hospital solid waste management activities within the hospitals. This may be due to the fact that the respondents learned from one another such that one's attitude was influenced and shaped by that of the collective group. The aged group might have influenced them if they faced the same limitation to demonstrate desired attitudes. It was found from the median score that the age group between 34 – 48 years had the least median score (md = 1.67) with all the other age groups having the same median score (md = 2.00).

Test for difference between the categorical data sex was tested on the continuous variables actual staff awareness and attitudes using the Mann-Whitney since the continuous variables were not normally distributed. The results for the actual staff awareness showed that there was no significant difference between the level of awareness about health hazards associated with hospital solid waste of males (md = 2.86, n = 113) and females (md = 2.86, n = 159), U = 8471.5, z = -0.80, p = .42., r = 0.04. The effect of r = 0.04 is very small according to Cohen (1988) criteria that if r value of 0.1 = small effect, 0.3 = medium effect and 0.5 = large effect. This means the males and females working in the hospitals had similar awareness level with regards to hospital solid waste management and that the effect of sex on the awareness was very small. This means that they are either exposed to the same information or lacked the same information which gave the same awareness.

On staff attitudes toward hospital solid waste activities there was no significant difference between the attitudes of males (md =2.00, n = 116) and females (md = 1.67, n = 160), U = 8454, z = -1.28, p = .42, r = 0.08. This implies that both males and females working in the hospitals had similar poor attitudes toward hospital solid waste management and that sex has small effect on the attitudes of respondents. The implication is that though both sexes are exposed to the same information but their attitudes did not match their awareness of the health hazards associated with hospital solid waste management for adopting preventive measures.

The results of Kruskal-Wallis test for the location of the hospitals against the awareness of staff health hazards associated with hospital solid waste showed a significant difference between the awareness of health hazards associated with hospital waste and the staff at these hospitals $\chi^2(5, n = 272) = 157.5$, $p = .000$. The Orthopaedic and Donkorkrom hospitals recorded the higher median scores (md = 3.5714) than Holy Family and VRA hospitals as shown in Table 51.

Table 51: *Median and Mean Rank from Kruskal-Wallis Test for difference between Hospitals and Staff Awareness*

Name of hospital	N	Median	Mean Rank
Koforidua Regional Hospital	91	3.1429	167.18
VRA Hospital	34	1.5714	54.43
Donkorkrom Hospital	37	3.5714	179.14
Atua Government Hospital	49	3.4286	181.71
Holy Family Hospital	48	1.4286	40.82
Orthopaedic	13	3.5714	197.92
Total	272	2.8571	

Source: Field Survey, Amfo-Otu (2015)

This means that staff from different hospitals and locations have different awareness about the health hazard associated with hospital solid waste management. In this case the private hospital and the district hospitals in the rural districts seem to have high level of awareness, as given by the median and the mean rank in Table 51.

The direction of the significance was determined by the post-hoc analysis which showed that the difference existed between a number of hospitals and their attitudes toward hospital solid waste management activities. The alpha level of 0.05 was divided by the number of paired comparisons made from the hospitals which added up to 15 to give the new alpha level of $p = 0.003$ for the determination of the significance between each pair as given by Bonferroni as cited in Pallant (2007). Therefore the post hoc tests were compared with the new alpha value of $p = 0.003$ to determine the statistical significance for both the staff awareness and attitudes using Mann-Whitney U test.

The results of Mann-Whitney U test revealed that there was statistically significant difference in the awareness on health hazards associated with hospital solid waste management of staff at Koforidua regional hospital (md = 3.1429, n = 91) and VRA hospital (md = 1.5714, n = 34), U = 111.5, z = -7.979, $p = 0.000$, r = 0.71. The effect size as given by r = 0.71 is a large effect according to Cohen (1988). Similarly, there was statistically significant difference in the awareness on health hazards associated with hospital solid waste management of staff at Koforidua regional hospital (md = 3.1429, n = 91) and Holy Family hospital (md = 1.4286, n = 48), U = 88.5, z = -9.301, $p = 0.000$, r = 0.79.

This means that the Koforidua hospital staff have higher level of awareness than VRA and Holy Family hospitals staff. The reason may be that the regional hospital may be doing more training of staff on hospital waste hazards and have more access to information than the VRA and Holy Family hospitals. This finding affirms the relevance of information in change in attitudes as indicated by Pred's behavioural matrix. More so, the regional hospital had a safety nurse who coordinated training activities as well as policy on occupational health which will definitely raise the awareness of staff.

There was statistically significant difference in the awareness on health hazards associated with hospital solid waste management of staff at VRA hospital (md = 1.5714, n = 34) and Atua Government hospital (md =

3.4286, n = 49), U = 68, z = -7.106, p = 0.000, r = 0.78. The median score shows that the awareness of staff at Atua hospital was higher than VRA hospital. Similar result was obtained between VRA hospital (md = 1.5714, n = 34) and Donkorkrom hospital (md = 3.5714, n = 37), U = 47.5, z = -6.710, p = 0.000, r = 0.80. The median score shows that the awareness of staff at Donkorkrom hospital is higher than VRA hospital. These may be due to more training of staff on hospital waste hazards and more access to information at Atua and Donkorkrom than the VRA hospital.

There was statistically significant difference in the awareness on health hazards associated with hospital solid waste management of staff at Donkorkrom hospital (md = 3.5714, n = 37) and Holy Family hospital (md = 1.5714, n = 48), U = 36.5, z = -7.579, p = 0.000, r = 0.82. The median score shows that the awareness of staff at Donkorkrom hospital is higher than Holy Family hospital. Similar result was found between Atua Government hospital (md = 3.4286, n = 49) and Holy Family hospital (md = 1.5714, n = 48), U = 55, z = -8.120, p = 0.000, r = 0.82. There was statistically significant difference in the awareness on health hazards associated with hospital solid waste management of staff at Orthopaedic hospital (md = 3.5714, n = 13) and Holy Family hospital (md = 1.5714, n = 48), U = .000, z = -5.544, p = 0.000, r = 0.82. The median score shows that the awareness of staff at Orthopaedic hospital is higher than Holy Family hospital. This means that Holy Family hospital is probably not training their staff on health hazards associated with hospital waste or such information is not made available to them.

Kruskal-Wallis test revealed a statistically significant difference in the attitudes of the staff toward waste management activities at the hospitals across the six studied hospitals $\chi^2(5, n = 276) = 97.2$, $p = .000$. Donkorkrom and orthopaedic hospitals had the higher median scores (md = 3.3333) than the other hospitals as given in Table 52. This implies that some hospital staff had good attitudes whilst others had bad attitudes toward hospital solid waste management activities. These differences may be due to the availability of logistics to aid in the implementation of the right attitudes, lack of information to shape attitudes or other factors.

Table 52: *Median and Mean Rank from Kruskal-Wallis Test for difference between Hospitals and Staff Attitudes*

Name of hospital	N	Median	Mean Rank
Kof Regional Hospital	91	1.6667	111.92
VRA Hospital	37	2.0000	138.53
Donkorkrom Hospital	37	3.3333	235.76
Atuah Gov Hospital	50	1.6667	115.45
Holy Family Hospital	48	1.6667	110.92
Orthopaedic	13	3.3333	237.85
Total	276	2.0000	

Source: Field Survey, Amfo-Otu (2015)

The results of Mann-Whitney U test revealed that there was statistically significant difference in the awareness of staff about health hazards of hospital solid waste of staff at Koforidua regional hospital (md = 1.6667, n = 91) and Orthopaedic hospital (md = 3.3333, n = 13), U = 60.5, z = -5.291, $p = 0.000$, r = 0.52. The effect size as given by z = 0.5 is a large effect. These two hospitals are only comparable when considering the ownership. The Koforidua regional hospital which is very large well-resourced from human to logistics and owned by government but the orthopaedic hospital is relatively small facility with private ownership. Therefore there could be positive attitudes in private hospital influencing the other staff to have good attitudes.

There was significant difference in the attitudes of staff toward hospital solid waste management activities of staff at VRA hospital (md = 2.0000, n = 37) and Orthopaedic hospital (md = 3.3333, n = 13), U = 43.5, z = -4. 398, $p = 0.000$, r = 0.62. The effect of size as given by r = 0.62 is large effect. These two hospitals in terms of size of staff are different and one is privately owned whilst the other is owned by government institution as a quasi-government hospital. The provision of the required waste management logistics may be different. Moreover, due to the small size, effective supervision may help instil good attitudes in staff, and these may account for the differences in attitudes.

In addition, significant difference was observed in the attitudes of staff towards hospital solid waste management activities of staff at VRA hospital (md = 2.0000, n = 37) and Donkorkrom hospital (md = 3.3333, n = 37), U = 139, z = -5. 946, $p = 0.000$, r = 0.69. The effect size as given by r = 0.69 is a large effect. The difference may be due to the fact that one of the hospitals is located in a rural area and so staff may not have good access to information to improve on their attitudes. More so, irregular training and inadequate supply of appropriate logistics in these two hospitals may account for the differences. A significant difference was observed in the attitudes of staff towards hospital solid waste management activities of staff at Holy Family hospital (md = 1.6667, n = 48) and Donkorkrom hospital (md = 3.3333, n = 37), U = 48, z = -7.494, $p = 0.000$, r = 0.81. Even though they are all church based hospital facilities one is located in a rural area and the other is located in an urban area which may influence the human resource base and their attitudes. The result means that the rural hospital staff have good attitudes toward hospital solid waste management activities.

Mann-Whitney U test results showed a statistically significant difference in the attitudes of staff towards hospital solid waste management activities of staff at Holy Family hospital (md = 1.6667, n = 48) and Orthopaedic hospital (md = 3.3333, n = 13), U = 8.5, z = -5.401, p = 0.000, r = 0.69. The result shows that the private hospital staff has better attitude than the church based hospital. This may be due to large number of staff in the latter than the former given a wide range of individual attitudes.

Lastly, there was a statistically significant difference in the attitudes of staff towards hospital solid waste management activities of staff at Atua Government hospital (md = 1.6667, n = 50) and Orthopaedic hospital (md = 3.3333, n = 13), U = 64, z = -4.498, p = 0.000, r = 0.57. The result shows that the private hospital staff had a better attitude than the government based. This may be due to the large number of staff in the latter than the former given a wide range of individual attitudes. All the other pairs did not show any significant difference between the attitudes of staff towards hospital solid waste management and location or ownership of hospital.

Relationship between Hospital Staff Awareness, Attitudes and Years of Working Experience

The study examined the relationship between staff awareness of health hazards associated with hospital solid waste and their attitudes towards hospital solid waste management activities. Spearman correlation result

(Table 53) showed that there was significantly weak positive linear relationship between staff awareness and attitudes (rho = 0.128, p-value = 0.037). However, there was weak negative and insignificant relationship between the number of years staff have worked in the hospital with their level of awareness about health hazards associated with hospital solid waste (rho = -0.109, p-value = 0.073). This means that staff awareness about health hazards associated with hospital solid waste decreases as the years of work experience increases. This may be as a result of the routine nature of work at the hospital.

Table 53: *Relationship between Attitudes, Awareness and Working Experience*

Items	N	Spearman's rho	P-Value
Awareness and Attitude	269	0.128	0.037*
Years of experience and Awareness	269	-0.109	0.073
Years of experience and Attitudes	273	0.010	0.874

Source: Field Survey, Amfo-Otu (2015),

*Correlation is significant at 0.05 level of significance

There was very weak positive relationship between the years of working experiences with staff attitudes towards hospital solid waste management activities (rho = 0.010, p-value = 0.874) which was statistically not significant. This means that staff attitudes towards waste management activities at the hospitals is not associated with the years of working experience, even though it is expected that the more one works and gains experience the better the attitudes.

CHAPTER SEVEN

KNOWLEDGE OF OCCUPATIONAL HEALTH AND SAFETY PRACTICES AMONG HOSPITAL STAFF

Introduction

This chapter examined the occupational health and safety (OHS) knowledge and practices of the hospital staff. It considered the regulatory framework for health and safety practices, available safety equipment, workers training on occupational safety and practices.

Occupational Health and Safety Framework

Institutions or organisations that value occupational health and safety normally set out the regulatory framework to guide every staff as mandated by the National Labour Law (Act 653) (2003). The availability of such documents is critical to provide the needed information as to the "dos" and the "don'ts" of occupational health and safety to the staff. Respondents were asked if their hospitals had an occupational health and safety policy to guide their safety practices at the hospital. It was found that out of 274 valid responses 130 (47%) of them responded 'yes', 23 percent responded 'no' whilst 30 percent said they do not know. These responses indicate that most of the workers either do not know of the existence of the occupational health and safety policy or such documents do not exist at all. If it truly existed and they did not know then it shows how information is scarce or simply the staff were not interested in knowing what their occupational health and safety requirements and provisions were.

The 47 percent who were either aware of the policy or might have heard about it or they just answered 'yes' for convenience were in the minority. Interview with the administrators and the officers responsible for waste management confirmed that five of the hospitals did not have their own occupational health and safety policy or framework to ensure the protection of workers except the Koforidua regional hospital. At Koforidua regional hospital it was indicated that the hospital had developed a plan and policy for occupational health and safety practices but the book is yet to be printed. The drafted policy articulates the vision and objectives of the hospital as well as the hazards within the working environment of the hospital. However, a soft copy of the national occupational health and safety had been circulated to the unit heads to guide them in enforcing occupational health and safety practices at their respective units.

Training of Hospital Staff in Occupational Health and Safety

Capacity building is an integral part of every growing and forward-looking institution. Hospitals cannot be left out of the growing technology and the occupational health and safety demand associated with such technologies used in hospital operations. Staff were asked about the frequency of occupational health and safety training that were normally done for them by the hospital. It was found that training in this regard was inadequate. This is because most of the respondents (66.9%) indicated that training was done as and when it was needed (Table 54). This finding was corroborated by the interviews with the administrators and those who supervise waste management activities in five of the hospitals that no major official training had been organised for all staff on health and safety. It was found that the in-charges at the wards normally discussed infection prevention measures with staff. The result is similar to that of Bamfo-Tanor and Owusu-Agyei (2013) that training for healthcare waste management staff was low at Korle-Bu.

Table 54: *Frequency of Training of Respondents in Occupational Health and Safety*

Name of hospital	Responses with regard to Training				Total
	Twice in a year f (%)	Once in a year f (%)	As and when it is needed f (%)	Others f (%)	
Kof. Regional Hospital	6(2.2)	11(4.0)	62(33.7)	12(4.3)	91
VRA Hospital	4(1.5)	5(1.8)	25(13.6)	3(1.1))	37
Donkorkrom Hospital	4(1.5)	2(0.7)	28(10.2)	3(1.1)	37
Atuah Gov. Hospital	9(3.3)	4(1.5)	28(10.2)	8(2.9)	49
Holy Family Hospital	2(0.7)	5(1.8)	33(12.0)	8(2.9)	48
Orthopaedic	3(1.1)	0(0.0)	8(2.9)	2(0.7)	13
Frequency	28	27	184	36	275
Percent	10.2	9.8	66.9	13.0	100

Source: Field Survey, Amfo-Otu (2015)

At Koforidua regional hospital the safety officer indicated that they had just started training staff on monthly basis on common and specific OHS issues. Follow-ups were made weekly to monitor how things were going. When asked how long this had been done it was indicated that it was less than a year, and eight months ago. They added that the training covered the staff of the waste collection company engaged by the hospital to collect and haul their waste for disposal. This is an important step because the health and safety of staff of the private company could be relating to the hospital staff. On the frequency of training, it was indicated that the nature of work was such that it was difficult to mobilise the staff so training was done on meeting days of the various departments.

The findings imply that there were no fixed training schedules on occupational health and safety within a year but they were done depending on the needs at a point in time. Having a properly planned capacity building strategy for staff on occupational health and safety practices certainly, require hospitals to have such training frequency fixed (say once or twice a year with some emergency ones). Ad-hoc training was very good in the light of changing world of work and tight schedule of staff but may not address important but general issues of OHS of most of the staff. They are however very good for a specific target group of staff when addressing imminent OHS need.

Occupational Health and Safety Committee

Table 55 shows hospitals with Occupational Health and Safety Committees (OHSC) and/or Infection Prevention Control Committees (IPCC). The IPCC had the mandate to plan and implement programmes to help prevent the spread of infections within the hospitals whilst OHSC deals with health and safety of staff. All facilities recognised the need to ensure health and safety of staff hence the formation of IPCC and OHSC. It must be indicated that, safety at work in the hospitals go beyond infection prevention to address issues such as stress, ergonomics, and other psychosocial issues that affect the general well-being of workers. This means that infection prevention and control committees cannot replace occupational health and safety committees in terms of the role they play in ensuring that proper health and safety systems are in place and are working. One major role of safety committees is to stimulate the interest of workers to be safety conscious and provides platform for consultations between workers and managers. This role should not be ignored by substituting it with other committees that did not even have this mandate.

Table 55: *Hospitals with Occupational Health and Safety Committees*

Name of Hospital	Existence of OHSC	Existence of IPCC	Status
Kof. Regional Hospital	Yes	Yes	Both are active
VRA Hospital	No	Yes	IPCC active
Donkorkrom Hospital	No	Yes	IPCC active
Atuah Gov. Hospital	Yes	Yes	Both are active
Holy Family Hospital	No	Yes	IPCC active
Orthopaedic	No	Yes	IPCC active

Source: Field Survey, Amfo-Otu (2015)

Apart from Koforidua regional hospital where there was an active Occupational Health and Safety Unit which was coordinated by an Occupational Health Nurse all others did not have such units. At Volta River Authority hospital, the administrator indicated that occupational health and safety issues at the hospital were coordinated by the Occupational Health and Safety Unit of VRA. At Atua government hospital it was indicated that the hospital had in place occupational health and safety committee to plan and implement safety systems of work for staff but this does not include waste management activities. The committee was one year old at the time of the study but they had never met before. A copy of their terms of reference was requested for but it was indicated that there were no terms of reference. This gives an indication as to how these hospitals appreciate occupational health and safety and the need to give it a priority. Infection prevention committee's work may not fully address the safety concerns of hospital staff because safety at the hospitals goes beyond infection prevention.

At Koforidua regional hospital it was indicated that infection prevention education took the form of lectures and the use of flip charts to demonstrate and show the safety processes. The orderlies have been trained on how to handle the waste from the wards to ensure their safety and that of other staff and patients were yet to be organised. This means that some plans have been instituted to bring the attention of all workers as well as patients and their caregivers to the need for health and safety practices at the hospital.

Provision and use of Personal Protective Equipment (PPEs)

As required by law, employers are mandated to provide occupational health and safety measures for their staff including the provision of personal protective equipment. At all the hospitals, it was found that the staff were provided with personal protective equipment (PPE) such as gloves, nose covers, designed dress, one pair of safety shoe but no slippers to meet their occupational health and safety needs. The supply of uniform and safety boots were made to only the orderlies and ground workers at the private and VRA hospitals. Table 56 shows that about 41.9 percent of hospital staff frequently use personal protective equipment whilst 19.7 percent never used them. Apart from administrative and drivers all hospital staff need one or more personal protective equipment, hence the responses. Medical staff (11.1%) not using personal protective equipment may do so at their own risk since in their line of duty they may be exposed to one infection or the other.

This means that most of the hospital staff have been using the personal protective equipment provided by management to them. This finding is similar to Bamfo-Tanor and Owusu-Agyie (2013) who reported that about 61% of the medical staff used PPEs in hospitals in Accra. The staff listed safety PPEs used to include hand gloves (disposable and non-disposable), nose cover, uniforms and safety boots. The supplied PPEs are similar to what was supplied to healthcare waste workers in Addis Ababa (Debere et al., 2013).

Table 56: *Respondents frequency of using PPEs*

Categories of staff		Responses				Total
		not at all	not often	Often	very often	
Medical	n	31	23	54	66	174
	%	11.1	8.2	19.4	23.7	62.4
Paramedical	N	16	11	14	30	71
	%	5.7	3.9	5.0	10.8	25.4
Orderlies	N	8	5	0	21	34
	%	2.9	1.8	0.0	7.5	12.2
Total	N	55	39	68	117	279
	%	19.7	14.0	24.4	41.9	100.0

Source: Field Survey, Amfo-Otu (2015)

Common Health and Safety Practices among Hospital Staff

On the use of hand gloves, about 39.2 percent of staff who used PPEs strongly agreed that they frequently used the hand gloves during working hours as shown in Table 57. It implies that most of the workers used hand gloves provided by management to protect themselves from infectious agents that can be transmitted through hand contact. Those who strongly disagreed could be those whose work does not allow them to or they just do not comply with such safety requirement or measure or the required gloves are not supplied.

Table 57: *Respondents Agreement with using Hand Gloves during Working Hours*

Categories of staff		Responses				Total
		Strongly disagree	Disagree	Agree	Strongly agree	
Medical	n	40	15	35	53	143
	%	17.8	6.7	15.6	23.6	63.8
Paramedical	n	18	3	13	21	55
	%	8.1	1.3	5.8	9.4	24.6
Orderlies	n	7	3	2	14	26
	%	3.1	1.3	0.9	6.2	11.6
Total	n	65	21	50	88	225
	%	29.0	9.3	22.3	39.2	100.0

Source: Field Survey, Amfo-Otu (2015)

Some staff complained that sometimes the hand gloves do not come on time whilst one orderly said "*I had to buy a textile hand glove myself because the industrial one from the hospital was delaying*" (C. Ntow, personal communication, April 2, 2015). The findings point to the fact that workers were somehow alert and conscious of their health and safety and so have taken steps to protect themselves even if management does not provide them with hand gloves (required resources). Delay in supplying the appropriate hand gloves to waste management staff is similar to the observation of Haylamicheal et al. (2011) that some waste handlers were observed using disposable and surgical gloves for cleaning medical areas because of the unavailability of appropriate gloves.

Delay or unavailability of resource supply to staff cannot engender proper occupational health and safety behaviour among hospital staff. As indicated by the resource dependency theory, hospital staff depend on the supply of personal protective equipment by management to enforce health and safety behaviour. Staff providing themselves with industrial hand gloves becomes a possible way of managing personal dependency on management for personal protection. This implies that when staff are constrained by resources supply they will give priority to their own safety and procure the needed resources or improvise for themselves.

It was observed that the use of nose mask or cover was not very common and uniform among the staff from the hospitals. It was found that close to one third (30.3%) agreed that they used nose cover during working hours (see Table 58). Those who either agreed or strongly agreed together constituted about 53.1 percent of those who frequently used PPEs. This means that most of them agreed using nose cover during working hours. Those who strongly disagreed may be telling the reality since not all the work at the hospital requires the use of nose cover. For instance, at the administration, X-ray, OPD etc. it is not necessary for officers to use the nose mask but those at the pharmacy, records, laboratories, dental, wards, surgical wards etc. can use them.

Table 58: *Respondents agreement with using Nose Cover during working Hours*

Categories of staff		Responses: Strongly disagree	Disagree	Agree	Strongly agree	Total
Medical	n	39	24	44	36	143
	%	17.4	10.7	19.6	16.1	63.8
Paramedical	n	20	13	16	6	55
	%	8.9	5.8	7.1	2.7	24.6
Orderlies	n	3	6	8	9	26
	%	1.3	2.7	3.6	4.0	11.6
Total	n	62	43	68	51	224
	%	27.6	19.2	30.3	22.8	100.0

Source: Field Survey, Amfo-Otu (2015)

Complaints about the comfort in using PPEs most often comes from the use of nose cover because it makes breathing difficult. Statistically, there was a significant difference between the agreement levels expressed by the staff from the various hospitals with the use of nose cover during working hours [χ^2(15, n = 279, = 43.2, p = .001, V = .227]. This means that some hospital staff used the nose cover whilst others did not. This reflects differences in occupational health and safety practices among staff of different hospitals. The differences may be due to uninformed position of the staff, unavailability of the nose mask or the discomfort of using them. The role of health and safety in efficient staff performance is important to underscore the need to provide required resources for safety practices, and staff trading-off their comfort for their safety.

The use of overall coat or apron is another common safety practice among hospital staff to protect them from spills and other hazards. From Table 59, about one third (33.0%) of the staff strongly agreed that they used overall coat frequently during working hours. The spread of the agreement is very interesting even though it speaks to the facts on the ground.

Table 59: *Respondents agreement with using overall Safety Coat during working hours*

Categories of staff		Responses				Total
		Strongly disagree	Disagree	Agree	Strongly agree	
Medical	n	31	31	41	40	143
	%	13.8	13.8	18.3	17.9	63.8
Paramedical	n	13	5	14	23	55
	%	5.8	2.2	6.3	10.3	24.6
Orderlies	n	4	2	9	11	26
	%	1.8	0.9	4.0	4.8	11.6
Total	n	48	38	64	74	224
	%	21.4	16.9	28.6	33.0	100.0

Source: Fieldwork, 2015

The fact is that most medical staff do not use overall coat and they were in the majority within the hospitals. It could mean that those who should wear an overall coat during working hours were not aware of or it was not clear to them. However, paramedical staff like laboratory technicians, pharmacy staff, x-ray and orderlies handling solid waste at the hospital and medical staff were all expected to wear overall coat or apron to protect them against unexpected spills while attending to their work. The staff employed for handling waste in the hospital use almost complete personal protective equipment, including overall gown and protective boots and gloves (Abor, 2007).

Using overall coat is important for their safety and rightly used them whilst others did not, hence they may be exposed to spills. The reasons for not using may be due to inadequate information on the use of overall coat by hospital staff which reflected in their practices as explained by Pred's behavioural matrix (1967) that people with right information and capacity will make the right decisions and behave well. It can also mean that the overall coats were not provided making the staff think that they are not important safety measures as indicated in the resources dependency theory (Pfeffer & Salancik, 1978). If management provided the overall coat and staff did not use them then supervision on use of resources is weak, contributing to poor safety standard at work. Conceptually, administrative and individual functions have failed to ensure workers used the assigned resources for work.

Observance of some common safety practices among the hospital staff is important safety measures for infection prevention and control. It emerged that majority (86.0%) of them strongly agreed that washing of hands with soap is a good safety practice with only 0.4 percent disagreeing (See Table 60). This implies that majority of the hospital staff view hand washing with soap as an important safety measure for them and they actually practised that. This is an important behaviour for infection prevention and for promoting proper occupational health and safety. The decision of the majority (86.0%) may be as a result of weighing the pros and cons of hand washing and are practising it. According to the theory of planned behaviour, attitude is developed from a summation of beliefs that the behaviour will produce certain results and the evaluation of the weight of the outcome (Ajzen, 1991). Staff therefore have evaluated hand washing practices and belief it to be more beneficial to them, hence their positive attitude to hand wash practices.

Table 60: *Respondents agreement with hand washing as a Safety Measure*

Name of hospital	Responses				Total
	Strongly disagree	Disagree	Agree	Strongly agree	
Koforidua Regional Hospital	2	1	16	72	91
VRA Hospital	2	0	2	33	37
Donkorkrom Hospital	0	0	4	36	40
Atuah Gov Hospital	2	0	4	44	50
Holy Family Hospital	2	0	3	43	48
Orthopaedic	0	0	1	12	13
Frequency	8	1	30	240	279
Percentage (%)	2.9	0.4	10.8	86.0	100.0

Source: Field Survey, Amfo-Otu (2015)

The observation was that all the hospitals had soap and water points for hand washing at the wards but not outside the wards. This means that hand washing practices depended on the availability of resources to make the adoption of the behaviour possible and these were provided for staff to practice the behaviour. The presence or absence of hand washing facilities can serve as a control on behaviour of the staff in practicing hand washing. This is explained by the external promoting controls such as the provision of opportunities and resources component of perceived behavioural control in the theory of planned behaviour (Conner & Armitage, 1998). From the conceptual framework, it can be deduced that the administrative function is well performed to help protect workers by providing required resources for proper behavioural practices in hand washing and individuals have accepted and used the resources to their benefits.

Moreover, it was observed that most of the medical staff used disposable hand gloves, therefore, washing of hands was not frequently done but as and when they removed the gloves or when the gloves were soiled. This may protect the staff but not the patients since the gloves can aid in cross-infection of patients at the hospitals. This was the general trend at all the hospitals studied.

The effectiveness of the PPEs to protect hospital staff from possible hazards depends on their frequency of use and the rationale for using them. Table 61 shows that out of those who frequently used the PPEs, most (60.3%) of them strongly disagree that they use the PPEs because their supervisors and superiors expect them to do so but 15.7 percent agreed and 12.9 percent strongly agreed. The implication of this is that majority of the staff used the protective equipment to protect themselves on their own volition but not because their supervisors wanted or expected them to do that. Those who often used the PPEs not because their superiors were monitoring them implied good safety attitude among the staff. This in line with the position of the theory of planned behaviour (TPB) and theory of reasoned action (TRA) that attitudes are decisions taken based on one's personal norm (Ajzen, 1991; Fishbein & Ajzen, 1975).

Table 61: *Respondents use PPEs because their Superior wanted them to do so*

Categories of staff		Responses				Total
		Strongly disagree	Disagree	Agree	Strongly agree	
Medical	n	88	18	23	14	143
	%	39.3	8.0	10.3	6.2	63.8
Paramedical	n	28	6	10	11	55
	%	12.5	2.7	4.5	4.9	24.6
Orderlies	n	19	1	2	4	26
	%	8.5	0.4	0.9	1.8	11.6
Total	n	136	25	35	29	224
	%	60.3	11.1	15.7	12.9	100.0

Source: Field Survey, Amfo-Otu (2015)

However, those who either agreed or strongly agreed constituted about 28.6 percent, used the PPEs because of the expectation of their supervisors. This indicates how people will comply when they know that there are big eyes or authorities watching their actions. It confirms the perceived behavioural control in the theory of planned behaviour (Ajzen, 1991) to the effect that the environments of people actually influence their attitudes and behaviour. Given the chance these staff ordinarily would not have used the PPEs. This means that if the supervisors are absent the 28.6 percent are likely not to use the PPEs. It may also mean that they do not really know why they have to use them, which is why they do so to please their supervisors or to conform to the norm. This underscores the need for safety training and information flow as indicated in the conceptual framework.

One supervisor indicated that PPEs were provided as and when the old ones were damaged and not usable but there was no specific schedule for changing or replacing them. At the private hospital, the officer indicated that " *safety boots were provided on yearly basis at the beginning of the operation of the hospital but now due to numerous challenges confronting the facility this has changed and I don't know when it will be done again*" (Emmanuel Tanko). The implication is that some personal protective equipment are not regularly supplied as before due to some challenges which can be attributed to the availability of funds. Alagoz and Kocasoy (2008) reported low usage of PPEs due to lack of appreciation and irregular supply of the same. Both reusable (industrial) and disposable hand gloves were provided to staff. Using disposable hand gloves could be very expensive to management, therefore, changing to industrial gloves can help reduce expenditure on waste management. To keep the hand gloves hygienically, orderlies were provided with disinfectants such as Dettol and bleach (sodium hypochlorite) to disinfect the gloves and for hand washing. This may be one of the major steps to prevent infection among hospital solid waste management staff.

Quite often, the complaints about the use of personal protective equipment have been about their convenience to use and comfort of users. On respondents agreement with a statement that using PPEs is comfortable, about two thirds (31.6%) of those who frequently used PPEs agreed and 20.1 percent disagreed (see Table 62). This gives mixed responses but at least about 61.1 percent either strongly or just agreed that the PPEs were comfortable to use. It implies that those who do not feel very comfortable using the PPEs are not likely to use them and they may be among those who use it because of their supervisor's presence.

Table 62: *Respondents agreement with Comfortability of using PPEs*

Categories of staff		Responses				Total
		Strongly disagree	Disagree	Agree	Strongly agree	
Medical	n	26	28	46	43	143
	%	11.6	12.5	20.5	19.2	63.8
Paramedical	n	10	11	18	16	55.0
	%	4.5	4.9	8.0	7.2	24.6
Orderlies	n	6	6	7	7	26
	%	2.7	2.7	3.1	3.1	11.6
Total	n	42	45	71	67	224
	%	18.8	20.1	31.6	29.5	100.0

Source: Field Survey, Amfo-Otu (2015)

Incident and Accident Reporting situation among Hospital Staff

Incident and accident are inevitable in every occupational setting which could result in injury to life or damage to properties. Respondents from all the hospitals were exposed to a variety of health hazards and were supposed to report to their superiors in case of any incident or accident. When staff were asked whether they have been injured in the course of work before, 149 (54.6%) out of 273 valid response were 'no' indicating that they have not been injured before whilst 124 (45.4%) did say 'yes' implying that they have been injured before in the course of their work (see Table 63). The 45.4 percent who have been injured before is on the high side compared to the 18 percent who suffered injuries/punctures for the last six months in Agar (Nigeria) (Sharma, 2010). The high percentage of injured staff (45.4%) affirms the porous nature of the occupational health and safety system within the hospitals.

The implication of high injuries among the respondents is that there is no proper occupational health and safety system in place at some of the hospitals giving rise to the high rate of accident and injury among workers. The rate of injury was therefore not the same in all the hospitals implying that some hospitals were doing better than the others. From Table 63, VRA hospital recorded the highest number of staff (12.5%) who have been injured before. The high reporting rate may be influenced by compensation paid for accidents in the course of work as provided for under the workmen compensation Act of 1987 to affected staff.

Table 63: *Respondents who have been Injured on their Work before*

Name of hospital	Responses		Total (N)
	No f (%)	Yes f (%)	
Koforidua Regional Hospital	60(22.0)	31 (11.4)	91
VRA Hospital	1(0.4)	35 (12.8)	36
Donkorkrom Hospital	25(9.2)	15(5.5)	40
Atuah Gov Hospital	37(13.6)	12(4.4)	49
Holy Family Hospital	17(6.2)	27(9.9)	44
Orthopaedic	9(3.3)	4(1.5)	13
Total (%)	54.6	45.4	100

Source: Field Survey, Amfo-Otu (2015)

Payment of compensation, in this case, may be a motivating factor to an report injury. A cross-tabulation of hospitals against whether staff have been injured before showed a significant difference between them [χ^2(5, n = 273, = 59.0, p = .001, V = .465]. This implies that injuries experienced by hospital staff were not the same or uniform among the hospitals. Some hospital staff were prone to more injuries because of the kind of hospital they work in, which may be due to pressure at work or some financial motivation. Moreover, the hospital did not have occupational health nurse and had limited number of training on healthcare waste management. The rate of injury indicates the extent to which workers are exposed to possible infection from their work through pricks/injuries.

From Table 64, it is clear that all categories of staff in the studied hospitals have been injured before in the course of their work. However, staff (orderlies) that are related directly to hospital solid waste management were of major concern. Close to half of the orderlies have been injured before (47.1%). This means that their safety needs either not properly addressed due to inadequate resources, lack of training or personal negligence of staff.

Table 64: *Categories of Hospital staff injured in the Course of Work*

categories of staff		Responses		Total
		No	Yes	
Medical	N	93	78	171
	%	34.1	28.6	62.6
Paramedical	N	38	30	68
	%	13.9	11.0	24.9
Orderlies	N	18	16	34
	%	6.6	5.9	12.5
Total	N	149	124	273
	%	54.6	45.4	100.0

Source: Field Survey Amfo-Otu (2015)

Those who responded ‘yes’ to the question of having experienced injuries, listed the kind of injuries they have experienced. A total of 67 (54.0%) out of the 124 ‘yes’ respondents gave the following injuries; needle pricks (85.0%), cuts from sharp objects (7.5%), slip and fall (4.5%), burns from exposure to chemical (1.5%) and blood spill (1.5%). Needle pricks dominated the injury list of staff, implying that within the hospital setting the common injury is the needle prick or pinch followed by cuts by other sharp objects. This is similar to the findings of Cardo et al. (1997) that 91 percent of health care workers who reported injuries were due to needle sticks pricks. Needle pricks are very dangerous because they have a potential for spreading an infectious disease of different kinds especially if they have been used on infected patients (Cardo et al., 1997; WHO, 2003).

All the hospitals kept incident books for recording incidents reported by staff with the unit in-charges. Most of those who have suffered injuries before (58.9%) reported the injury to higher authorities whilst 41.1percent did not report the injury. This finding is high compared to what was reported by Radha (2012) at Adichunchanagiri Medical College in India where only 13.3 percent of injuries were reported to higher authorities among different categories of hospital staff. It is, however, less than what was reported by Patwary et al. (2011) where most of the workers (94%) reported injuries they experienced within one month. Reporting injuries suffered at work is important for an investigation into causes of such incidents for corrective measures to be instituted. Those who reported the accident to higher authorities implies that they are aware of the formal system of reporting incidents and have the attitudes to comply which is in-line with Pred's behavioural matrix (1967).

As to why some staff did not report the injury to the higher authority, only 25 (20.2%) respondents out of the 124 who have been injured before answered with varied reasons. The reasons ranging from needles being a new one or not used before (32%), minor injury (20%), treated immediately (36%), occupational hazard (4%), not deemed necessary (8%) were given by the respondents. The implication of these varied reasons is that management of occupational health and safety at the hospitals will be deprived of critical information for addressing injuries at the facilities. Their response implies that they were to report but were not ready to report which is bad attitude or there was no motivation to do so. This means some people may be aware of the laid down procedures yet will not comply as found by Desa (2011) that students had high awareness but had negative attitudes toward waste management in Malaysia. It may also imply that they are not motivated to report an accident. According to Patwary et al. (2011), lack of incentive to remember or report an injury (such as payment of compensation for injuries) suffered contributed to low reporting of injuries in Bangladesh.

Staff who suffered from accidents and reported were taken through prophylaxes processes. Not reporting the injuries means that they will not go through the prophylaxes processes or treatment support provided by the hospital, making them susceptible to possible infection especially those who thought it was minor injury, not necessary and occupational hazards. Staff not going through post-exposure prophylaxis after injury from sharps have been reported (Neogi 2001). Madhukumar & Ramesh (2012) reported that housekeeping staff did not feel it was important to report injuries, some were not aware of the hazards associated with it and most of them did not know that they had to report such injuries.

If there were staff who did not find it prudent to report accidents and incidents, then it will be difficult for management to have accurate information about the rate of injury among staff. This attitude will not augur well for occupational health and safety planning and management. This confirms the assertion by Haiduven et al. (1999) that most workers are reluctant to describe such incidents from sharp objects and Salkin (2004) indicated that about half of needle sticks injuries are not reported.

One of the officers indicated that "*usually staff who experienced pricks and cuts were treated by given them first aid and were made to undergo medical check-up in another hospital (Tetteh Quarshie Memorial Hospital) to get an independent report to assure them of their safety*" (E. Tanko, personal communication, March 25, 2015). This means some staff may feel sceptical about results given to them by the hospital so they trusted independent results to be sure and confident of their health status after injury. In another dimension management of the hospital may want to create a sense of security by asking such affected staff to go for the test from another facility for neutrality sake.

On accident or incident related healthcare waste management, one of the labourers said that "… *I suffered a needle prick while pressing the waste into the waste bin*" (J. Bonko, personal communication, March 11, 2015). This implies that some sharps were not properly disposed of and mixed with the other categories of solid waste. A similar experience was reported by the

Occupational Health and Safety nurse at Koforidua regional hospital where one waste collection staff suffered a needle prick injury from a waste bin. This indicates that even though sharps were supposed to be in puncher proof boxes, they sometimes found their way into waste bins. The attitude of pressing the waste into a waste bin is not best practices for waste workers because it can make them more exposed to infectious agents or hazards. It confirms that low or no training is given to them on health and safety practices for handling hospital solid waste.

When asked if he went through treatment, he indicated that "*no, I squeezed that finger for the blood to come out so nothing entered my blood and since then nothing has happened to me*" (J. Bonko, personal communication, March 11, 2015). This implies that the labourer did not report the injury to a higher authority and therefore did not go through prophylaxes. Moreover, if the sharp was infected he would have been infected as well. Squeezing of the finger after needle prick is not the best safety measure to substitute for prophylaxes. Waste workers or Orderlies have not been insured, each staff had to do his/her own national health insurance but the hospital also provided healthcare services for staff annually.

Health screening for waste Management Staff

Staff in every employment enjoys some fringe benefits related to their work hence hospital staff were expected to enjoy some basic healthcare services from their workplace free of charge. Administrators were asked if waste management staff have been vaccinated against hepatitis B and C since they could be contracted through healthcare waste management activities. It was indicated that at the employment stage, one of the requirement was for the staff to go through medical screening which gives them the opportunity to work with the hospital. This may imply that most of the waste management staff have been vaccinated against hepatitis B. One administrator indicated that hepatitis B and C were part of the routine health screening for all staff, especially the orderlies.

At the private hospital, it was found that orderlies were not vaccinated against hepatitis B and C by the hospital, even though they were screened before employment. Most of the hospitals have instituted an annual health care screening exercise for staff to ensure that they are healthy and fit for the work. At Koforidua regional hospital the occupational health nurse indicated that staff were generally screened and vaccinated against some common diseases but vaccination against hepatitis B could not be confirmed immediately. At Atua government hospital, it was indicated that clinical staff were vaccinated against Hepatitis B in 2012 but not all staff.

These responses indicate that some of the hospital staff have been vaccinated against Hepatitis-B and C viruses. Vaccinating some staff and leaving others will make the unvaccinated group vulnerable to the infection. This is similar to what was reported in India where about 73.5 percent of study respondents were vaccinated for the Hepatitis-B virus (Asadullah et al., 2013). Vaccinating the staff may be fuelled by the knowledge that exposure to infectious waste may be a route for infection transmission to hospital staff.

The private waste management company had the responsibility of screening their staff working on hospital solid waste at the various hospitals. Upon contacting the supervisors of the waste company, it was indicated that some health screening was done generally before their employment. They were however not sure whether it was for hepatitis B and C screening but they were sure of HIV screening. This implies that if staff do not take care of themselves they can be infected with hepatitis B or C virus through exposure to solid waste from the hospitals. This will be against their environmental right to safe and hazard-free environment. It was reported that the company had an agreement with some hospitals to provide health care services for the staff apart from the fact that most of them had registered with the National Health Insurance Scheme. This means that measures have been taken to provide health support services to the workers.

Satisfaction of Staff with Safety Measure

Staff indicated how satisfied they were with the occupational health and safety measures instituted by hospital management to address their health and safety concerns. The responses were that 40.9 percent of them were not satisfied, with 13.0 percent being very satisfied with the occupational health and safety measures instituted at the hospital (see Table 65). This indicates that occupational health and safety measures at the hospitals are weak and needs improvement. It may mean that people are not aware of the safety measure or they do not exist at all. This result also reflects staff knowledge on the existence of occupational health and safety policy where the majority did not know.

One of the clear evidence to support staff not being satisfied is the fact that five (5) of the hospitals did not have substantive Occupational Health and Safety Officer except Koforidua Regional hospital. From Table 65, most of those who were satisfied or very satisfied were from Koforidua hospital. This indicates that some of the hospitals are actually performing creditably in occupational health and safety issues whilst others did not. The satisfaction with safety practices was not uniform implying that hospital management has a lot to improve health and safety practices among workers, especially orderlies.

Table 65: *Respondents Satisfaction with OHS Measures*

Name of hospital	Responses				Total
	Strongly dissatisfied	Dissatisfied	Satisfied	very satisfied	
Koforidua Regional Hospital	9 (3.3)	26(9.4)	31(11.2)	25(9)	91
VRA Hospital	15(5.4)	15(5.4)	5(1.9)	1(0.4)	36
Donkorkrom Hospital	2(0.7)	18(6.5)	15(5.4)	4(1.4)	39
Atuah Hospital	11(4.0)	18(6.5)	18(6.5)	3(1.1)	50
Holy Family Hospital	8(2.9)	31(11.2)	7(2.5)	1(0.4)	47
Orthopaedic	0(0)	5(1.9)	6(2.2)	2(0.7)	13
Frequency	45	113	82	36	276
Percent	16.3	40.9	29.4	12.9	100

Source: Field Survey, Amfo-Otu (2015)

Other Health and Safety Measures

One of the safety measures adopted to keep the waste collection system clean and safe was the washing of the waste storage bins. It was found from some of the hospitals that liquid soap, azar and bleach (Sodium hypochlorite) were provided for washing of waste storage bins. Washing of waste bins was done every week to keep the bins in good sanitary conditions by the waste collectors in two of the hospitals, others washed them as and when they thought it was important. The 240 litre bins used for secondary storage were washed by the orderlies in charge of waste management at the

Nkawkaw Holy Family Hospital every week. At other places they were washed on a monthly basis since the wastes were kept in liners which do not mostly soil the container. The exception was at the surgical wards areas where they were washed sometimes two days or weekly depending on whether the containers were soiled or not. From the private company providing the waste collection services, it was indicated by their supervisors that the communal types of containers were washed once in every month after emptying the content.

It was indicated that the detergents provided were also to be used by the orderlies and sanitation workers to maintain high personal hygiene standard for themselves apart from using them for the cleaning of waste storage containers. They were to use them to wash their hands, the re-usable protective equipment such as the hand gloves and other working tools. This is an essential measure to maintain the health and safety of such workers so that they will not be exposed to all kinds of pathogens from the waste unduly. However, some of the workers from the hospitals indicated that the supply of these consumables sometimes delays and do not come every month. They appreciated the fact that decision to provide them with this safety support was good but supply should be regular.

At Atua government hospital it was indicated that the incineration operator was trained in the operation of the incinerator, health and safety precautions to be observed but the training material was not available because it had been a long time. Even at the time of the data collection the so-called trained officers had retired the month before the study. At VRA hospital one of the morgue attendants has been assigned to operate the incinerator with no proper training to cover his safety needs but only on how to operate the machine. At Donkorkrom it was reported that the initial person who was trained to operate and manage the incinerator had stopped the work, therefore, another labourer was assigned to do that without any major training.

To examine if private company workers who are handling the waste at the Koforidua hospital and those providing the haulage services have been trained on health and safety by the company, it came out that no such major training has been done. For instance, drivers and their janitors were trained on the operation of the truck in loading and off-loading the content of the containers but not with respect to health care waste haulage. Training on general safety issues has been done by the safety unit of the company but they recognised the need for proper training on the handling of hospital solid waste.

Summary

The study has shown that most of the hospital staff were not aware of the existence of occupational health and safety policy document at the facility level. They do not have access to the document to inform them of their responsibilities and their rights. This is inimical to proper occupational health and safety practices and will not engender appropriate attitudes and behaviour for managing hospital solid waste. Stifling the staff of necessary information as argued in the Pred's behavioural matrix (1967) that adequate information is important for proper behaviour and decision making will lead to poor occupational health and safety practices. This means that if administrators fail to perform their functions the individuals will suffer which will affect waste management activities at the hospitals as illustrated by the conceptual framework for the study (Figure 5).

Some staff were not provided with the right personal protective equipment (PPEs) resources for their health and safety practices. This placed limitation on them to exhibit the necessary attitudes required for their safety. The availability of hand washing logistics facilitated frequent hand washing among staff. This means where resources were provided the majority of staff exhibited the required attitude. These examples conform to the perceived behaviour control component (control belief) of the theory of planned behaviour (Ajzen, 1991) which refers to factors and conditions that may influence or impede the performance of behaviour. In this case not providing PPEs affected staff safety practices and providing hand washing facilities enhanced hand washing practices. This finding also affirms the appropriateness of using the resource dependency theory for the study (Pfeffer & Salancik, 1978).

CHAPTER EIGHT

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter focuses on the summary, conclusions and recommendations of the research work. First of all, the chapter presents the main and specific objectives of the study and mentions the theories and concepts that informed the study. Secondly, it presents the summary of methods employed in collecting and analysing the data. Major findings from the study have been summarised in the next section of the chapter. Moreover, the conclusions drawn from the study and contribution to knowledge have been captured by the chapter. Lastly, recommendations made for the actors to improve on hospital solid waste management in the region and for further studies have been captured in this chapter.

Objectives of the Study

The main focus of the research was to assess the hospital solid waste management practices in the Eastern Region of Ghana. This was to help examine the processes involved in managing hospital solid waste in the region, institutional arrangements as well as staff attitudes toward such activities so as to protect hospital staff, patients and the general public from contracting infections from the hospital solid waste.

The specific objectives were to:

- describe the solid waste management systems in the hospitals;
- analyse the institutional arrangement for managing hospital solid waste in the selected hospitals;

- assess the awareness of hospital staff on the hazards associated with hospital waste;
- assess the attitudes of the hospital staff toward solid waste management in the hospital.
- examine the occupational health and safety practices among the hospital staff;

The study reviewed a number of theories and concepts that relate to waste management, resource availability for waste management, awareness and attitudes towards waste management. Specifically, the study was guided by the Theory of Planned Behaviour by Ajzen (1985), Pred's (1967) Behavioural Matrix, Resource Dependency Theory by Pfeffer and Salancik (1978) and Integrated Sustainable Waste Management by van de Klundert and Anschütz (2000).Various aspect of these theories as applied to the study were adopted to inform the study but not to test the theories.

Summary of Findings

Description of hospital solid waste management activities

The hospitals studied were responsible for managing their waste but did not keep records on the quantities of solid waste generated. Storage of hospital solid waste was done at the wards within a day and outside the wards for one to fourteen days before collection to the disposal site by hospital staff or Zoomlion Ghana limited. Three of the hospitals had contracted their waste collection activities to a private company whilst staff of the other three did the collection to the various assigned disposal sites. Sharps, pharmaceutical and anatomical wastes were separated from all other types of waste for special handling. All other infectious wastes were not properly separated but mixed before disposal. Colour coding of storage bins and the use of appropriate colour coded liners for storing specific waste categories were not adhered to as specified in the national policy. Pharmaceutical wastes were destroyed at designated dumping sites of the municipal assemblies by responsible committees from the hospital.

All the hospitals employed the high thermal treatment method for treating the sharps and in some cases anatomical waste. Pathological waste was dumped into placenta pits within the hospitals and in some cases incinerated in high-temperature incinerators. Four of the hospitals had De Montfort incinerators but only two were working. Ash residues from the incinerators were open dumped in most cases whilst others dumped them in an unlined open pit. Zoomlion Ghana Limited which has been contracted by three hospitals collected the waste and dumped them at the open and controlled dumpsites of the various District Assemblies. The burning of solid waste was practised at all the dump sites involved in the study. Three of the hospitals dumped their waste at various places cited and operated without approval from Environmental Protection Agency. Scavenging activities were observed at four of the dump sites studied.

Institutional and legal framework for managing healthcare solid waste

Institutional arrangements for managing hospital solid waste involved the Ministry of Local Government and Rural Development and the Environmental Protection Agency (Act 490), where the former has legal mandate to undertake storage, collection, transfer and transportation, treatment and disposal of waste in the country through the decentralised District, Municipal and Metropolitan assemblies and the other regulatory functions. With respect to healthcare waste management, the national policy on healthcare waste was developed based on "Polluter Pays Principles (PPP)" and "proximity principles". The hospitals were required by policy to take practical steps to ensure waste segregation, storage, transfer and transportation, treatment and safe disposal of waste generated from their operations. They were however at liberty to engage the private sector in providing such service in collaboration with the Ministry of Local Government and Rural Development (MLGRD) and Environmental Protection Agency (EPA).

Legally, there is no law in Ghana that comprehensively addresses healthcare waste management. However other environmental laws could be applied to address both environmental and public health challenges presented by health care waste to the society. At the hospital level, there was no specific written plan and policy to meet the special circumstances of each hospital. There existed some form of institutional linkages among some of the hospitals, various Assemblies, Environmental Protection Agency and the Zoomlion Ghana limited. Private hospitals had a link with Environmental Protection Agency because they were required to go through permitting processes but the public hospitals did not go through such processes. The EPA was worried about the way and manner in which landfills were operated but had difficulties in closing them down.

Hospital solid wastes management in the government-owned hospitals were financed by Government through the Ministry of Health, Ghana Health Service and National Health Insurance payments as well as internally generated funds. World Health Organisation supported most of the public and one of the faith-based hospitals studied with incinerators for sharp waste treatment. The private hospital studied did not receive any kind of support from Government and International Development Agencies. Delays in payment for services provided to the National Health Insurance card holders for over six months affected the ability of hospitals to maintain their waste management facilities and infrastructure. Hospitals operated composite budget and therefore did not have a separate budget for hospital solid waste management activities.

Hospital staff awareness of health hazards associated with hospital solid waste

The study found that majority (66%) of the hospital staff were aware of the health hazards associated with their work at the hospital. These hazards were identified to include infections due to exposure to microorganisms (21.3%) (HIV, hepatitis, tuberculosis, etc.), needle pricks (38.6%), cuts from sharp objects (15.2%), injury due to a splash of fluids (5.3%) and chemical hazards (10.2%). Hazards that could be related to hospital solid waste management ranged from hazards from sharp objects (30.5%), infections from micro-organisms (6.4%), chemical hazards (5.5%), radioactive hazards (0.7%), cytotoxic and genotoxic hazards (4.4%) and all the above (51.1%).Chi-square results showed a significant difference between the type of hospital and the staff attribution of type of hazards to solid waste management (χ^2(30, n=272) = 57.4, p= .002, V = .205). Moreover, the overall staff awareness of the hazards associated with hospital solid waste management was high.

Hospital staff got to know these hazards through job training (25.3%), formal education (20.9%), personal reading (19.4%) and all these three modes (31.9%). Hospital staff (41.6%) agreed that they were trained on hospital solid waste management during their formal education as health professionals. Respondents strongly agreed (41.4%) that hospital solid waste management can contribute to the spread of HIV, Hepatitis B and C (36.6% and 30.3% respectively) among hospital staff and the community at large. Chi-square results showed significant difference between the responses of staff from different hospitals with regards to the ability of hospital solid waste contributing to the spread of HIV [χ^2(15, n = 278, = 145.7, p = .001, V = .418] and hepatitis B [χ^2(15, n = 276, = 134.9, p = .001, V = .404].The Kruskal-Wallis result for the hypothesis found that the awareness of hospital staff about the hazards associated with hospital waste do not differ among different professionals in the hospitals [χ^2(2, n = 272) = 1.54, p = .463]. Therefore the null hypothesis was accepted.

Hospital staff attitudes towards waste management activities

On the attitudes of staff towards solid waste management activities at the hospital, it was found that most of the staff (48.7%) strongly disagreed that segregation of healthcare waste at the point of generation was difficult. The proportion of the responses was not statistically different χ^2(15, n = 279, = 19.7, p = .183, V = .153]. It was found that about 40.9% of the hospital staff strongly agreed to support hospital separation efforts so as to minimise the quantity of solid waste produced by the hospitals. Two thirds of the Staff (66.7%) indicated their willingness to segregate healthcare waste for recycling whilst one third (33.3%) were not willing and this was significantly different [χ^2(15, n = 258, = 109.0, p = .001, V = .650]. More so, about 31.7 percent of the staff agreed to report colleagues who will refuse to separate the hospital solid waste to higher authorities and the proportion was statistically different χ^2(15, n = 278, = 65.3, p = .001, V = .280].

Most of the respondents (59%) strongly disagreed that the role of the environmental health unit is not needed in the hospital which was significantly different [χ^2(15, n = 278, = 160.3, p = .001, V = .438]. About one-third (33.0%) of the respondents rated the function of Environmental Health Unit as most important in comparison with other units in the hospitals. Less than one-third of the hospital staff (30.7%) disagreed that hospital solid waste management increases the financial burden of management. There was no statistical difference between the responses given by the hospital staff from the six hospitals [χ^2(15, n = 277, = 14.4, p = .498, V = .131]. The overall attitudes of staff were normal.

The result of hypotheses tested using Kruskal-Wallis showed no significant difference between the attitudes of different categories of professionals in the hospitals towards waste management activities [χ^2(2, n = 276) = 1.22, p = .542]. Similarly, staff awareness of health hazards associated with hospital solid waste across the three different categories of staff working in the hospitals was not significantly different [χ^2(2, n = 272) = 1.54, p = .463]. Therefore the null hypotheses for the study were retained and the alternatives were rejected. Moreover, Spearman correlation result showed that there was significant positive linear relationship between staff awareness and attitudes (rho = 0.128, p-value = 0.037). However, negative non-significant relationship was found between the number of years staff have worked in the hospital with their level of awareness about health hazards associated with hospital solid waste (rho = -0.109, p-value = 0.073) as well as positive relationship between the years of working experiences with staff attitudes towards hospital solid waste management activities (rho = 0.010, p-value = 0.874).

Occupational health and safety knowledge and practices among hospital staff

The study found that Ghana has an Occupational Health and Safety Policy for the health care sector. However six of the hospitals studied did not have their own occupational health and safety policies to provide the basis for workers safety. Almost one-half of the respondents (130 (46.6%)) said the hospitals have occupational health safety. Four of the hospitals did not have copies of the occupational health and safety policy for the health sector developed by the Ministry of Health. Apart from Koforidua hospital where there was occupational health and safety nurse, all the other hospitals did not have such nurse to coordinate occupational health and safety activities.

On training in occupational health and safety, most of the respondents (66.9%) indicated that training was done as and when it was needed. Four of the hospitals did not have occupational health and safety committees. They had Infection Prevention Control Committee (IPCC).Only one hospital had both. About 41.9 percent of the hospital staff used personal protective equipment very often and about one third (32.0%) were comfortable in using PPEs. There was significant difference between the responses of staff from the various hospitals and comfortability using PPEs [X^2(15, n = 278, = 144.2, p = .001, V = .416]. Staff indicated that PPEs normally used include nose mask, hand gloves, safety boot and overall coat. They used Dettol, soap and sodium hypochlorite for their personal hygiene and cleaning.

The results on occupational injury showed that more than one-third of the respondents (45.4 %) have been injured before in the course of their work while more than one-half (54.6%) never experienced any injuries. More than two thirds (85.0%) of those who have been injured before suffered needle pricks, cuts from sharp objects (7.5%) and slip and fall (4.5%). Most of those who have been injured before (58.9%) reported the injury to higher authorities and the rest (41.1%) did not. Reasons for not reporting ranges from needles being new (32%), minor injury (20%), treated immediately (36%), occupational hazard (4%) and not deemed necessary (8%). About 40.7 percent of the respondents were somewhat satisfied, with the occupational health and safety measures instituted at the hospital for their safety.

Conclusions

In concluding the study, it can be said that the hospital solid waste management activities at the hospitals could be best described as below standard. The hospital solid waste storage, segregation or separation and collection processes were all not properly done to ensure a safe working environment for the staff, patients and caregivers. Storing the waste temporarily in hot climatic conditions for one week or more at an unprotected area is not proper and safe. These practices have the potential to contribute to the spread of infections within the neighbourhood and the hospitals with resultant high morbidity and mortality in the region.

The operation of the De Montfort incinerators poses a threat to both public and environmental health since they operated at lower temperatures, emitted dioxins and could not completely burn the needles. Poor maintenance of treatment technologies contributed to the breakdown of some of the treatment facilities. Open burning of hospital solid waste on bare soil or in a pit is not the best environmental practice.

Lack of engineered landfills within the assemblies in the region to accommodate the hospital solid waste for proper disposal is a threat to all the communities and the available natural resources in the study areas. Surface and groundwater resources can be exposed to unacceptable levels of pollutants from the operations of open or controlled dumping sites. Moreover dumping of incinerator residues on bare soil or unlined pits can be dangerous. These can pose a health threat to communities and animals depending on them.

On institutional arrangement for managing hospital solid waste, it can be said that though there are a national policy and guidelines, not all the hospitals made effort to access it. Hospitals did not have their own policies to address their peculiar waste management challenges. There were no plans that could be used to attract funding from donor agencies. Hospitals budgeted compositely for housekeeping and did not have a specific budget line for waste management activities. A legal framework for punishing mishandling of hospital solid waste disposal does not exist and this can encourage indiscriminate disposal of hospital solid waste.

There seems to be a weak relationship between the hospitals, Environmental Protection Agency and the various District and Municipal

Assemblies in managing hospital solid waste. This weakens the supervisory roles of the Assemblies and the EPA in ensuring that hospitals have proper systems and structures for managing their solid waste. The private company may take advantage of such weak collaboration to indulge in unsafe practices which can be inimical to the health of the general public. The application of stringent environmental quality measures on private hospitals alone to improve on hospital solid waste management shows signs of discrimination and inequity on the part of EPA.

The staff awareness of health hazards associated with their work and hospital solid waste management was high and this was not influenced by the staff categorisation. The staff have made conscious effort to be aware of the hazards confronting them so that they could take protective measures. The attitudes of the staff towards waste management activities, however, were poor generally. This reflected in their waste segregation practices at the wards and various units. The high awareness of the health hazards did not translate into strong and positive attitude. The provision of single storage bins at the wards probably limited their ability to properly segregate the waste according to their categorisation. Those with high educational level had good access to information on hospital solid waste as well as occupational health and safety due to their ability to read and their professional development requirement.

Occupational health and safety practices were limited to the use of hand gloves, nose mask and uniforms. Hand washing with soap is a common hygiene practice among the staff at the hospitals. There was no occupational health and safety committee at most of the hospitals which affected the safety practices of staff. Safety training was not well structured but was done on an ad-hoc basis. Generally, the personal hygiene and safety practices of the staff can be said to be encouraging despite the weak institutional arrangement at the hospitals.

Contribution to Knowledge

The study has contributed theoretically to the application of the theory of planned behaviour in the discourse of individual attitudes when examining individual behaviour in relation to hospital solid waste management. The application of Pred's Behavioural matrix in looking at the information through training and education on hospital solid waste management as well as occupational health and safety give credence to its utility in examining attitudes and behaviour. The dependence of the hospitals on other institutions for resources and service delivery indicates the appropriateness of using the resource dependence theory in studying institutions that provide social service.

Conceptually, the examination of institutional framework and arrangement for managing hospital solid waste and linkages among the stakeholders give credence to the integrated sustainable waste management concept. More so the findings of the study have confirmed the appropriateness of the conceptual framework that guided the study which could be applied in studying waste management arrangement at the national and facility level. Defining the functions of various actors clearly in the framework is an important contribution of this work to the study of hospital waste.

Methodologically, the study has shown that when the seven items in Table 28 are put together they are able to predict the awareness level of hospital staff in relation to waste management. Other researchers may build on it as a standard tool for the purpose of assessing awareness of health hazards associated with hospital solid waste management. Moreover, the findings of the study have contributed to the existing body of knowledge about hospital solid/health care waste management.

Recommendations

Based on the findings and the conclusions of the study, some recommendations were made to enhance hospital solid waste management practices at the hospitals and in the country.

Recommendations for Hospitals

- Since four of the hospitals did not have Occupational Health and Safety Committees, the hospital authorities should establish such committees to complement the work of Infection Prevention and Control Committee (IPCC). Alternatively, the functions of Infection Prevention and Control Committee can be expanded to include occupational health and safety activities.
- The practice of budgeting to cover all housecleaning services at the hospitals by hospital management should be modified to capture specifics for various activities such as solid waste management, janitorial services before putting them together as composite budget. This will help in monitoring the budget lines allotted to each unit so that appropriate measures can be instituted to properly manage

budgets and that will reduce competition on using funds meant for waste management activities for other purposes.

- Well-structured in-service training on health care waste management and occupational health and safety should be given to all categories of staff by hospital authorities to enhance and sustain their awareness of health hazards and safety measures to safeguard their health. This will ensure that information on waste management as well as occupational health and safety are provided.
- Since waste segregation was poorly done, training, provision of appropriate storage facilities and good supervision at the point of generation should be prioritised by the management of the hospitals to help workers in practising good segregation. This will help reduce the volume of infectious waste to be treated and disposed of at the dumpsites and encourage recycling of some. The net effect will be a reduction in the environmental and public health risk associated with disposing of mixed and untreated hospital solid waste.
- Hospitals within certain radius should consider sharing solid waste treatment facilities or technologies (cluster or central treatment) since the initial cost of installing sound treatment technologies are expensive.

Recommendation for Ministry of Health

- For proper solid waste management practices, supervision from an external body with the power to sanction should be established by the Ministry of Health in consultation with other related ministries that have the responsibility of protecting the environment and public health. This body should be made up of designated members from Ministry of Health, Ministry of Local Government and Rural Development, Ministry of Sanitation and Water Resources and Ministry of Environment, Science, Technology and Innovation as well as development partners, the media and Non-governmental organisations to periodically visit hospitals for inspection. The findings and report can be used as the basis for a national award or increasing funding allocation to support hospitals irrespective of ownership.

Recommendations for EPA

- EPA should strengthen its regional offices by increasing their staff strength or establish district offices that can deliver on their mandate since they were not having district offices and officers. Moreover, the Agency should not apply the environmental regulations on only private hospitals but the public hospitals as well.

Recommendations for Donor's and Development Partners

- Since the benefits of hospital solid waste treatment is for the public good it is recommended that international development agencies should consider supporting both private and public hospitals by providing hospital solid waste treatment infrastructural support.

Suggestions for Further Studies

The following are suggested for further research:

- For proper evaluation of waste generation to aid management planning it is recommended that a more practical and scientific method of data collection using an appropriate instrument to record waste generation for different categories of waste be studied so that the actual quantum of infectious and general waste from these hospitals can be known. This will really help to know the extent of environmental pollution and risk attributable to the infectious waste.

- There is the need for an epidemiological study to assess the effect of storage and waste collection on hospital staff and mixing of hospital solid waste with municipal solid waste on scavengers. This will help to confirm if indeed people have had some infection or not as a result of their exposure to hospital waste.

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APPENDICES

APPENDIX A1

Data Collection Instruments

Interview Guide on Healthcare Waste Management for Environmental Health Officers and Hospital Administrators

Hospital Profile

1) Hospital (name, location) ………………………………………
2) Type of hospital ………………………………………………………..
3) No. of inpatients/day ………………………………..
4) No. of outpatients/day ……………………………..
5) No. of beds (total)/day………………………………..
6) Bed occupancy rate (percentage)/day ………………………..

<u>SECTION B - HEALTHCARE WASTE MANAGEMENT ACTIVITIES</u>

Healthcare Waste Generation

7) Records keeping on the quantity of healthcare waste generated by the hospital
8) Data on the waste quantities generated for the following years, if available.

Year	Amount of Waste (tons)	Comments
2009		
2010		
2011		
2012		
2013		

Waste segregation, collection, storage, and handling

9) Waste segregation practices in the hospital
10) Available scheme to demonstrate how segregation is done (collect a copy)
11) Type of primary storage facility used for storing segregated waste
12) Describe briefly the type of labelling (if any) used for marking segregated waste
13) Describe the colour codes for the liners used in collecting segregated waste
14) Who handles or removes the segregated waste from the point of generation (designation of the hospital staff member)
15) Provision of personal protective equipment to responsible officers
16) List of personal protective equipment supplied to waste handlers
17) Vaccination of waste handlers against Hepatitis B & C
18) Describe how internal transport of the waste is done
19) Average waste storage days/time at the secondary collection point before disposal
20) Visit the stored segregated waste site before collection to the final disposal site (for observation after interview).

Transportation of healthcare waste for disposal

21) Mode of transporting healthcare waste to the disposal or treatment site
22) Location and distance of the waste disposal site
23) Monthly cost of waste disposal service to the hospital (GH₵)
24) Measure for ensuring that waste does not spill around the hospital and the vicinity

25) If waste disposal is in hospital facility, visit where it waste is disposed

26) Management and maintenance of storage bins and other equipment

Treatment and disposal of healthcare waste

27) Types of pre-treatment done on waste before collection and disposal

28) Type of treatment technology used at the hospital

29) Frequency of maintenance of the treatment technology and facility

30) Final disposal site for the waste/ ash residue (taken to municipal landfill, buried on hospital grounds, municipal incinerator etc.).

31) Describe briefly how the final disposal of the segregated/unsegregated healthcare waste is done.

Capacity of personnel involved in the healthcare waste management

32) Educational qualification and years of experience of the officer responsible for managing healthcare waste in the hospital.

33) Number and general qualification of waste handlers in the hospitals

34) Frequency and nature of training in healthcare waste management for staff

Existence of healthcare waste management policy

35) Existence and awareness of legislation applicable to hospital waste management in this hospital.

36) Kindly list the legislative acts

37) Awareness of the hospital waste management policy in the country.

38) Any written policy on healthcare waste management for the hospital (collect a copy)

39) Collect a copy of written hospital healthcare waste management plan, if it exists.

40) Functions and composition of waste management committee if any.

41) Give the designation, qualification and years of experience of the team members.

42) Names and roles of institutional partners for healthcare waste management at the hospital (private sector, government agencies, NGOs if any)

43) Annual budgetary allocations and support for healthcare waste management activities (management, government, NGO and other donors).

44) Implication of current waste management practices on the staff, environment and public health

45) Major challenges affecting waste management at the hospital

46) Recommendation for redress (by management, government and other stakeholders).

APPENDIX A2

Interview Guide on Healthcare Waste Management for the Managers of Private Sector Partner to the Hospital

1) Profile of private sector partner (name, location, core business, years of experience)
2) Roles of private sector partner in healthcare waste management at the hospital
3) Collect a copy of contract agreement
4) Quantity of waste collected on monthly bases (records on haulage)
5) Monthly service charge to the hospital
6) Safety measures adopted to protect waste collection crew and the environment
7) Conditions at the final disposal site
8) Relationship with other stakeholders on the collection and disposal of healthcare waste (EPA and district or municipal assembly – supervision, permitting, monitoring).
9) Implication of current waste disposal practices on the environment and public health
10) Challenges associated with healthcare waste management to the private partner
11) Recommendation to address current challenges

APPENDIX A3

Interview Guide on Healthcare Waste Management for the Environmental Health Officers at the Assemblies

1) Profile of Assembly (name, location, year of establishment, years of experience of Officer, probe)
2) Roles of the assembly in healthcare waste management at the hospital
3) Monitoring and supervision records
4) Assembly by-laws on healthcare waste handling and disposal
5) The role of the assembly to the environment and public health
6) Ownership and management of the final disposal site
7) Nature of relationship with other stakeholders on the management of healthcare waste (EPA and private sector partner, probe).
8) Implication of current waste disposal practices on the environment and public health
9) Challenges associated with healthcare waste management to the assembly
10) Recommendation to address current challenges.

APPENDIX A4

Interview Guide on Healthcare Waste Management for the Environmental Protection Agency (EPA) Officer or Representative at the Assembly

1) Profile of Assembly and Officer (name, location, year of establishment, years of experience of Officer)
2) EPA Guidelines on healthcare waste management
3) Roles of EPA in healthcare waste management in and outside the hospital
4) Monitoring and supervision records (probe if red flags have been raised)
5) The role of EPA in the protection of environment and public health
6) Supervision and monitoring of the final disposal site (probe conformity to EPA guidelines)
7) Nature of relationship with the hospitals and private sector partners on the management of healthcare waste.
8) Implication of current waste disposal practices on the environment and public health
9) Challenges associated with healthcare waste management to the Agency
10) Recommendation to address current challenges

APPENDIX B

Questionnaire for Hospital Staff

Please kindly spend some minutes (30 minutes) of your time to answer the following questions for the study entitled **"Hospital waste management practices in hospitals in the Eastern region of Ghana and implication for environmental management".** This information is needed for an academic research only; therefore any information provided would be treated with utmost confidentiality.

SECTION: Biographical information

1. How old are you? ……………………
2. Sex? a) male ( ) b) female ( )
3. How many years have you been working in the hospital? …………
4. What is the name of your department in the hospital? ………………
5. What is your education qualification? ………………………………
6. What is your designation in the hospital? ……………………………
7. What is your position in the hospital? ………………………………

SECTION B – Information on healthcare waste management

8. Have you received training in proper disposal of healthcare waste? Yes/No
9. Does the hospital have a policy on occupational health and safety? Yes/No/Don't know
10. Does the hospital have a policy on healthcare waste management? Yes/No
11. Does the hospital have a plan on healthcare waste management? Yes/No

12. Do you agree that all the above documents are available to all staff? a) strongly agree b) agree c) somewhat agree d) least agree e) don't know
13. How often is health and safety training organised for staff? a) Twice in a year b) once in a year c) as and when it is needed d) others (specify) …………….

SECTION C: Health and Safety Practices among Healthcare Staff

14. How often do you use the personal protective equipment? a) very often b) often c) not often d) not at all
15. I frequently use the hand gloves. a) Strongly agree b) Agree c) disagree d) Strongly agree
16. I frequently use the overall coat. a) Strongly agree b) Agree c) disagree d) Strongly agree
17. I frequently use the nose cover. a) Strongly agree b) Agree c) disagree d) Strongly agree
18. Do you agree that washing of hands with soap is good safety practice? a) Strongly agree b) Agree c) disagree d) Strongly agree
19. Do you agree that the hospital is complying with the OHS policy? a) Strongly agree b) Agree c) disagree d) Strongly agree
20. Do you agree that you use the safety equipment because your superiors want you to do so? a) Strongly agree b) Agree c) disagree d) Strongly agree

21. Do you feel comfortable when using personal protective equipment? Very comfortable b) comfortable d) somewhat comfortable d) least comfortable
22. Are you satisfy with the current occupational health and safety measures put in place at the hospital? a) Very satisfied b) satisfied c) somewhat satisfied d) least satisfied
23. Have you been injured before in the course of work? Yes/No
24. If yes to 21, what kind of injury?...
25. Did you report the injury to higher authorities? Yes/No
26. If no, why?...

<u>SECTION D – Awareness of health hazards associated with healthcare waste</u>

27. Do you agree that you have been well trained in healthcare waste management by the hospital? a) strongly agree b) agree c) somewhat agree d) least agree
28. Do you agree that you were trained or educated on healthcare waste management during your formal education as health professional? a) strongly agree b) agree c) somewhat agree d) least agree
29. Do you agree that pricks, cuts and pinch are the most common injuries associated with healthcare waste management? a) strongly agree b) agree c) somewhat agree d) least agree
30. Are you aware of hazards associated with your work at the hospital? Yes/No

31. What are some of the hazards?
…………………………………………
……………………………………………………………………………
.
32. Which of these hazards are associated with healthcare waste management?.......................
…………………………………………...
……………………………………………………………………………
..
33. Which of the following can be considered as hazards associated with healthcare waste management? a) hazards from sharps b) hazards from infectious micro-organisms c) chemical hazards d) radioactive hazards e) cytotoxic and genotoxic hazards f) all of the above g) none of the above.
34. How did you get to know these hazards? (a) Personal reading (b) formal education (c) on the job training d) from a-c (e) others (specify)………………...
35. Do you agree that the information is sufficient to inform good decisions on healthcare waste management practices? A) strongly agree b) agree c) somewhat agree d) least agree e) don't know
36. Improper healthcare waste management can contribute to nosocomial infections in the hospital? A) strongly agree b) agree c) somewhat agree d) least agree
37. Improper healthcare waste management can endanger your health? A) strongly agree b) agree c) somewhat agree d) least agree

38. Do you agree that poor management of healthcare waste can contribute to HIV infection? A) strongly agree b) agree c) somewhat agree d) least agree
39. Do you agree that poor management of healthcare waste can contribute to hepatitis B virus infection? A) strongly agree b) agree c) somewhat agree d) least agree
40. Do you agree that poor treatment and disposal of healthcare waste can affect the health of community members and the environment? A) strongly agree b) agree c) somewhat agree d) least agree

SECTION E - Attitudes of hospital Staff toward solid waste management activities

41. Do you agree that healthcare waste management in the hospital is a shared responsibility? A) strongly agree b) agree c) somewhat agree d) least agree
42. Do you agree that hospital staff have to separate the waste at the point of generation into specified storage containers? A) Strongly agree b) agree c) somewhat agree d) least agree
43. Healthcare waste management department is under resourced? A) strongly agree b) agree c) somewhat agree d) least agree e) don't know
44. The role of the environmental health unit is not needed in the hospital? A) strongly agree b) agree c) somewhat agree d) least agree
45. The environmental health unit does not appear in the hospitals organogram? A) strongly agree b) agree c) somewhat agree d) least agree e) don't know

46. Do you agree that staff of the Environmental Health Department are the least respected in the hospital? a) strongly agree b) agree c) somewhat agree d) least agree
47. Do you agree that segregated waste can be treated and recycled? A) strongly agree b) agree c) somewhat agree d) least agree e) don't know
48. Are you willing to segregate healthcare waste for recycling? Yes/No
49. If no, Why?
50. Will you support any effort to ensure segregation of waste? Yes/No
51. In your opinion, has the hospital prioritised minimisation of healthcare waste as a management concept to pursue? Yes/No
52. How will you rate the importance of environmental health department in terms of the functions in relation to other department on the scale of 1 to 10, where 10 is the least and 1 is the most important? ……………………….
53. In your view, what are the top four (4) challenges confronting hospitals in the management of healthcare waste? ………………………………………………………………………… ………………………………………………………………………… ………………………………………………………………………… .

APPENDIX C

OBSERVATION GUIDE

1. Availability of primary storage bins at the wards
2. Colour coding of bins for different categories of waste
3. Use of plastic liners for storage of waste at the wards
4. Use of safety protective equipment among waste handlers (hand gloves, overall coat, nose mask, safety boot, etc.)
5. Conditions of waste storage bins
6. Cleanliness of secondary storage site
7. Fencing or protection of secondary storage site
8. Overflow of storage bins
9. Colour codes for storage bins
10. Available communication or posters on healthcare waste management
11. Conditions and type of treatment technology
12. Maintenance schedule for the treatment technology
13. Washing or cleaning point for the waste bins if any
14. Position of environmental health unit in hospital's organogram
15. Mode of transporting waste within and outside of hospital
16. Visit to the disposal site (type of disposal facility, site management and conditions at the place, pictures)