INFECTIOUS WASTE MANAGEMENT IN BHUTAN:

AN ANALYSIS OF POLICY AND PRACTICE

Submitted by

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DEDICATION

This academic achievement is dedicated to my mother, Tashi Lhamo, for her prayers and blessings, husband Tenzing Tshering for all his sacrifices, providing encouragement and support during stressful moments, sons Kesang Phuntsho Tshering, Karma Shedrup Tshering and daughter Sonam Choden Tshering for understanding my absence and supporting my academic pursuit. It was the unconditional love and support of my family which enabled me to dedicate full time in this endeavour successfully.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 5

CHAPTER 6

CHAPTER 7

CHAPTER 10

LIST OF FIGURES

CHAPTER 2

CHAPTER 4

CHAPTER 6

CHAPTER 7

LIST OF PHOTOGRAPHS

CHAPTER 8

LIST OF ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AIDS	Acquired immunodeficiency syndrome
AN	Assistant nurse
ANM	Auxiliary nurse midwife
ANS	Assistant nursing superintendent
ATSDR	Agency for Toxic Substances and Disease Registry
BHU	Basic health unit
CDC	Centers for Disease Control
CEHA	Center for Environment Health Activities
CME	Continuing medical education
CN	Chief nurse
DANIDA	Danish International Development Agency
DMS	Department of Medical Services
DNS	Deputy nursing superintendent
ECOP	Environmental Code of Practice
EPA	Environmental Protection Agency
ESPS	Environmental Sector Programme Support
GEO	Global Environment Outlook
HAIs	Hospital acquired infections
HBV	Hepatitis 'B' virus
HBsAg	Hepatitis 'B' serum antigen
HCV	Hepatitis 'C' virus
HCW	Healthcare waste
HCWs	Healthcare wastes
HCWH	Health Care Without Harm
HCWHA	Health Care Without Harm Asia
HCWM	Healthcare waste management
HIV	Human immunodeficiency virus
IARC	International Agency for Research on Cancer
ICC	Infection control committee
IC and HCWM	Infection control and healthcare waste management
ICN	Infection control nurse
ICT	Infection control team

IMR	Infant mortality rate
ISWM	Integrated solid waste management
JDWNRH	Jigme Dorji Wangchuk National Referral Hospital
MDR	Multiple drug resistant
MHCR	Medical and Health Council Regulations
MoH	Ministry of Health
MoWHS	Ministry of Works and Human Settlement
MSW	Municipal solid waste
NRH	National Referral Hospital
NTMH	National Traditional Medicine Hospital
NEC	National Environment Commission
NEPA	National Environmental Protection Act
NS	Nursing superintendent
NSI	Needle-stick injury
NSIs	Needle-stick injuries
OHS	Occupational Health and Safety
OPD	Out-Patient Department
OR	Odds ratio
PCBs	Co-plannar polychlorinated biphenyls
PG	Postgraduate
PHC	Primary Health Care
PPE	Personal protective equipment
PVC	Polyvinyl chloride
RAA	Royal Audit Authority
RGoB	Royal Government of Bhutan
RIHS	Royal Institute of Health Sciences
RRH	Regional referral hospital
RSPN	Royal Society for Protection of Nature
SARS	Severe acute respiratory syndrome
SN	Staff nurse
TMHW	Transboundary Movement of Hazardous Waste
UHEC	University Human Ethics Committee
UNEP	United Nations Environment Program
WHO	World Health Organization

ABSTRACT

All waste generated by health facilities is not hazardous; typically only 10 % to 25% of the total healthcare waste is hazardous. Infectious waste is one category of hazardous waste that requires special handling and treatment to make it safe for disposal because of inherent pathogenic microorganisms that have the potential to transmit infections and cause injuries.

The study reported in this thesis examines the policies and practices of hospital infectious waste management in the Kingdom of Bhutan. This study is pioneering as it is a “whole of system” study on a national level. To identify the nature of problems and present possible solutions, conceptual model was used as a framework to explore policy practice gaps. A mixed-method research design using a range of data collection techniques, including official documents, in-depth interviews, survey questionnaires, focus group interviews and observations of waste management practices was employed. Participants in the study included policy makers and managers from the Ministry of Health and health facilities, heads of health training institutions, members of Infection Control and Healthcare Waste Management Committees, health professionals (doctors and nurses) from the 11 selected hospitals, and hospital cleaners of the National Referral Hospital.

The study revealed inadequacies in policy frameworks, rules and regulations, policy and practice expertise, occupational health and safety standards, infrastructure for waste management in the design of health facilities, training for health professionals and hospital cleaners, availability of personal protective equipment, and monitoring and supervision of practice. Breaches in practice related to segregation, handling, treatment, transportation and disposal of waste were identified.

The integration of findings from the mixed-method research study has identified areas for policy improvement for hospital infectious waste management and the implementation of these policies is recommended to promote and strengthen safe infectious waste management in Bhutan.

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STATEMENT OF AUTHORSHIP

I declare that “except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis submitted for the award of any other degree or diploma.

No other person’s work has been used without due acknowledgement in the main text of the thesis.

This thesis not been submitted for the award of any degree or diploma in any other tertiary institution”.

Neyzang Wangmo

Year : March 2013

ETHICAL APPROVAL

All research procedures reported in this thesis were approved by the La Trobe University, Faculty of Health Sciences, Human Ethics Committee (Appendix B) on *September 8, 2008. Ethics Approval Number 08-110.*

Institutional approval was obtained to gain access to participants from the Ministry of Health Bhutan (Appendix A) on *April 2, 2008 vide reference number MoH/Sec/Gen/08/263.*

ASSISTANCE RECEIVED

I have received assistance with English expression from my supervisors since English is not my native language.

PREFACE

The researcher is a nurse in Bhutan. She was among the first batch of nurses to graduate from the Royal Institute of Health Sciences (then the Health School) as a registered nurse-midwife in 1986. Since then, she has worked in various capacities at the National Referral Hospital, in the Ministry of Health and has taught nursing and allied health students at the Royal Institute of Health Sciences.

During her work in Bhutan's health system, she developed an interest in healthcare waste management. To date there has not been a study on healthcare waste management policy and practice in Bhutan. This thesis is therefore, a pioneering attempt of such a study using a mixed method study design. It is also intended as a practical contribution to improving healthcare waste management practices in Bhutan with a view to protecting health care workers, patients and the public from preventable risks of infections and injuries. In this study, there is also recognition that improved healthcare waste management contributes to the protection of the environment, a goal cherished by the people of Bhutan.

CHAPTER 1

INTRODUCTION

Health facilities generate hazardous waste that requires special treatment and disposal methods to protect not only workers and patients but also the wider population and environment. Infectious waste as a category of hazardous waste presents particular challenges due to its potential to transmit diseases and to inflict injuries from sharp instruments and needles.

The research reported in this thesis examines the management of hospital-generated infectious waste in the Kingdom of Bhutan, a small landlocked country situated in the eastern Himalayas, bordered by China to the north and by India to the south, east and west. It has a land area of 38,394 square kilometres and a population of 634,982 people (Census Commission, 2005). Bhutan has a centralised government located in the capital city of Thimphu. The Ministry of Health is responsible for the delivery of health services throughout the country. The health services and hospitals are 100% state owned and the Government has complete authority to determine policy. This research is a pioneering effort to examine hospital infectious waste management from a "whole-of-system" perspective, which encompasses an examination of the legislation, policies and practice concerned with infectious healthcare waste management throughout the healthcare system in Bhutan. This includes examining the processes of segregation, collection, storage, treatment and transportation as well as the disposal of infectious hospital waste. The study ranges from exploring knowledge and practice at the individual level of nurses, doctors and hospital cleaners in selected hospitals to investigating the views of senior policy makers, managers and heads of health training institutions.

A mixed-method research design was employed to collect information from different groups of people at various levels within the healthcare waste management system. The design included a range of data collection methods, including document analysis, survey questionnaires, in-depth interviews, focus group discussions and observations. Analysis was informed by a conceptual model developed from the fields of performance improvement and policy implementation. Gaps and weaknesses in the existing policy and practices were identified and measures to strengthen infectious waste management practices in Bhutan were suggested.

It was possible for the researcher to contact most policy makers because of their small number and their central location in Thimphu, as well as a substantial number of health professionals (doctors and nurses) involved in clinical practice in various hospitals throughout the country. From the total number of 157 doctors and 559 nurses employed in Bhutan (Ministry of Health, 2008), 69 (43.9%) doctors and 322 (57.6%) nurses) were invited to participate in the study.

The National Referral Hospital (NRH) in Thimphu is the apex (and the biggest) hospital in the country with 350 beds. All complicated cases from regional and district hospitals that require further management are referred to the NRH, which is a designated teaching hospital; both nursing and allied health students from the Royal Institute of Health Sciences are assigned to the hospital for their clinical placements. In the future medical students will also be posted to this hospital. Although other district and referral hospitals also generate infectious waste, according to the report submitted to the Ministry of Health by the Danish International Development Agency (DANIDA) (2004), the NRH is the biggest generator of infectious waste in Bhutan.

The process of infectious waste management does not just involve the disposal of waste. Rather it extends from the initial stage of decision making and planning until the waste is finally disposed of correctly and appropriately, in a manner which is technically sound, environmentally friendly and safe to human health. The management of infectious waste requires a team effort, involving different groups of people at various levels, from policy makers to hospital cleaners, each with specific roles and responsibilities. Poor execution of responsibilities by any of the group members or weaknesses in any aspect of the process will detract from the overall efficiency and effectiveness of the system. Thus, this study engaged with three groups of participants from different levels of the hospital system in an endeavour to obtain a more comprehensive understanding of infectious healthcare waste management.

Environmental protection is an important issue in Bhutanese public policy. Article 5 of the Constitution contains a commitment to maintain a minimum of 60% land forest cover at all times to safeguard natural resources and to prevent degradation of the ecosystem (Royal Government of Bhutan, 2008). In recognition of this commitment and the precedence given to environment conservation by the Government, the Champion of the Earth award was bestowed upon Bhutan in 2005 by the United Nations Environmental Program (Kuensel, 2005).

Due to the topography of the country, situated in the eastern Himalayas, there are limited areas of flat land. Thus, identifying proper areas to construct sanitary landfills for the safe disposal of waste, and safeguarding water sources is a major problem (Royal Government of Bhutan, 2008). Bhutan has problems similar to other developing countries within the region with regard to managing waste. With the continuing socio-economic development of the country and the emerging and re-emerging of infectious diseases, not only has the volume of waste generation increased but there have also been changes in the nature of healthcare waste, some of which is hazardous.

In Bhutan the problems of both household and commercial waste is an emerging issue. Public discussions about municipal waste started in national forums only in 2005. In Bhutan, the volume of waste from health facilities is not as conspicuous as that of municipal waste. Nonetheless, this is no guarantee of infectious waste being managed well, or that it is not an issue. In Bhutan, to date, there has not been a single report of someone contracting an infection, or an outbreak of disease related to hospital infectious waste, but, this does not signify that there have been no incidents of occupational health hazards. Very often policy changes are brought about by a “defining event” or a crisis, but so far this has not been the case with healthcare waste (HCW) in Bhutan. However, the absence of a defining event does not necessarily mean that infectious waste is being managed in a safe and correct way. In view of the potential risks associated with ineffective management of infectious waste, it is imperative that occupational health risks are minimised and that safe, effective infectious waste management practices are promoted.

In the process of delivering healthcare services, both hazardous and non-hazardous healthcare waste is generated. Hazardous waste includes infectious waste, sharps (used needles, blades, lancets), pathological waste, chemical and pharmaceutical waste, radioactive waste, genotoxic waste, pressurised containers and heavy metal content wastes (Prüss, Giroult & Rushbrook, 1999). Poor waste management detracts from the goal of providing quality health care services to the people of Bhutan. Johannessen, Dijkman, Bartone, Hanrahan, Boyer and Chandra (2000) state that safe and proper disposal of healthcare waste should be an integral part of the normal function of a health facility, as are maintaining cleanliness and controlling nosocomial infections. Prüss et al. (1999) identify important values in HCW policy. They argue that healthcare providers not only have a duty of care to their patients, but also a moral duty of non-maleficence (that is not to do harm), to protect the environment, and to promote public health by properly managing the wastes that are generated in the process of providing care. An ineffective healthcare waste management (HCWM) system may not only pose occupational health risks to people handling waste within facilities, but also has the potential for environmental pollution and the transmission of infection to nearby communities. Furthermore, it places an extra burden on the limited resources available to manage the waste.

More than two decades ago Neal and Schubel (1987) observed in United States of America that the traditional methods of reusing items had been made redundant by the use of disposable items (including syringes, needles, patient gowns and gloves) to prevent cross-infection and reduce costs of sterilisation in the delivery of services, further increasing the volume of HCW. According to Kennet and Azaiwa (2007), and Kharbanda and Stallworthy (1990) the risks associated with poor management of waste, especially hazardous waste, has created a major problem for policy makers and hospital administrators. It has been estimated that about 25% of the total HCW poses health risks due to the presence of pathogenic micro-organisms, sharps, chemicals, radioactive, pressurised gases and pharmaceutical waste, which call for special handling and treatment prior to disposal (Johannessen et al., 2000; Prüss et al., 1999). The remaining 75% of the HCW is similar to general domestic waste that can be managed by an urban waste management system.

Bission, McRae and Shaner (1993) have commented that public health issues, rising costs and emerging environmental consciousness have put pressure on hospitals to be proactive in managing HCW as there are opportunities to reduce waste and contain cost by altering management practices. They pointed out that in many instances all the waste generated from hospitals is considered as infectious waste which unnecessarily increases the cost of treatment and disposal of waste. Bission et al. (1993) reiterated the importance of everyone involved in the management of healthcare waste understanding that only approximately 25% of the healthcare waste needs to be treated in order to render it safe for disposal.

If infectious waste is not properly segregated at source and is mixed with other HCW, the whole volume must be considered as infectious. This unnecessarily increases the total volume of infectious waste and requires more resources because of the treatment requirement to render the waste safe before disposal. As will be seen in Chapter 2, there is evidence of transmission of blood-borne infections from contaminated sharps injuries contributing to the global burden of disease (Prüss-Ustün, Rapiti & Hutin, 2005). The management of sharps and infectious waste is therefore important to prevent injuries and the spread of infectious diseases.

The Global Environment Outlook (GEO), produced as part of the United Nations Environment Program, provides comprehensive evidence-based, policy information on the current, as well as future state of the global environment and human health. According to the GEO (2000), health facilities unavoidably generate environmentally harmful waste while providing services. The waste acts as a reservoir of potentially harmful micro-organisms that can infect both people within and outside the health facility when such waste is managed inappropriately. Furthermore, poorly managed HCW indicates poor management of the facility and does not give a good impression of the facility to people visiting hospitals.

The management of infectious waste and sharps is, therefore, a significant issue not only for hospital administrators and policy makers, but also for environmentalists as well as the general public.

1.1. AIM

The aim of the study was to investigate gaps in current policy and practice related to hospital infectious waste management in Bhutan in order to propose policy reforms and interventions to improve and strengthen the hospital infectious waste management system.

1.2. OBJECTIVES

The study objectives were to:

- identify gaps and weaknesses in the existing policies related to infectious HCWM
- investigate the current practices of infectious waste management from collection to disposal
- identify (occupational, public health and environmental) risks evident in the current practices of infectious waste management system
- explore perceptions, knowledge and attitudes of policy makers, doctors, nurses and hospital cleaners related to the management of hospital infectious waste
- suggest improvements in policy and the practices of infectious healthcare waste management in Bhutan

1.3. RESEARCH QUESTIONS

- What are the gaps and weaknesses in policy and practices related to hospital infectious waste management?
- What risks are identifiable in the current practice of hospital infectious waste management?
- What are the perceptions of policy makers on hospital infectious waste management?
- What are the attitudes, knowledge and practices of the hospital staff (doctors, nurses and hospital cleaners) on the management of hospital infectious waste?
- What measures need to be taken in order to improve both policy and practice related to hospital infectious waste management?

1.4. RATIONALE

Healthcare facilities should be places of healing and health promotion. The management of healthcare waste must be a part of the overall healthcare delivery system and not pose any risk to either the users or the providers of healthcare services. Infection control, providing a safe environment for both patients and staff, and minimising risks through effective management of healthcare waste is imperative and must be an issue of concern for all health staff. As Blenkharn (2006) has argued, HCW management must be linked to the overall standards of hospital hygiene and safety issues.

The essence of the national philosophy of “Gross National Happiness” in Bhutan is the peace and happiness of the Bhutanese people. Therefore, good health of the people is crucial in the overall economic development of the country. The Royal Government of Bhutan’s investment in building health infrastructure and providing free health services for the well being and good health of its people risks being adversely affected if infectious waste is not managed safely. Findings from the survey for human-immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) showed that 11.3% of the general population in Bhutan, aged between 15 to 49 years had used illicit drugs during their lifetime (Ministry of Health, 2008a). Of these 9.0% used injectable drugs. Similar findings were also reported in the National Baseline Assessment of Drugs and Controlled Substance Use in Bhutan (Ministry of Health, 2009). Bhutan has a large youth population. According to the National Statistics Bureau (2009) almost 52% of the population is below the age of 25 years. With the emergence of injection as a way of using illicit drugs among youth and the prevalence of infectious diseases including meningitis, tuberculosis, gastroenteritis, and blood-borne viruses such as hepatitis B virus (HBV) and hepatitis C virus (HCV) and HIV, there is no room for complacency in the management of infectious waste and sharps. Studies of the implementation of safe HCWM practices, as described in Chapter 2, have demonstrated both cost savings and minimisation of associated occupational health risks. It is vital that hospital infectious waste is managed properly from the site of generation to its final disposal.

There has been little research into healthcare waste in Bhutan, other than a preliminary assessment of HCW based on visits to selected health facilities by DANIDA in 2003, and an inventory of hazardous waste from industries and health facilities conducted in 2008 with technical assistance from the Asian Development Bank (ADB) (Yangzom, 2008). No whole-of-system study specific to hospital infectious waste and sharps has been conducted in Bhutan previously.

The choice of hospital infectious waste, including sharps, as the focus of this study by no means underestimates the importance of management of other categories of HCW. However, sharps and infectious waste carry a higher risk of disease transmission compared with other categories of HCW. This study employs a "whole-of-system" approach in seeking to obtain a comprehensive picture of infectious HCWM in Bhutan. This approach is intended to help in identifying gaps and weaknesses present in the existing policies and practices related to infectious waste management. Furthermore, it explores the views of policy-makers, health professionals and hospital cleaners on infectious waste management and identifies problems in implementing best practices of infectious waste management. The findings from the study will be used to advocate evidence-based policy changes and improve hospital infectious waste management practices with the ultimate aim of creating a safer environment for people both within and outside Bhutan's health facilities.

1.5. BACKGROUND

Prior to 1990, there was no system of managing waste in Bhutan. In 1994 a small office was established in the capital city to manage waste (Rinchen & Chhetri, 2006). One of the consequences of the socio-economic development process which started in Bhutan in the early 1960s, has been a change from the use of conventional reusable or eco-friendly packaging to plastic bags and packaging that is harmful to the environment (Royal Society for Protection of Nature (RSPN), 2006). Discussions on municipal waste began to appear in national forums in mid 2000s because of the increasing volume of urban waste. Official documents reveal that in Bhutan, prior to the enactment of the *Waste Prevention and Management Bill* in 2009 there was no specific legislation on waste. Despite the absence of legislation, the Government took various initiatives for the proper management of HCW. These included developing the *Environmental Code of Practice for Hazardous Waste Management 2002* and *Guideline for Infection Control and Healthcare Waste Management in Health Facilities 2006*[1]. Infectious Waste Management Committees were also established in the Ministry of Health. Other measures included in-service training programs on HCW, introducing colour-coded waste receptacles to collect different categories of HCW and using Nulife Dots (needle and syringe destroying equipment) with the aim of minimising injuries and associated health risks from sharps. Although the Waste Prevention and Management Act of Bhutan is now in force it is not specific to HCW; rather this legislation seeks to regulate all categories of waste.

In Bhutan, there have been a few studies (Penjor, 2007; Phuntsho, Yangden & Heart, 2008; RSPN, 2006) on waste in general. These have been conducted by individuals, a non-governmental organisation and the Ministry of Works and Human Settlement, but the focus has been on municipal solid waste. Hospitals, despite their contribution to municipal waste, were not included in any of these studies.

Having set the aims, objectives, rationale and background for the study, the structure of thesis is now outlined.

Chapter 2 deals with the principles underlying HCWM, including legislation and policy guidelines, definitions and categories of HCW. Different waste treatment and disposal methods related to infectious waste and sharps currently practised in Bhutan are discussed, including other options that could be used in the future. The chapter also describes the risks of poor management of infectious HCW and highlights the importance and benefits of its proper management.

Chapter 3 provides the context for the study by outlining Bhutan's system of governance and its healthcare system. It also describes briefly the current system of municipal waste management to provide the context for the specific management of healthcare waste.

Chapter 4 presents the conceptual framework used to explore gaps in policy and practice relating to the management of sharps and infectious hospital waste, the methodological approach, the rationale for choosing the particular study design,

[1] *The word "guideline" is used in the singular in the original document despite there being more than one guideline.*

categories of informants, and different techniques employed to obtain information to answer the research questions. The process of data analysis is also outlined.

The findings of the study are provided in the four subsequent chapters. In Chapter 5, findings related to policy on infectious waste management are presented in two parts: Part One, findings derived from document analysis; and Part Two, findings from in-depth interviews with policy makers. Chapter 6 presents findings from a survey of health professionals (nurses and doctors) working in 11 hospitals selected for the study. Chapter 7 describes findings from focus group interviews conducted with hospital cleaners from the NRH. Chapter 8 presents findings of the observations of infectious waste management practices at the NRH, the designated teaching hospital for nursing and allied health students from the Royal Institute of Health Sciences.

Chapter 9 discusses the findings from the different methods employed in the study, identifying discrepancies and weaknesses in policy and practices related to hospital infectious waste. This chapter also draws attention to occupational health risks, as well as public and environmental health risks evident in current practices. Limitations of the study are also described. The final Chapter 10 discusses conclusions drawn from the research and presents ways of improving hospital infectious waste management practices through evidence-based policy and program development. Areas for future research are also identified.

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CHAPTER 2

MANAGING THE RISKS OF HOSPITAL INFECTIOUS WASTE

Although healthcare wastes (HCWs) constitute a small component of municipal waste, they are of concern because of inherent potential public health risks and environmental pollution. In this chapter, the context for research into the management of hospital infectious waste in Bhutan is established beginning with a general review of the management of healthcare waste (infectious waste being one of the categories of healthcare waste) before focusing on the risks of infectious waste from health facilities.

Principles underlying the management of HCW are discussed, including those informing regulations, policy frameworks and technical guidelines. Terminology used to describe HCW, classifications of waste and factors that influence effective healthcare waste management (HCWM) are discussed. Strategies to develop healthcare waste management plans are described. Infectious waste treatment and disposal options with possible application to Bhutan are explored and discussed. The risks of poor management of hospital infectious waste are identified. An example of best practice of healthcare waste management from four different levels of hospitals in Manila is used to demonstrate how effective HCWM could be implemented in developing countries using simple tools and innovative ideas.

Literature related to hospital infectious waste was obtained from peer-reviewed publication databases including Medline, CINAHL, ProQuest and PubMed, as well as online journals. Grey literature and other information was also sought from the World Health Organization (WHO), Healthcare Without Harm, the World Bank and the United Nations Environmental Program (UNEP) websites. Further information was obtained by following some of the websites cited in journal articles.

Due to limited comprehensive information on the safe management of healthcare waste (HCW) in developing countries, addressing regulatory frameworks, system planning, waste handling from collection to transportation, and treatment and disposal techniques, the WHO guidance document, “Safe management of wastes from health-care activities” edited by Prüss, Giroult and Rushbrook (1999) has been used as the authoritative text for this study. This publication has been used in most studies on HCWM and has been identified as a key resource for managing HCW in Southeast Asia by Healthcare Without Harm (HCWH). HCWH is an international coalition comprised of more than 470 organisations (hospitals and healthcare systems, medical professionals, community groups, health-affected constituencies, labour unions, environmental and environmental health organisations, and religious groups) in 52 countries working to change the health care sector to prevent it from being the source of harm to the public and the environment.

In the introduction to the text by Prüss et al. released in 1999, the WHO states it is the first global and comprehensive guidance document on safe management of HCW. The document contains information on legislation and policies, planning and basic processes of management of HCW and treatment and disposal technologies, taking into account not only the safety aspects but also affordability, sustainability and cultural appropriateness of waste management strategies in health facilities with limited resources. Relevant information from this publication provided the researcher with criteria to assist in analysing policy frameworks and practices related to the management of solid and liquid hospital infectious waste in Bhutan and guide suggestions for the future.

According to the UNEP (2003), the quantity of global waste is rising, with an increasing proportion of inorganic waste and the presence of hazardous waste. About 57% - 85% of all solid wastes generated are disposed of in landfills and the remainder is incinerated, burnt, dumped or recycled. The UNEP (2003) is concerned about the haphazard and incorrect disposal of municipal solid waste, which is often mixed with untreated infectious HCW. The improper segregation of waste not only minimises the opportunity to reuse resources from both organic and inorganic wastes, but also increases the volume of waste as well as raising health and environmental issues (UNEP, 2003). Visvanathan and Trankler (2003) point out that countries which lie in the tropical or sub-tropical regions have long wet and hot months. Such climatic conditions not only increase the weight of waste due to higher moisture content but also hasten the process of decomposition of organic waste, producing foul odours. The mixing of untreated infectious waste with the municipal waste may further increase the risk of transmission of infection to waste handlers.

As will be seen, there is no uniform or single term for healthcare waste used in the literature. Different terms such as hospital waste, clinical waste, medical waste, regulated waste, hazardous, clinical, biohazardous or biomedical waste have been used synonymously by various authors (Appleton & Ali, 2000; Johannessen, Dijkman, Bartone, Hanrahan, Boyer & Chandra, 2000; McRae & Agarwal, 1999; Prüss et al. 1999). According to Rutala and Mayhall (1992) differentiating infectious waste from general healthcare waste is the main problem associated with managing HCW. Almuneef and Memish (2003) state that in Saudi Arabia the lack of a universally accepted definition of infectious waste led to over-use of incineration. Miller, Fournier, Rugg and Frei (1990) have also commented that in the United States problems in categorising waste as infectious or non-infectious led to more waste being treated as infectious. According to Miller et al. (1990) the global definition of infectious waste has been vague. Therefore, how the term “infectious waste” is defined and understood by people involved in the management of waste is important to prevent subsequent adverse consequences.

Unlike general waste from health facilities that can be disposed of as domestic waste, solid and liquid infectious waste requires special treatment and disposal techniques because of the presence of pathogenic microorganisms and ‘sharps’ (items such as needles and scalpel blades) associated with potential health risks and injury (Appleton & Ali, 2000; Prüss et al. 1999). The mixing of infectious waste with non-infectious HCW contaminates all of the waste and it needs to be considered as infectious. Therefore, as several researchers have observed, how infectious waste is defined will have a direct impact on its management, the related costs and on the choice of treatment and disposal options (Appleton & Ali, 2000; Johannessen et al., 2000; McRae & Agarwal, 1999; Prüss et al., 1999).

Although municipal solid waste management is not the focus of the present study, the principles of a hierarchy of integrated solid waste management can be applied in managing healthcare waste.

2.1. INTEGRATED WASTE MANAGEMENT

Several authors (Kennet & Azaiwa, 2007; Curzio, Prosperetti & Zoboli, 1994; Tchobanoglous Theisen & Vigil, 1993; Raymond, 1993) claim a hierarchy of integrated solid waste management as the basis of effective and efficient waste management system. This integrated approach involves choosing and applying suitable techniques and tools to institute an effective waste management system (Tchobanoglous et al., 1993). Integration enables optimal utilisation of resources, better coordination and selection of lower cost alternatives (Curzio et al., 1994; Raymond, 1993; Tchobanoglous et al., 1993). A hierarchy of waste management is shown in Figure 2.1. While prevention is considered the highly desirable in managing waste, there can never be a situation of zero waste. Therefore, the next best option would be waste reduction or minimisation. This can be achieved by considering substitution of products that generate less waste (Vermont Hazardous Waste Management Regulations, 2001; Raymond, 1993). The waste reduction strategy not only reduces the volume of waste but also management costs and associated risks (Kennet & Azaiwa, 2007).

Production of waste from health facilities cannot be stopped but efforts can be made to reduce the volume of healthcare waste generated by using reusable items and products. The concept of "reuse and recycle" is feasible with general HCW as it is similar to general domestic waste, but not with infectious waste because of the presence of pathogenic microorganisms and the risk of transmitting infections.

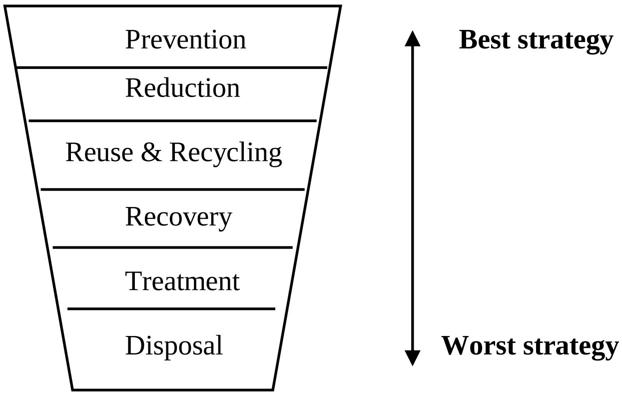

Figure 2.1 A hierarchy of integrated waste management

(Source: Adapted from Curzio et al., 1994; Raymond, 1993; Tchobanoglous et al., 1993)

According to Kennet and Azaiwa (2007) recycling is one of the ways to recover energy. However, to enable recycling, waste needs to be segregated properly at the source, collected, stored and transported. This waste can be used as a substitute for raw material or as a raw material in another process to produce a new product (Raymond, 1993).

Raymond (1993) asserts that the effectiveness of the integrated waste management approach will depend on many factors that he terms driving forces. He describes factors that may facilitate better waste management, as *positive driving forces* and those that work against it as *negative driving forces* (see Figure 2.2). Raymond (1993) asserts that among these forces communities are considered to be the most influential driving force (positively or negatively) and also the least controllable factor in bringing changes. For example, if the management of waste is not a priority for the community in that locality, the government may require more vigilance to ensure proper compliance of rules and regulations related to managing the waste. Moreover, the management of waste will also depend on a particular country's living standards, policies and priorities. Raymond (1993) suggests that in countries with high living standards where basic necessities are well established, people may place a high priority on environmental issues. However, in poor and developing countries, (which includes Bhutan) the basic necessities of life will have a higher priority over environmental issues.

Raymond (1993) argues that in order to have effective integrated waste management, all the driving forces (especially negative forces) need to be considered. Lack of knowledge and negative attitudes can make people resistant to changes because of the unknown. Adequate information and open communications may help to overcome this barrier.

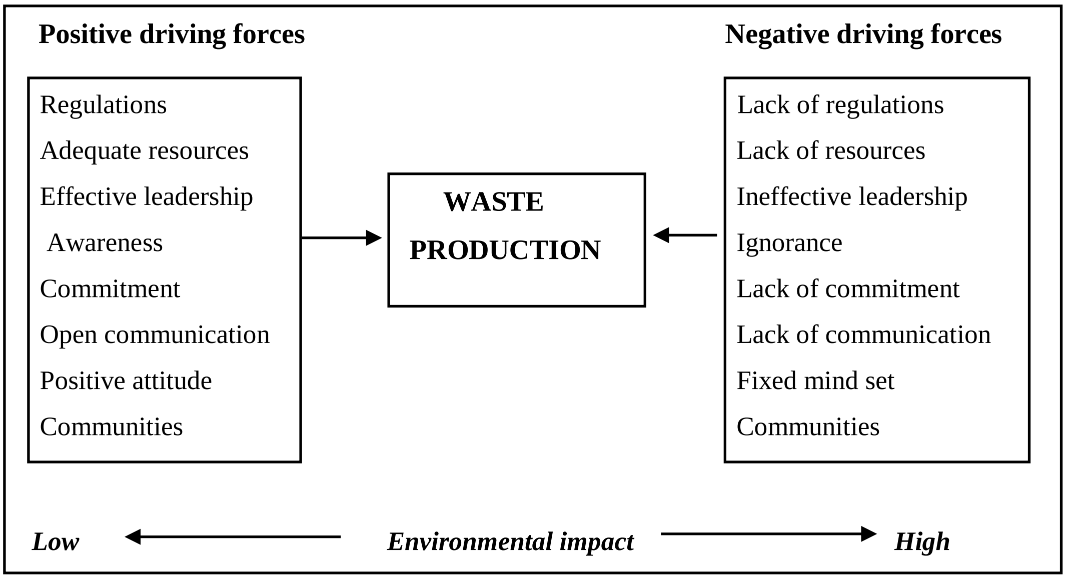

Figure 2.2 Driving forces for integrated waste management

(Source : Adapted from Raymond, 1993)

2.2. HAZARDOUS WASTE MANAGEMENT

The effective management of hazardous waste, which includes infectious hospital waste, should be based on a set of principles and guided by regulatory frameworks that are practical and applicable in the local context. The principles, regulatory frameworks and guidelines are discussed separately in the following section.

2.2.1. Principles for the Management of Hazardous Waste

According to Prüss et al. (1999), any waste that is a risk to the safety of public health or to the environment because of its hazardous properties is governed by the following:

Duty of care principle – any organisation that generates waste or any person handling hazardous substance or equipment has an ethical responsibility to safely dispose of the waste.

Proximity principle – in order to reduce risks the treatment and disposal of waste should occur, as far as possible, closest to its source; communities should recycle or dispose of waste within their own area.

Polluters pay principle – waste producers have the legal and financial responsibility for the safe and environmentally sound disposal of the waste they produce. In the event of an accident or pollution, the organisation is liable for the cost of damage and cleaning up.

Precautionary principle – this is the main principle governing health and safety. When the scale of risk of the waste is in doubt, then measures should be taken accordingly to protect human health and ensure safety.

These principles provide the foundation for establishing national legislation and policy guidelines related to managing HCW in any country.

2.2.2. The Basel Convention

Environmental issues are of global concern and pollution does not recognise national borders. In recognition of this fact, measures have been taken to improve and protect the environment by developing international regulatory frameworks to manage hazardous wastes. The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes (TMHW) is one such framework. The Convention was established in 1989 and put into force in 1992 (Basel Convention, no date). The Basel Convention for TMHW takes into account problems and challenges posed by hazardous waste in countries that lack the expertise or facilities to manage such wastes by permitting the legal export of such waste to countries that have both the facilities and expertise for safe disposal. The Convention regulates the transboundary movement of hazardous wastes and requires that these wastes are not only properly managed but also disposed of in an environmentally safe manner. Bhutan, as a signatory to this Convention, has the option of transporting hazardous waste, including HCW, outside of its border in the future.

2.2.3. National Legislation

According to Prüss et al. (1999) national legislation provides the foundation for improving healthcare waste management practices by instituting legal controls to empower the government, ministry or agency to implement effective management of

HCW. National legislation should be developed according to international regulations and principles underlying the management of waste and protection of the environment. Legislation should clearly state a definition and different categories of HCW. It should also specify the legal obligations of waste producers with regard to safe handling and disposal, proper documentation and reporting, including monitoring tools, mechanisms to enforce the law and penalties for breach of the law or non-compliance (Prüss et al., 1999). HCWM practices must then conform to the national legislation that defines regulations for general waste management, environmental protection, emission standards, management of radioactive materials, occupational health and safety standards, and the prevention and control of transmission of infectious diseases (Prüss et al., 1999).

Legislation helps to set up controls and put pressure on agencies for proper implementation of waste management policy directives, besides making staff accountable. Prüss et al. (1999) suggest that policy and technical guidelines need to be developed, including job responsibilities, for the effective implementation of a waste management system.

2.2.4. Policy Framework

Prüss et al. (1999) maintain that a policy framework for HCWM should set out the rationale for the legislation, national targets and strategies to achieve them. The elements they suggested are listed in Table 2.1.

Table 2.1 Elements of policy guidelines to manage healthcare waste

- Rationale for sound and safe healthcare waste management practices in healthcare facilities;
- Rules regarding protection of health and safety of people handling such wastes;
- Cost estimation of healthcare waste management;
- Importance of waste management process (procurement, waste minimization, segregation, collection, storage, handling, transport, treatment and disposal);
- Approved techniques of treatment and disposal of waste;
- Impact of improper waste management on health and safety issues;
- Proper documentation and reporting system; and
- Training, continuing education

(Source: Prüss et al., 1999)

According to Peabody, Rahman, Gertler, Mann, Farley, Luck, Robalino and Carter (1999) the best policies use evidence-based policy making with proper planning within the local context to make appropriate interventions with optimal cost-effective use of resources. In order to make evidence-based policy, good quality data must be used during the formulation of policy. However, they argue that very often the required evidence is missing. In the event of the absence of data, Peabody et al. (1999) reiterate that policy implementation must be done carefully using a rational process based on sound reasons.

Once policies are established, detailed technical guidelines can be developed to direct the implementation of policy.

2.2.5. Technical Guidelines

According to Prüss et al. (1999) technical guidelines should not only be in line with the legislation and policy framework, but must also be applicable to the local situations. Guidelines should be clear, with specific instructions which are practical, applicable and easily understood by staff to ensure safe practices. Each category of healthcare waste should be defined and accompanied by detailed procedures for its management to maintain safe practice standards. The technical guidelines should contain the elements listed below in Table 2.2.

Table 2.2 Essential elements of technical guidelines to manage healthcare waste

• Legal framework for safe management of healthcare waste and occupational health and safety; • Responsibilities of different relevant ministries, departments and agencies, organisations or private sectors both at the national and local level related to HCWM must be clearly outlined; • Procedures for waste minimisation, waste segregation, handling, storage and transportation; and • Recommended treatment and disposal measures for each category of HCW and waste water

(Source: Prüss et al., 1999)

2.3. CLASSIFICATION OF HEALTHCARE WASTE

2.3.1. Definitions

Healthcare waste refers to all categories of waste produced by health facilities, research centres and laboratories in the process of diagnosis, treatment or immunisation of humans and animals (Appleton & Ali, 2000; McRae & Agarwal, 1999) and disposed of with no intention of further use (Hoornweg & Thomas, 1999).

Hazardous waste is referred to as any waste with properties which have the potential to cause harmful effects to humans or to the environment when poorly managed, treated, stored, transported or disposed of (Department of Health United Kingdom (UK), 2006; Prüss et al., 1999). It is characterised by the presence of any one of following properties: pathogenic microorganisms, explosives, cytotoxic drugs, reactive, corrosive (acids of pH<2 and alkaline of pH >12) and ignitable characteristics (United States Environmental Protection Agency, 2007; Johannessen et al., 2000) or sharp objects that can penetrate or cut the skin.

Infectious waste is defined as waste that contains pathogenic microorganisms that have the potential to produce disease in a person or animal. It is a subset of HCW and is sometimes referred to as hazardous waste (Johannessen et al., 2000; Prüss et al., 1999).

2.3.2. Categories of Healthcare Waste

There is no single classification of healthcare waste. Irrespective of the number of HCW categories, the most important consideration is that people managing the waste must have a common understanding of each category of waste and their management requirements. Akter (2000) classifies HCW into four categories: *clinical, non-clinical, laboratory* and *kitchen wastes* whereas Appleton and Ali (2000) and Prüss et al. (1999) divide healthcare waste into two main categories: *hazardous / clinical waste and non-hazardous /non-clinical or general waste*. Appleton and Ali (2000) and Prüss et al. (1999) further categorise hazardous waste into nine different types and the non-hazardous into two different categories as shown in Figure 2.3.

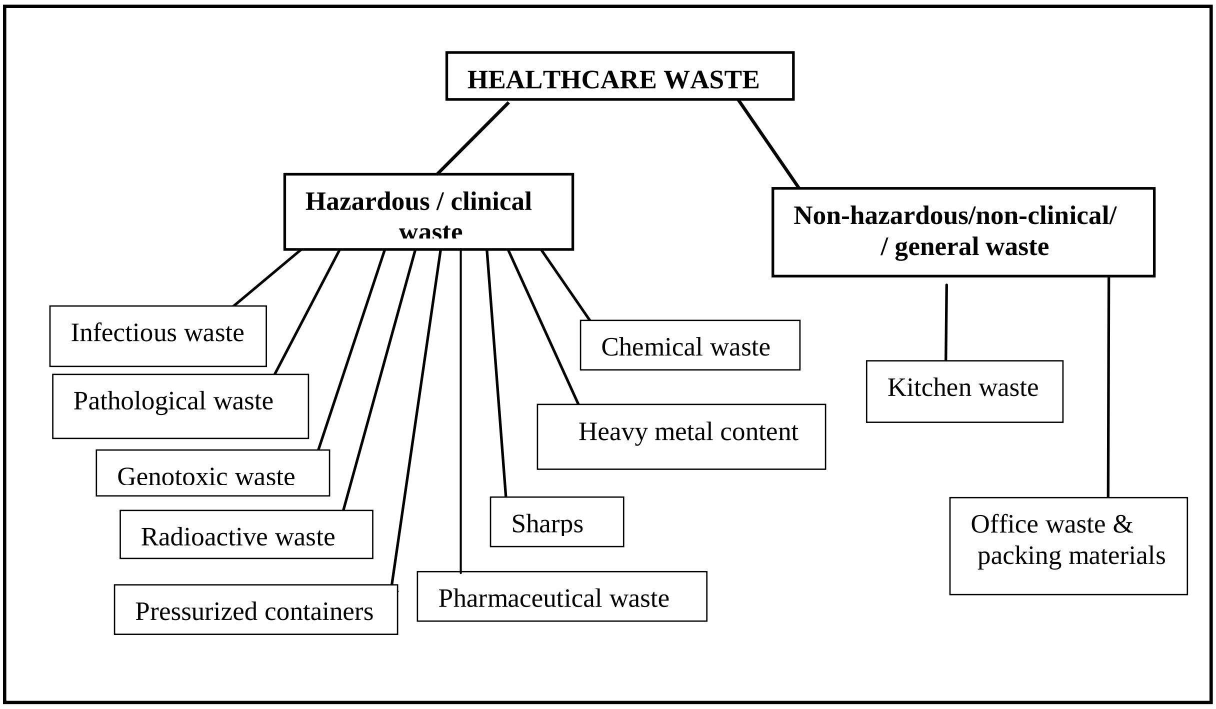

Figure 2.3 Categories of healthcare waste

(Source : Adapted from Appleton & Ali, 2000, p.3; Prüss et al., 1999, p.3)

Not all waste generated from health facilities is hazardous. Prüss et al. (1999) estimate that between 75% and 90% of HCW is comparable to domestic waste and the rest is hazardous, requiring special treatment and disposal facilities because of potential health risks and environmental pollution. Prüss et al. (1999) estimate sharps to constitute 1% of infectious waste and 15% of total hazardous healthcare waste.

According to Prüss et al. (1999), sharps should be considered as hazardous HCW and, irrespective of being infectious or not, a subset of infectious waste. Pathological or anatomical waste is also a subcategory of infectious waste although it potentially includes healthy anatomical specimens. Table 2.3 lists types and description of different types of hazardous HCW.

Table 2.3 Types and description of hazardous waste

Type of waste	Description of waste
Infectious waste	Cultures, samples and stocks from laboratory, surgery and autopsies, blood and blood products, and excretion from infectious patients, any equipment, dressings, clothes that have been in contact with infected patients
Sharps	Suture needles, scalpel blades, lancets, pipettes, broken glass, knives, infusion sets and nails.
Pathological/ anatomical waste	Body parts, tissues, organs, foetuses, placentae, body fluids, blood and blood products
Pharmaceutical waste	Unused, contaminated, expired drugs, vaccines and serum
Genotoxic waste	Cytotoxic drugs, highly toxic and may contain mutagenic, teratogenic or carcinogenic properties. Used in oncology and radiotherapy units to treat cancer.
Chemical waste	Laboratory reagents, film developer, disinfectants.
Radioactive wastes	Radioactive substances used for diagnostic or therapeutic purpose, and blood, urine and faeces of patients on treatment or tested with radionuclides
Pressurised containers	Gas cylinders (anesthetic gas, oxygen, compressed air in health facilities) stored in pressurized cylinders, cartridges, aerosols and cans.
Heavy metals	Mercury from broken thermometers and blood pressure equipment, cadmium from batteries.

(Source : Prüss et al., 1999)

2.4. HEALTHCARE WASTE MANAGEMENT

According to the HCWM Guidance Note of the World Bank (2003), HCWM is not a single act but a process that starts from the purchase of items to their disposal, ensuring hospital hygiene and the safety of healthcare providers, patients and the community. The process involves planning, procurement, infrastructure development, capacity building, and identifying appropriate techniques, and requires regular monitoring and evaluation (World Bank, 2003). The HCWM system needs a broader reach by involving stakeholders beyond the domain of the health facilities for better coordination, sharing of resources and sustainability of the system.

A WHO publication produced by Zghondi (2002) for the Regional Office for the Eastern Mediterranean Center for Environment Health Activities cautions that developing policy guidelines, rules and regulations and allocating resources for hospital waste management at the national level without considering inputs from people working in the area may prove to be less effective. Appropriate techniques for safe and effective management of HCW are required at each step of initial planning (World Bank, 2003). Institutional and individual responsibilities at various levels should be specified and guidelines developed (WHO, 2005) including human resource development, securing funds, and monitoring and evaluation tools. Zghondi (2002) warns that, unless a process of proper planning is introduced, improving or starting new HCWM systems in healthcare facilities is unlikely to succeed or be sustained.

2.4.1. Factors Affecting Effective Healthcare Waste Management

The most common factors affecting proper management of HCW identified by WHO (2004) are an absence of national policy and regulatory frameworks, a lack of or a weak monitoring system, inadequate understanding of the inherent risks in poor management of HCW, and inadequate information on safe waste treatment and disposal options. In addition, the lack of expertise in the area and inadequate resources limit the ability to make appropriate choices for treatment and disposal.

Leape and Berwick (2000) identified dedicated leadership as an important factor in successfully pursuing quality improvement. Lack of commitment from organisational leaders and health professionals will lead to fragmented and uncoordinated efforts. Committed leaders are required at all levels in the field. Leape and Berwick (2000) argue that to establish patient safety initiatives requires changes in culture as well as in technology. However, they also caution that bringing about cultural change is not as simple as installing a new technology. Thus, it is important to focus not only upon the type of task, but also the processes and the conditions or environment under which tasks are performed, including staff interaction and training programs.

The overall effectiveness of HCWM also depends upon the commitment of authorities, hospital administrators and the entire healthcare staff. To ensure proper management of HCW, staff must be committed to implement best practice of HCWM and be well informed about the whole process of managing waste, including the risks (WHO, 2005).

WHO (2000a) has provided a technical paper outling some of the factors which may have possible influences on the poor management of HCW. As summarised in Figure 2.4, WHO emphasises the need to be cognisant of basic conditions, unmet requirements and their effect on health. WHO cautions that these factors may not be exhaustive and that other factors specific to individual countries may exist (WHO, 2000a).

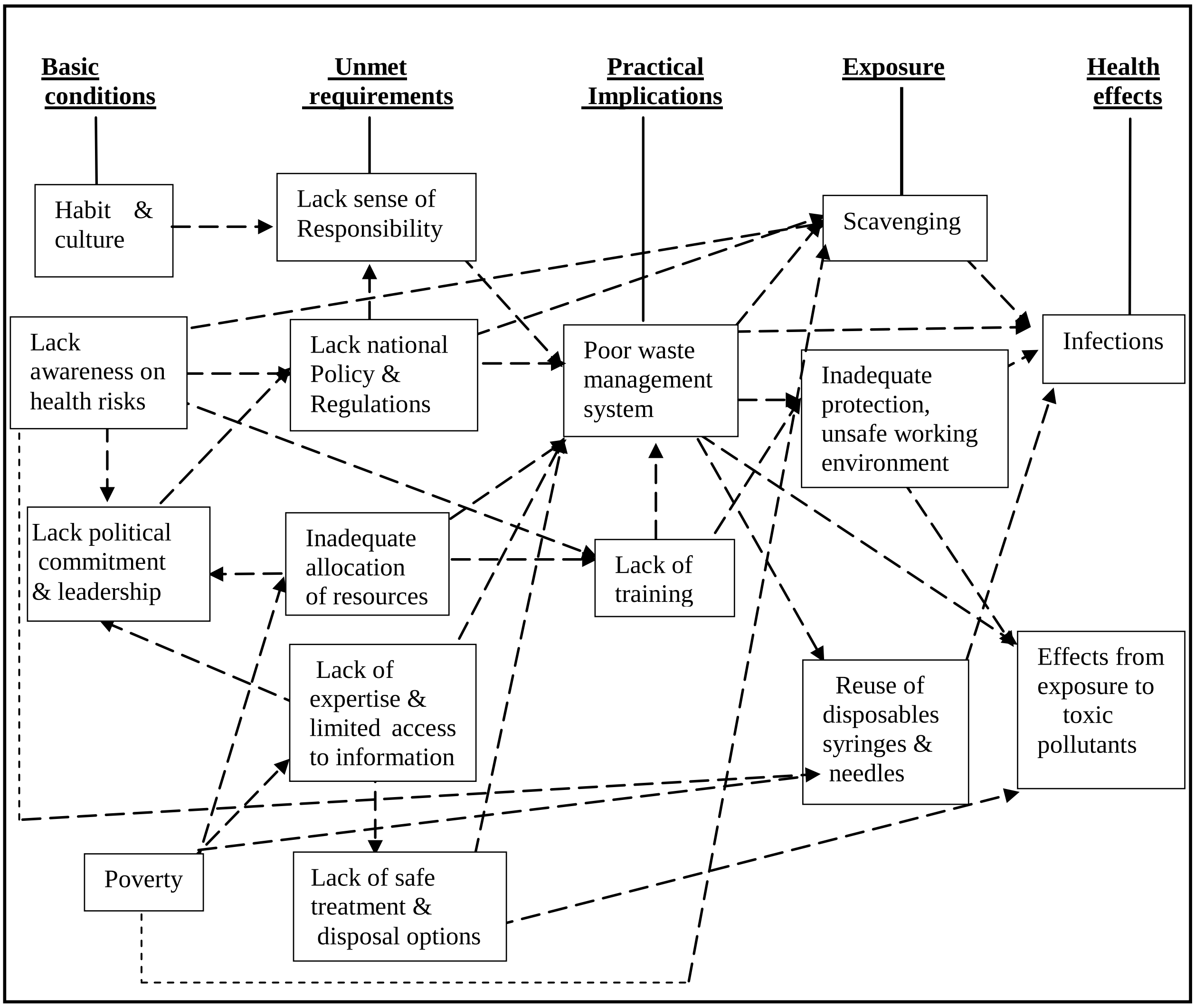

Figure 2.4 Possible influences on poor healthcare waste management system

(Source : Adapted from WHO, 2000a, p.2)

2.4.2. Advantages of an Effective Healthcare Waste Management System

According to the HCWM Guidance Note of the World Bank (2003) and the overview document on HCWM of WHO (2005), effective HCWM reduces the incidence of hospital-acquired infections and related complications, disrupts the cycle of infection, shortens patient stay in hospital and increases recovery rates. Moreover, it should reduce the incidence of transmission of infectious diseases from infectious waste, prevent the illegal resale of contaminated needles and syringes, and reduce both risks to people handling waste within and outside health facilities and the ill effects on human health and the environment from burning of HCW containing toxic substances such as polyvinyl chloride.

Studies on effective implementation of HCWM (Almuneef & Memish, 2003; Healthcare Without Harm Asia, 2007) have shown savings on the cost of waste management due to a reduction in the volume of waste. Moreover, extra income has been generated for the hospital from the sale of reusable items.

2.5. A COMPREHENSIVE HEALTHCARE WASTE MANAGEMENT SYSTEM

According to WHO (2005) the development of a HCWM system requires thorough planning, consideration of constraints and opportunities, appropriate resource allocation, and clearly formulated objectives and achievable outcome indicators. WHO cautions that the waste treatment and disposal methods used effectively in developed countries may not necessarily be effective when transferred or copied in developing countries without adapting and considering local situations. Campbell (1999) also warns that introducing the best and latest technology does not necessarily mean that the problems associated with waste will be solved.

McRae (no date) has identified five areas: *segregation, reduction, substitution, personal protective equipment* and *secure collection of waste* as “soft” technology approaches to HCWM. According to McRae (no date) implementing soft technology approaches has resulted in increased worker safety and a reduced volume of waste, thereby reducing the requirement for special treatment, the costs, and the associated public health risks. He argues that choosing a waste treatment without considering the health and environmental risks could turn out to be more harmful than of benefit to health workers and the public. Therefore, McRae (no date) stresses the importance of first understanding the nature of the waste before choosing the treatment and disposal options.

WHO (2005) identified steps that need to be considered when developing a HCWM plan. These steps, shown in Table 2.4, include the development of policy, standardised practice guidelines and evaluation mechanisms. WHO (2000) stresses the importance of waste management as a fundamental aspect of overall healthcare service delivery. A failure to reduce potential harm through the institution of preventive waste management practices detracts from overall health achievements and investments.

Table 2.4 Strategies to develop a healthcare waste management plan

- Raise awareness of the issue among concerned people, especially among the policy makers, donor agencies the and stakeholders;
- Consolidate existing legal and regulatory frameworks; or, if absent, develop them;
- Develop a policy framework and guidelines;
- Conduct an assessment of the current healthcare waste situation to highlight areas of weaknesses that may require immediate interventions. This will provide a base-line to make comparisons or for future evaluation
- Set up waste management plans based on different types of healthcare facility;
- Standardize HCWM practices;
- Build capacity and secure funding; and
- Institute a monitoring and evaluation mechanism

(Source: WHO, 2005)

Following the development of a HCWM plan, the WHO recommends developing a comprehensive waste management system recognizing the points identified in Table 2.5, taking into account appropriateness, achievability and sustainability including safe and environmentally friendly techniques.

Table 2.5 A comprehensive healthcare waste management system

- *Assign responsibilities*- a clearly written job responsibilities of all people involved in the waste management;
- *Allocation of resources*- adequate allocation of human and financial resources for the smooth operation of waste management;
- *Infrastructure*- appropriate infrastructure for treatment and disposal of HCW;
- *Waste minimisation strategy*- minimization of waste should be integrated into the national purchase policy and efficient stock management practices;
- *Segregation*- good management of HCW starts with effective segregation of waste followed by proper handling and disposal of waste accordingly;
- *Safe collection, handling and storage*- implementation of safe collection, handling, storage, transportation, treatment and disposal of wastes; and
- *Identify a person*- responsible for the implementation of waste management action plan

(Source: WHO, 2000)

2.6. HEALTHCARE WASTE SEGREGATION, TREATMENT AND DISPOSAL

Segregation of waste at the source will not only reduce management and operation costs but will also reduce risks of transmission of infection and injuries to people handling the waste (Prüss et al., 1999). However, waste treatment and disposal options will depend upon the policy of the particular country, as well as the type and volume of waste generated.

As several authors (Visvanathan & Adhikari, 2006; World Bank, 2003; Prüss et al., 1999) maintain, there is no single technology that is best for all categories of HCW. It is equally important when choosing a particular technology to take into account the cost versus benefits, and the availability of expertise for operation and maintenance (Johannessen et al., 2000; Prüss et al., 1999). Other factors, including the availability of space to build the infrastructure, infrastructure requirements, estimates of future waste production and the impact of the waste management technology on human health and the environment are also important considerations (Department of Health, United Kingdom, 2006; Prüss et al., 1999).

The choice of technology may also be influenced by an individual country's legislation, policies and standards. For example, in 1994 according to the report of United States Environmental Protection Agency in the United States of America (USA), medical waste incinerators were found to be the main emitters of toxic substances, including dioxin, furan and co-planar polychlorinated biphenyls (PCBs) from burning plastic waste containing polyvinyl chloride (PVC). The burning of products containing PVC were said to be carcinogenic, affecting both human and environmental health. This led to enforcement of strict pollution control standards and an increase in the use of alternative technologies such as autoclaving, microwaving and chemical disinfection to treat infectious HCW in the USA (Agrawal, 1998). According to Singh (2003) the usage of incinerators in health facilities in the USA dropped from 5,000 in 1994 to 764 in 2000.

The discussion on waste segregation, treatment and disposal that follows deals with the management of both solid and liquid hospital infectious waste.

2.6.1. Waste Receptacles and Colour Coding

For effective waste segregation, the safety of people handling waste and easy identification of different categories of healthcare waste, WHO (1999) recommends using different colour-coded waste receptacles with symbols to indicate the nature of the waste (see Table 2.6).

Table 2.6 WHO recommended description of waste receptacles, colour code and biohazard symbols

Colour code	Description and type of receptacle	Symbols
Red	strong leak-proof container or a bag, which can be autoclaved, for highly infectious waste, with biohazard symbol	
Yellow	strong leak-proof container or a bag for pathological and anatomical wastes with biohazard symbol	
Yellow	puncture-proof receptacle, labeled as “Sharps”	
Brown	plastic bag or a container for chemical and pharmaceutical wastes with a symbol	
Lead container	radioactive symbol for radioactive wastes	
Black	container or bag for general healthcare waste	

(Source: WHO, 1999)

As will be seen in later chapters, methods used in Bhutan for treating infectious waste prior to disposal include autoclaving, incineration and chemical disinfection. Disposal options include landfill, deep pit burial and open pit. Treatment and disposal options such as microwave irradiation and encapsulation which could be used as an alternative to the existing practices in Bhutan have been explored to help decision makers and program planners to make an informed choice in the future. However, the final decision of implementation of the methods will depend upon government policy, volume of waste generated and donor supported funding of the country.

Treatment and disposal options applicable to infectious waste and sharps, classified by Prüss et al. (1999) are shown in Table 2.7 and discussed below.

Table 2.7 Treatment and disposal methods for infectious waste and sharps

Methods	Infectious waste	Sharps
Incinerator	√	√
Chemical	√	√
Autoclave	√	√
Microwave Irradiation	√	√
Encapsulation	X	√
Burial	√	√
Sanitary landfill	√	X

√ - *recommended*, X – *not recommended* (Source: Prüss et al., 1999, p.114.)

2.6.2. Waste Treatment

The waste treatment options of incineration, autoclaving, chemical disinfection, encapsulation and microwave irradiation are outlined below and a recently developed method, solar treatment, is also discussed.

Incineration

According to Johannessen et al. (2000) and Prüss et al. (1999), incineration used to be the choice of treatment for most hazardous waste as it fully destroyed pathogens besides reducing the volume of waste. However, incinerators require effective pollution control devices (World Bank, 2003). Although this method is still commonly used for wastes that cannot be recycled, reused or disposed of in landfill, alternative treatment techniques are becoming increasingly popular in view of the emission of toxic pollutants and high maintenance costs associated with incineration.

Chemical disinfection

Chemical disinfection is a process to either to remove or to reduce pathogenic microorganisms, except spore bacteria from non-living objects (Rutala, Weber & Healthcare Infection Control Practices Advisory Committee, 2008). The scope of use of chemical disinfection has extended from its use on medical equipment, floors and walls to the treatment of healthcare waste (Prüss et al., 1999). Therefore, it is important to recognise the type of microorganism that needs to be destroyed as some disinfectants may be effective in killing or inactivating certain types of microorganism but not effective against all types. The most common types of chemicals for disinfection of healthcare wastes are aldehydes, ammonium salts, chlorine and phenyl compounds (Rutala, et al. 2008; Prüss et al., 1999).

The efficacy of chemical disinfection will be dependent on the strength of the disinfectant, the contact time and the total immersion of the equipment to be disinfected (Rutala, et al. 2008; World Bank, 2003; Prüss et al. 1999). An important aspect to consider is that the hazardous nature of potent disinfectants will necessitate workers wearing personal protective gear whilst handling them (World Bank, 2003).

Autoclaving

Autoclaving uses steam under high temperature and pressure. Autoclaving is generally used to treat infectious waste (Prüss et al., 1999). Minimum contact time and temperature of the autoclave depends on the moisture content of the waste and the ease of penetration of the steam. The effectiveness of the treatment will depend on the autoclave meeting the operational conditions (World Bank, 2003; Prüss et al., 1999).

Encapsulation

Encapsulation treatment involves filling three-quarters of a container (made from high density polyethylene) or metallic drums with waste (sharps, chemical or pharmaceutical) and filling the remaining space in the container with a medium (cement or clay). After the medium has dried, the container is sealed and taken to the municipal landfill (Prüss et al., 1999). This method of treatment is comparatively cheap, safe and appropriate in health facilities that practice minimal programs of disposal of sharps, chemical and pharmaceutical wastes. This method is also effective in reducing scavengers' accessibility to hazardous waste.

Microwave irradiation

Microwave irradiation uses microwave (a frequency of 2450 megahertz and a wavelength of 12.2 centimeters) to kill all microorganisms. Prior to irradiation, wastes need to be shredded and humidified. The moisture in the waste is heated by the microwave and the heat conduction renders the waste non-infectious. This process takes 20 minutes. After irradiation, the waste is placed in a container and disposed of along with the general municipal waste. Prüss et al. (1999) recommend regular routine bacteriological and virological tests to monitor the efficacy of microwave irradiation. Although this method of treatment of waste is increasingly gaining popularity, Prüss et al. (1999) do not recommend its use in developing countries due to the high costs of operation and maintenance. However, the choice of treatment will vary from country to country depending upon the factors discussed earlier.

Solar treatment

Jamwal (2004) reports that researchers at the Choithram Hospital and Research Centre in India have developed a new solar treatment disinfection technology that is cheaper and environmentally-friendly and does not require skilled manpower. It consists of a box-like solar cooker, with an upper cover to hold up a reflecting mirror and a lower metal box. Waste mixed with water is placed in the box and exposed to solar rays for six hours. Although this process does not destroy all microorganisms there is a reduction of microorganisms (Jamwal, 2004). Jamwal suggests that the technology may be found useful in rural areas in developing countries where other treatment technologies, such as autoclave and microwave, are not affordable.

2.6.3. Waste Disposal Techniques

Despite its many disadvantages, land disposal remains one of the most common methods of waste disposal, particularly in developing countries (Kharbanda & Stallworthy, 1990). Neal and Schubel (1987) comment that if there were large areas of land available, with low population density, no water sources nearby the landfill, and the composition of wastes was mainly biodegradable, this approach of waste disposal would be safe and efficient. However, with increasing populations, waste disposal practices changed from open burning and dumping to engineered sanitary landfills and regulated incineration (Bisson, McRae & Shaner, 1993; Neal & Schubel, 1987) and later towards recycling and recovery of energy, especially in developed countries (Curzio et al., 1994). Various land disposal methods are outlined below.

Open dumps (open pit)

Open dumps are unsightly and produce foul odours and pose fire risks from the gases produced by the waste. Uncontrolled and scattered waste provides easy access to scavengers (humans and animals) with risks of transmission of diseases (Prüss et al., 1999).

Deep burial pit

As Prüss et al. (1999) explain minimum standards must be maintained whilst making a deep burial pit. The standards are designed to protect water supplies and minimise risks to people and to the environment, are shown in Table 2.8. The pit is good to be used for one to two years for about five to ten tonnes of waste.

Table 2.8 Minimum standards of a deep pit burial

- the burial pit should be lined with low permeable material (clay) to prevent the pollution of groundwater;
- the bottom of the pit should be at least 1.5m above groundwater level;
- only hazardous healthcare waste should be buried to preserve limited space;
- not more than one kilogram of chemical waste should be buried at a time to reduce environmental impacts;
- after each layer of waste, cover with a layer of soil or a deposit of lime to prevent odours and breeding of rodents or insects; and
- the site should be fenced with access restricted to authorised personnel only.

(Source: Prüss et al., 1999)

Sanitary landfills

Sanitary landfills are specifically designed and sited away from human dwellings. Prüss et al. (1999) recommend that each site has a designated supervisor to oversee the waste landfill process. After every load of waste, the landfill has to be covered by a layer of soil to deter scavengers, to prevent contamination of soil and natural water sources, control air pollution and odour, and prevent direct contact with people. Certain healthcare wastes (infectious and some amount of pharmaceutical waste) can be disposed of into sanitary landfills. Unlike open pits, sanitary landfills require a constructed site and a supervisor (Prüss et al., 1999).

2.6.4. Advantages and Disadvantages of Treatment and Disposal Methods

As seen in the table below, there is no single waste treatment or disposal technique that is considered best for a particular type of waste and which does not have disadvantages. A summary of advantages and disadvantages of different treatment and disposal methods is presented in Table 2.9.

Table 2.9 Summary of advantages and disadvantages of different treatment and disposal methods

Method	Advantages	Disadvantages
Incinerator	- good for infectious waste - disinfection efficiency very high - substantial reduction of weight and volume of waste	- high investment & operation costs - emission of air pollutants - requires periodic removal of soot
Chemical disinfection	- highly efficient disinfection under proper operating conditions - some disinfectants, cheap	- requires well qualified technician to operate - safety measures because of use of hazardous substances - inappropriate for pharmaceutical, chemical and some of infectious wastes
Autoclave	- environmentally sound - comparatively low investment and operation cost - reduces 80% volume and 20-35% weight of waste	- requires technician to operate - cannot manage large volumes of waste - inappropriate for anatomical, cytotoxic and radioactive wastes
Microwave irradiation	- Environmentally sound - huge reduction in volume of waste - good disinfection under correct operating conditions	- investment and operation costs high - possibility of problems with operation and maintenance
Encapsulation	- simple, cheap and safe - applicable to sharps and pharmaceutical wastes	- not recommended for non-sharp infectious waste
Safe burial	- cheap - safe if access to site is restricted and with limited natural permeation	- safe only if access to site is restricted and minimum standard measures taken whilst making the pit - require more land area

(Source : Prüss et al., 1999, p.110)

2.6.5. Factors Influencing Treatment and Disposal Methods

The HCWM Guidance Note of the World Bank (2003) states that various treatment techniques may ensure the removal of hazardous substances or pathogens from HCW but reiterates the need to consider such factors as the moisture content of waste, the correct level of temperature of the device, duration of contact time, and the concentration of chemicals that influence the effectiveness of treatment methods including the production of secondary waste (see Table 2.10). Moreover, the disposal options may in themselves have health risks if instructions are not followed correctly in the process of using the technology. For example, incorrect incinerator temperatures and inadequate emission control systems will emit hazardous pollutants, and toxic leachate will enter water sources from inappropriately structured landfills.

Table 2.10 Factors influencing treatment and disposal methods

Method	**Factors influencing the Effectiveness**	**Concerns**
Incineration *(treatment)* *(disinfects, huge volume reduction of waste, produces secondary waste)*	- turbulence / mixing - moisture content of waste - combustion chamber filling - temperature and duration - maintenance and repair	- depending on type of waste incinerated may produce emission and hazardous ash - may require pollution control devices to meet local regulations - high infrastructure, operation and maintenance costs - training requirement
Autoclave *(treatment)* *(only disinfects, little reduction of volume of waste, produces secondary waste)*	Depends on : - the model - temperature, pressure & duration - steam penetration - load size - chamber air removal	- applicable for reusable items - some models cannot manage big volumes of waste and may require high maintenance and operation costs - treats only some types of HCW - training requirement - need water and electricity
Microwave *(treatment)* *(disinfects, some reduction of volume of waste, produces secondary waste)*	Depends on characteristics of waste: - moisture content of waste - waste mixture content - duration	- expensive, requires good infrastructure - requires training
Chemical *(treatment)* *(disinfects, may increase the volume of waste, produces secondary waste)*	Depends on: - concentration of chemical, P^H level and temperature - chemical contact time - correct waste and chemical mixture	- increase volume of waste - safety of worker (very important) - personnel intensive
Burial *(Disposal)* *(simple, inexpensive)*	- depth of ground water size of trench / pit - lining of pit with non-porous material - sealing method	- no disinfection required - handle only small volume of waste - possibility of waste being unburied or partially buried and may pose danger to communities

(Source: World Bank, 2003, p.2)

2.7. RISKS OF POOR MANAGEMENT OF INFECTIOUS WASTE

Risks associated with poor management of hospital infectious waste are evident from the literature. However, the level of risks to people involved in the managing the waste will differ among different groups of people, both within and outside health facilities. It will depend on the type and complexity of job tasks (Puro, DeCarli, Petrosillo, & Ippolito, 2001), level of education, awareness of risks and socio-economic conditions (Rahman & Ali, 2000). In Bhutan, patients are often accompanied by their relatives and who stay with them whilst undergoing treatment in the hospital. During the stay in the hospital, the relatives would be exposed to infectious HCW, thus risk contracting infection or sustaining injury if the waste is not managed safely.

2.7.1. People at Risk

Any person exposed to infectious healthcare waste is at risk. This may include health workers within the health facility who generate infectious waste, hospital support staff (laundry and kitchen workers, cleaners), patients, visitors and people outside the facility handling the waste, including waste pickers (scavengers) (United States Environmental Protection Agency (EPA), 2006; Nessa, Quaiyum, & Khuda-e-Barkat, 2001; Akter, 2000; Johannessen et al., 2000). However, according to Appleton and Ali (2000), and Rahman and Ali (2000) the level of risk will differ from one group to another. The people most at risk are the waste pickers, recyclers, and hospital and municipal waste handlers as they are in direct contact with waste. Injecting drug users looking for syringes and needles from the waste are also at a risk of sustaining injury and contracting infections. In the United States, according to Lichtveld, Rodenbeck and Lybarger (1992), about one third of work-related injuries in hospitals are caused by sharps. The punctured skin gives the entry point for pathogens to transmit infection. However, Turnberg (1996) estimates that waste handlers in United States processing waste outside health facilities are 2.7 to 4 times more likely to get infected by blood borne pathogens than staff working within the facilities.

According to Appleton and Ali (2000) and Rahman and Ali (2000) waste handlers and waste pickers, especially in poorer parts of developing countries, have the highest risk of contracting infections and sustaining injuries because of their low socio-economic status, poor living conditions and poor nutritional status which makes them more susceptible to diseases and infection. Furthermore, they usually have little or no education, thus lack awareness of the risk associated with HCW and do not take preventive measures, such as the use of personal protective equipment. Appleton and Ali

(2000) also suggest that since municipal waste handlers have easy access to waste, they may also be involved in waste picking to make extra income.

2.7.2. Health Risks

There is epidemiological evidence of transmission of blood-borne infections such as Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) from contaminated sharps injuries. The safe HCWM policy paper of WHO (2004) states that a person with one needle-stick injury (NSI) from an infected needle has a 30%, 1.8% and 0.3% risk of being infected with HBV, HCV and HIV respectively. The Centres for Disease Control and Prevention (1999) consider NSIs to be the main cause of transmission of blood- borne infections among healthcare workers globally. According to Prüss-Ustün, Rapiti and Hutin (2005) an estimated 39.0%, 37.0% and 4.4% of HCV, HBV and HIV infections respectively of the global burden of disease is attributed to occupational exposure to contaminated percutaneous injuries. However the Agency for Toxic Substances and Disease Registry (ATSDR) (1990) of United States claims lack of evidence of a member of the public or a worker in the waste industry acquiring infection from categories of HCW other than from contaminated sharps. Infection from infectious HCW has occurred within healthcare facilities during patient care, in the laboratory or whilst disposing of sharps (ATSDR, 1990). Although Rutala and Weber (1991) argue the absence of literature identifying HCW as the cause of outbreaks of disease, WHO (2005) and World Bank (2003) affirm that proper handling, treatment and disposal of infectious HCW does reduce the occupational and public health risks as well as those to the environment.

The Department of Health, United Kingdom (2006), Vermont Hazardous Waste Management Regulations (2001), Burke, (1994), and Rutala and Mayhall, (1992) assert that for the transmission of a disease, there has to be an adequate dose of virulent pathogen with a portal of entry and a susceptible host. Pathogenic microorganisms are living organisms requiring favourable conditions for their survival or transmission of infection. Pathogens from the waste may enter the human body through abrasions or cuts in the skin or via mucous membrane, inhalation or ingestion (Sharma, 2007; Vermont Hazardous Waste Management Regulations, 2001). Burke (1994) proposes education as the most important strategy to inform the public of the actual risks of HCW to avoid unnecessary panic and to create better means of dealing with the waste.

According to the World Health Report of WHO (2002) health workers throughout the world annually sustain two million needle-stick injuries (NSIs), resulting in Hepatitis

B and C and HIV infections. The global burden of disease attributed to occupational exposure is estimated to be 40% of Hepatitis B and C infections and 2.5% of HIV infections among health workers (WHO, 2002). WHO estimates that 90% of occupational exposures take place in developing countries because of excessive or inappropriate handling of contaminated syringes, increasing the risk of the occupational transmission of diseases (WHO, 2003).

According to Wilburn and Eijkemans (2004), figures from injection safety surveys conducted by WHO and others reveal on an average, annually, four NSIs per worker occur in African, Eastern Mediterranean and Asian populations. Studies have reported recapping of used needles (Salehi & Garner, 2010; Bi & Boss, 2008; Prüss-Ustün et al., 2003; WHO, 2003; Yassi, McGill & Khokhar, 1995) and unsafe collection and disposal of sharps to be the most common causes of NSIs among health workers (Bi & Boss, 2008; Prüss-Ustün, Rapiti & Hutin, 2003; WHO, 2003). Studies from Australia (Smith, Smyth, Leggat & Wang, 2006), China (Phipps, Honghong, Min, Burgess, Pellico, Watkins, Guoping & Williams, 2002), Singapore (Ng, Lim, Chan & Bachok, 2002), Italy (Puro, DeCarli, Petrosillo & Ippolito, 2001), Saudi Arabia (Memish, Alumneef & Dillon, 2002) and Taiwan, (Guo, Shiao, Chuang & Huang, 1999) suggest syringe needles as the most common cause of NSIs among health workers. By contrast, in Japan, ampoules or vials were the most common cause of sharps injury among nurses (Smith, Mihashi, Adachi, Nakashima & Ishitake, 2006).

In an Australian tertiary hospital, a study was conducted to examine sharps injury and body fluid exposure among healthcare workers (Bi & Boss, 2008). The researchers used surveillance data of reported cases of sharps injuries and body fluid exposures. From a total of 640 cases reported in the study, 47% of the sharps injuries and 68% of the body fluid exposures were reported by nurses, 38% and 16% by medical staff, and 5% and 4%, by non-medical staff (students, contractors and agency staff) and the rest reported by non-hospital staff 10% and 12% respectively. Some 56% of the injuries were from hollow-bore needles, while 11% occurred from recapping and improper disposal of sharps (Bi & Boss, 2008). According to Jagger (1996) preventive measures such as training of health workers, universal precautions, work place controls (no recapping of sharps, providing sharps receptacles) have reduced NSIs by 80%, with a further reduction with the use of safer sharps collection devices.

Effluent may also pose risks of infection. In India, a study was conducted to examine the spread of multi-drug resistant (MDR) bacteria from hospital effluent to a municipal sewerage system (Chitnis, Patil, Ravikant & Chitnis, 2000). Ten samples were taken from hospital effluent and 11 samples from residential sewage. From the samples taken the study showed MDR bacteria from hospital effluent ranging from 0.58% to 40% whereas samples from residential sewage showed less than 0.03%. According to Chitnis, Chitnis, Vaidya, Ravikant, Patil and Chitnis (2004) municipal treatment plants are uncommon or absent in developing countries and as such, liquid waste (both infectious and non-infectious) from hospitals flows either into a sewerage system or into open drains without being treated, highlighting the risk of finding a higher percentage of MDR bacteria in hospital effluent.

Another study of bacterial populations in a hospital effluent treatment plant at various stages of treatment in a tertiary hospital in central India (Chitnis et al., 2004) showed the continuous presence of a diverse range of pathogens. These included salmonellae, shigella and multiple drug resistant coliforms, which further required chlorination for decontamination. The study highlighted the gravity of risk of transferring pathogens such as salmonella, shigella and vibrio cholerae. In France, a study of ecotoxicological risk assessment also revealed drug resistant bacteria in hospital waste water (Emmanuel, Perrodin, Keck, Blanchard & Vermande, 2005). Emmanuel et al. (2005) highlight the challenges that may be posed in treating infections that may be caused by drug resistant bacteria.

2.7.3. Environmental Risks

WHO (1999) has identified the following risks to the environment as a result of improper management of healthcare waste:

- open burning of waste (especially plastic wastes containing PVC) releases toxic fumes which contain dioxin and furan that remain as persistent organic pollutants (POP);
- accumulation of toxic chemicals in the soil over a long duration affects the microbial process of decomposition resulting in unfertile soil, thus reducing food production;
- plastic waste materials not only contaminate soil but also reduce water seepage into the ground during rainfall, thus reducing the water table level;
- leakage of leachate contaminates water sources, reducing the quality of water, increasing risk of transmission of infections; and
- domestic animals grazing in and around open dump sites have the potential to reintroduce microorganisms into the food chain.

In addition to these risks it has been identified that waste may also block drainage pipes and cause flooding in the locality (Working Group on Environmental Auditing, 2004) if not disposed of at appropriate sites, further increasing the risk of transmission of diseases.

Among the different categories of infectious waste, contaminated sharps pose a double risk because of the chance of both injury and the transmission of infections.
Therefore, potential strategies to prevent sharps injuries and associated risks will be discussed.

2.8. CONTROL MEASURES TO PREVENT NEEDLE-STICK INJURIES AND ASSOCIATED RISKS

According to Wilburn and Eijkemans (2004) NSIs can be prevented by avoiding unnecessary injections, and removal of sharps through implementation of educational programs, following universal precautions and eliminating needle re-capping. Although studies (Adams & Elliott, 2006; Elder & Paterson, 2006; Ng et al., 2002) show that NSIs can be minmised, effective prevention strategies will require a combination of multi-facet approaches starting from training, use of safer sharps devices, administrative and work place controls, and universal precautions. However, Elder and Paterson (2006) assert that training is an important aspect of prevention strategy but safety engineered sharps devices (Elder & Paterson, 2006; Trim & Elliot, 2003; Ng et al., 2002; Prince, Summers & Knight, 1994) and environmental changes (Makofsky & Cone, 1993) are likely to be more effective in preventing NSIs.

Adams and Elliott (2006) conducted a four-year prospective study on the impact of safety needle devices at the University Hospital Birmingham National Health Service Foundation Trust. The initial training program consisted of an enhanced standard sharps awareness program which included road shows, providing inoculation injury information in staff payslips, safety device open days, setting-up of sharps box trays in clinical areas and new inoculation injury and sharps awareness placards were introduced in the hospital. In the following sharps training program, Adams and Elliot (2006) included universal precautions and the actions to be taken following a needle-stick injury but without including any of the previous training sessions stated earlier. A range of safety sharps devices which included a safety glide needles and blunt fill cannulae were assessed and introduced in four clinical areas. Trainings were conducted for staff on the usage and safe disposal of these devices. Following the implementation of enhanced sharps program, there was a decrease by 18% in the number of NSIs (from 16.9 /100,000 to 13.9

/100,000); whereas, following the standard sharps training there was an increase in the number of NSIs to 20 /100,000 devices. However, following the introduction of both safety devices along with related training, there was a significant reduction of 70% of NSIs (6/100,000) (Adams & Elliot, 2006). Although the use of needle protective devices demonstrate reduction in associated sharps injuries compared with the conventional products, Trim and Elliot (2003) emphasise the need for correct use of the device to provide protection. They also assert the need to include training on safe handling and disposal of sharps devices as well as legislative actions.

In another study at the Christian Medial College Hospital Vellore in India, large sharps receptacles were introduced along with educational programs. Following implementation the number of NSIs from disposal of sharps dropped from 69.2% to 38.5% (Richard, Kenneth, Ramaprabha, Kirupakaran & Chandy, 2001).

2.8.1. Elimination of Hazards

In order to eliminate risks of NSIs, Wilburn and Eijkemans (2004) suggest replacing injections with alternative medication routes in the form of tablets, inhalers or transdermal patches. Use of needleless intravenous systems may be one other way to eliminate NSI hazards.

2.8.2. Engineering Controls

Wilburn and Eijkemans, (2004) suggest using needles that retract, sheathe or blunt immediately after use to reduce incidents of NSI. Ng et al. (2002) reported that hospitals that used re-engineered sharps safety devices (retractable lancet needles, vacutainer equipment for venipuncture, small sized sharps boxes) did not report any sharps injuries Similarly, Adams and Elliott (2006) and Elder and Paterson (2006) found a significant reduction in the number of NSIs following the introduction of sharps safety devices.

The “straight-drop” styled system of sharps receptacle allowed more stuffing of sharps in the filled up box, thereby resulting in NSIs. In order to reduce sharps injuries among health workers, Vanderbilt University Medical Center in the United States of America undertook a project to improve the sharps container. Before implementation of the project staff members were almost three times more likely to sustain a disposal injury. Following the implementation of the project there was a significant reduction; the annual NSIs rate was reduced by two-thirds (Hatcher, 2002).

2.8.3. Administrative Controls

Wilburn and Eijkemans (2004) identify administrative controls as including policies to mimimise exposure to occupational health risks and implementation of universal standard precautions, allocation of resources to show commitment to the safe management of HCW, needle-stick prevention committee and, regular and relevant training programs on use of safety devices.

The study on “Effects of Hospital Staffing and Organisational Climate on NSI to Nurses” conducted by Clarke, Sloane and Aiken (2002) in the United States reported the risk of NSIs to be three times more among nurses working in units with lower numbers of staff, lack of nurse leadership, inadequate resources and higher levels of emotional exhaustion. Clarke et al. (2002) suggest working conditions could be equally important as safety devices in reducing risks.

2.8.4. Work Practice Controls

As work place control measures Wilburn and Eijkemans (2004) suggest no-recapping of needles after use, sharps receptacles to be placed at eye level or at arms reach and ensuring sharps are disposed of on-schedule before being filled-up. The non-randomised interventional study of installing needle disposal boxes closer to patients’ bedsides showed a significant reduction in the recapping of needles besides promoting behavioural change among health workers (Makofsky & Cone, 1993). Similarly, Richard et al. (2001) saw a further reduction of NSIs after placing smaller sharps receptacles close-by in patient areas.

2.8.5. Personal Protective Equipment

Personal protective equipment (PPE) consists of eye shields, goggles, gloves, masks and gowns. The use of PPE helps to prevent transmission of infections by acting as a barrier between the health worker and source of infection or hazard (Wilburn & Eijkemans, 2004); however PPE does not necessarily prevent NSIs. Therefore, in the control measures for NSIs, PPE is least effective.

2.9. EXAMPLES OF BEST PRACTICES IN HEALTHCARE WASTE MANAGEMENT

The safe management of HCW does not necessarily require sophisticated plans or technologies. The following summary of a study in the Philippines shows how small initiatives can make a difference in effectively managing HCW.

In 2005 Health Care Without Harm Asia (HCWHA) conducted a study in four tertiary hospitals (with different specialty services, case management, and hospital size) in metropolitan Manila to identify best practices of HCWM. The researchers reported that despite a ban on incineration, effective methods can be used to manage and dispose of waste safely even in developing countries. It was also reported that the commitment of hospital authorities to safe healthcare waste and protection of the environment, enabled staff to face the challenges of instituting best practices of HCWM. HCWHA (2007) affirms that there was no single system, guide or specific set of practices used by the hospitals in the study to improve the management of waste. Rather each hospital employed different strategies to develop best practices to manage their waste, as outlined in Table 2.11.

According to HCWHA (2007) in Hospital A, the hospital HCWM committee members (besides their enthusiasm and dedicated leadership roles), ensured that staff involved in managing healthcare waste were not only aware of the issues related to HCW but also the reasons for making hazardous waste safe for disposal. Hospital B was the smallest health facility of the four hospitals. The staff at this hospital instituted an efficient segregation of infectious waste which resulted in a significant reduction in the volume of waste and the waste management costs. At Hospital C, because of the incentives (in the form of remuneration) provided for waste segregation efforts, waste minimisation became everybody’s affair in the hospital. The income made from the sale of recyclable and non-biodegradable waste was used for staff welfare, which included free annual medical check-ups. Hospital D, despite being the largest of the four health facilities in the study, demonstrated that it was possible to institute effective management of waste by taking small initiatives, as shown in Table 2.11.

HCWHA (2007) found that effective HCWM practices do not need a complicated system or expensive technology. As demonstrated by the four hospitals in the study, simple tools and innovative ideas can result in improved practices of managing waste and minimising associated public health and environmental risks.

Table 2.11 Examples of initiatives taken by the four hospitals in Metro Manila to institute best practices of healthcare waste management (2005)

Hospital A	***Policy making***
Leadership	-Formation of a dedicated HCWM committee -Orientation to new staff & patients on waste segregation and policies -Monthly meetings to discuss, address issues and disseminate updates on HCWM -An annual infection control & waste management week -Committee kept abreast with the trends in HCWM to develop a system using different techniques to manage waste - Communication and training ; conducting spot checks - Verbal reprimand in first instance of breach of policy or incident reporting. A written warning in second instances placed in personal records
Hospital B	***Waste reduction activities***
Small steps go a long way	-To overcome financial constraints, income from sale of recyclable items were used as financial income supplement for the hospital. Monthly income from sale reported to accounts division
Hospital C	***Waste reduction activities***
Getting everyone Involved	-A profit sharing scheme instituted. People rewarded for waste segregation efforts -Free annual check-ups and Tetanus and Hepatitis B immunization to prevent contraction of diseases
Hospital D	***Waste processing***
Effective system in place	-Drafting of HCWM manual based on standards set by Department of Health -Developed HCWM & Ecological Awareness Program with three subprograms: reduce, recycle & reuse -Each subprogram with own team and approved financial -Compliance and monitoring program. Health education program -Quarterly five-day waste management training program. Ecological tours to landfills and waste treatment -Pre and post training evaluation to assess awareness and knowledge on HCWM -After successful completion of training staff selected and further trained to become facilitators for future training programs

Source: HCWHA, (2007)

2.10. SUMMARY

In this chapter the importance of properly defining infectious waste in order to institute an effective management system and establish regulatory frameworks and policy guidelines that incorporate the principles underlying the safe management of hazardous waste has been established. To ensure proper management of infectious HCW, factors such as basic conditions, unmet requirements and negative driving forces need to be addressed. The literature suggests that there is no one treatment or disposal technique that is the best; rather, the choice of waste treatment and disposal options needs to be made according to local conditions, including the policy and regulations related to waste management and the volume and type of waste generated. In addition, the choice of technology needs to be made in the light of relative risks compared with the broader benefits to public health and the environment.

Although potential risks have been associated with infectious HCW, there is a lack of evidence on actual transmission of disease by infectious HCW. However, there is strong evidence of transmission of infections from contaminated sharps. Nevertheless, the literature suggests that safe management of infectious HCW does reduce potential occupational and public health risks.

As the study of best practice HCWM from four hospitals in Manila demonstrates, implementing a proper HCWM system does not need complicated plans or expensive technologies. Commitment of the staff, effective leaders at all levels of management and safety as the goal of the organisation serves to promote effective management of healthcare waste. Risks associated with poor management of hospital infectious waste could be reduced by regular and relevant training programs, and using appropriate and safer equipment and technologies. However, decision makers and managers should also consider the influence of hospital staffing levels and organisational work environment in order to facilitate implement safer management of infectious hospital waste practices.

The following chapter presents a brief discussion of Bhutan’s governance, healthcare system and municipal waste management to provide the context for this study of the management of infectious hospital waste in Bhutan.

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CHAPTER 3

HOSPITAL INFECTIOUS WASTE MANAGEMENT IN BHUTAN

The study reported in this thesis is an exploration of national policy as well as institutional practices relating to the management of hospital infectious waste in Bhutan. In this chapter the various potential stakeholders or agencies in the policy process are described. These include the Cabinet, the Parliament, the Royal Audit Authority (RAA), the National Environment Commission (NEC), the Ministry of Health (MoH) and the Municipal Corporation of Thimphu. International agencies including the World Health Organization (WHO) and Danish International Development Agency (DANIDA) as well as various non-governmental organisations and the mass media may also influence the implementation of policy decisions with regard to hospital infectious waste management.

After 100 years of absolute monarchy, Bhutan became the youngest democratic constitutional monarchy in the world, with its first parliamentary election in 2008. In accordance with the Constitution of Bhutan, the system of governance consists of the executive, the legislature and the judiciary. The executive, which is the Cabinet, comprises 10 ministers and is headed by the Prime Minister. Under the Constitution, the Parliament has legislative powers. The bi-cameral Parliament consists of the National Council and the National Assembly (Royal Government of Bhutan (RGoB), 2008). The judiciary is separated from the executive and legislative branches of the government.

Bhutan initiated its modernisation with the introduction of the first five-year developmental plan in the early 1960s. Development activities focused mainly on establishing infrastructure including roads, schools and health facilities. Even with rapid socio-economic development, the country has, for the most part, maintained its pristine environment intact (NEC, 2008). The Government of Bhutan regards the protection of the environment as a priority. The Constitution of the Kingdom of Bhutan, Article 5 has a specific section on the environment:

> *Every Bhutanese is a trustee of the Kingdom's natural resources and environment for the benefit of the present and future generations and it is the fundamental duty of every citizen to contribute to the protection of the natural environment, conservation of the rich biodiversity of Bhutan and prevention of all forms of ecological degradation including noise, visual and physical pollution through the adoption and support of environment friendly practices and policies.*

(RGoB, 2008, p.11)

3.1. REGULATION OF WASTE IN BHUTAN

The Environmental Codes of Practice (ECOP) for Hazardous Waste Management, the policy document specific to hazardous waste, has used the text from the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal to define the term hazardous as “any substance that cause harm to human health and to the environment, unless adequately handled, stored, treated, transported, and disposed of” (NEC, 2002, p.2). The Convention established that any substance that is toxic, explosive, corrosive, flammable, or infectious is considered to be hazardous and requires environmentally sound management to prevent harm and protect human health and the environment.

The Basel Convention for Trans-boundary Movements of Hazardous Waste and Their Disposal regulates and ensures proper management and safe disposal of hazardous waste in an environmentally safe manner. According to the inventory of hazardous wastes (infectious waste and sharps included) study conducted in 2008 in Bhutan, hospitals in Bhutan annually generated about 310.84 tonnes of hazardous waste (Yangzom, 2008). The Census Commission of Bhutan has predicted that the total population of the country will be 887,000 by 2030, an increase of 40% (Census Commission, 2005) and with the country’s developmental processes and increasing number of hospitals, the amount of hazardous waste from health facilities and other areas will increase.

The only healthcare waste (HCW) audit to date was carried out by the RAA at the National Referral Hospital (NRH) and Phuntsholing Hospital between December 2007 and February 2008. A summary of these findings are provided in Table 5.7 of Chapter 5. The RAA is responsible for checking the accounts of government offices, including the legislature and judiciary, public funds, and the police and defence forces (RGoB, 2008). It also conducts audits on standards and practices to promote economic, efficiency and effectiveness.

The NEC is the designated overall regulatory authority on issues related to the environment and the management of waste. The Commission has been stringent in executing its role related to approval of new project proposals after assessing environmental impacts; however, the Ministry of Health is responsible for the actual implementation of safe healthcare waste management (HCWM) practices in all health facilities in Bhutan.

Policies for the regulation of waste, to be described fully in Chapter 5, are developed in a centralised bureaucratic system. The number of civil servants involved in the management of waste is small, and expertise in the area of healthcare waste in Bhutan is limited. Due to a small bureaucratic elite, a nascent civil society and a developing party and parliamentary system, scrutiny of policy performance and demand for policy reforms is limited.

Not withstanding the introduction of democracy in Bhutan, the policy making process is the preserve of a small elite group of civil servants in a centralised bureaucratic system. Elite theory maintains that because of the unequal distribution of wealth, talent and intellect in a society, a ruling minority exercises power. According to Crinson (2009) elites attain power or position based on their high social status as well as knowledge and expertise. Elite players are considered to have the ability to decide policy because of their knowledge and skills, status, talents and closeness to policy making process. At this stage of Bhutan's development public policy making conforms to an elite model and there is limited influence from the public as less than 60% of the population is literate. A survey conducted by the National Statistics Bureau (2007), estimated an overall literacy rate of 56% in Bhutan. Thimphu, the capital city had the highest literacy rate of 72% and Gasa the least with 40%.

The Royal Society for Protection of Nature (RSPN), a non-profit environmental organisation in Bhutan established in 1986, is the only non-governmental organisation working on environment conservation, sustainable development and management of municipal waste. The organisation does not have a direct role in the management of HCW therefore, has a limited policy role. However, wastes from health facilities also contribute to the total volume of municipal waste. Since hospital infectious waste is a category of HCW and the unsafe management of this category of HCW has the potential of harmful effects on the environment, the RSPN could have an influence in the policy process from that perspective.

International agencies that could have an influence in the policy process as well as in the implementation of HCWM include WHO and DANIDA. In view of limited national expertise in managing waste, these agencies could bring in consultants as technical advisors and give their inputs and support in capacity building and giving of financial aid.

The mass media is beginning to play a role in bringing about policy reforms by highlighting the issues associated with waste through print media and television programs. Since 2008, the print medium, *Kuensel* (the national English-language newspaper) has started to publish articles related to healthcare waste. For example, Dema (2009), a *Kuensel* journalist, in an article titled “Medical waste - a minefield of infection” commented on the foul odour from the NRH waste disposal pit, highlighting its location being next to the main motor road. The issue of healthcare waste not being audited either by the Ministry of Health or by any other agencies prior to the waste audit conducted by the RAA in 2008, was also raised by Dema. Norbu (2010) another *Kuensel* journalist, revealed that the NRH, despite having moved to a new complex, was using the previous waste disposal systems as the hospital authorities were unable to develop a new waste disposal site due to lack of land.

3.2. WASTE MANAGEMENT IN BHUTAN

Although this study is concerned with the management of hospital infectious waste, it is important to find out how and when the management of municipal waste started in Bhutan and its status. Since waste from healthcare facilities also contributes to the total volume of municipal waste, the management of municipal waste is part of the wider context of this study.

3.2.1. Status of Municipal Waste Management

According to a conference presentation in 2006 by Rinchen, (the Deputy Minister responsible for NEC) and Chhetri (an officer working closely on municipal waste in the office of City Corporation in Thimphu), there was no waste management system in Bhutan prior to the early 1990s. In 1994, a small unit known as the City Corporation was established in Thimphu. Rinchen and Chhetri (2006) reported that all collection and disposal of waste in Bhutan is performed manually. Segregation and collection of waste at the source is poorly handled and illegal dumping into drains, roadsides and open areas occurs because of inadequate facilities, lack of adequate human resources and funding, littering habits and poor civic sense within the community. Gurung (2010) an English language reporter for the *Bhutan Observer* (another local newspaper) reported that, according to a senior environmental officer of the City Corporation, only 40-50% of urban waste from Thimphu is deposited at the Memelakha landfill, the only landfill site for the city; the remaining waste is thrown into rivers or drains.

Penjor's (2007) master's thesis on *Enhancing Municipal Solid Waste Management System with 3R (*reduce, recycle and reuse) *Options* found the conventional system of collection, transportation and disposal of municipal solid waste (MWS) initiated in the 1990s, was continuing without much change or improvement, and highlighted the absence of proper waste management systems in most urban areas of Bhutan.

Rinchen and Chhetri (2006) reported that although local municipal corporations are responsible for the collection, transportation and disposal of waste, including waste from hospitals, municipal corporations have not yet been established in all districts of Bhutan. Therefore, there is no organisation responsible for managing the waste in these places. Penjor (2007) points out that even in districts where municipal corporations have been established, staff were unable to implement the services properly due to their limited authority, lack of funds, inadequate human resources and limited technical choices to manage the waste.

In a conference presentation, Tashi and Penjor (2006), officers from NEC and City Corporation respectively, reported on Bhutan's failure in implementing the concept of 3Rs of waste management. They argued that this was due to a lack of both recycling facilities and a local market for recyclable waste. There was also a lack of private firms interested in taking up waste management as they did not consider this business to be profitable. However, there are limited sales to dealers in India of recyclable waste items, such as, glass, plastic bottles, metal and beer cans by informal waste dealers and municipal waste handlers (who also scavenge). According to Visvanathan and Glawe (2006) Bhutan sends about 20% of collected waste to India for recycling.

According to the Housing and Population Census, 69% of Bhutan's total population resided in rural areas in 2005 (Census Commission, 2005). The Commission estimates that the urban population will increase by 21% annually due to rural-urban migration, causing increasing pressure on the urban and peri-urban environment (United Nations Environment Program (UNEP), 2001). The impact of rural-urban migration resulting in the concentration of population into limited urban areas, increased pressure on inadequate existing urban infrastructure planning, housing, sanitation and water supply was highlighted by Global Environment Outlook (GEO) in 2000 and can be seen occurring in major urban areas of Bhutan. Moreover, the lack of areas for landfill sites and inadequate financial support, make the management of waste a pressing issue (Baud & Schnek, 1994; Seng, 1993). In addition, problems are often compounded by a lack of technical expertise in waste disposal.

In 2004, the National Environment Commission submitted a report to the National Assembly highlighting the urgent need to develop urban environment management plans, taking into account air pollution, water sources and waste management systems. During the observation of World Environmental Day in 2005, for the first time, urban solid waste management was identified and publicly discussed as an emerging problem in Bhutan. In 2005, in order to improve urban environmental conditions and to develop a policy framework in the country, RSPN initiated the project, Public-Private Partnership for the Urban Environment, with financial support from United Nations Development Program. The project revealed limited policy and weak enforcement of the existing rules and legislation on waste management to have contributed in the poor standard of management of waste. Furthermore, due to rapid socio-economic development in Bhutan, changes in consumer practices from the use of reusable items to non-biodegradable plastic packaging had contributed to the increase in waste production. The habit of people discarding waste anywhere, together with the increasing amount of urban waste, have further compounded the problems of waste and its management (RSPN, 2006). Although the quantity of waste from institutions (schools and hospitals) industries and agriculture is not as large as domestic waste, it not only adds to the total volume of the waste but also increases potential health risks to people handling the waste, as well as to the community and the environment.

The RSPN report raised concerns about the increasing volume of waste disposed of at the landfill attributed to poor segregation of waste at the source and lack of reuse or recycling facilities. It also specifically identified the issue of little attention to the types of waste reaching the landfill (RSPN, 2006). This was despite the existence of Environmental Codes of Best Practice (ECOP) for Hazardous Waste Management to guide practice. This could be interpreted as non-compliance with the Code with regards to managing hazardous waste, which also includes infectious waste and sharps from hospitals.

The landfill site designated at Memelakha was opened in 1992 and is still being used despite having reached its maximum capacity. To identify a suitable new landfill site is a problem for City Corporation officials due to limited flat land because of country’s topography and the risk of leakage of toxic substances from landfill sites into rivers and streams (Rinchen & Chhetri, 2006; RSPN, 2006). Dorji (2009) a journalist from the *Kuensel* reported an outbreak of fire at the landfill which took almost a year to burn out as fire fighting efforts had failed to extinguish it. The cause of the fire was reported to be highly inflammable gas produced in the process of decomposition of biodegradable waste. Despite the strong political commitment to preserve the environment and to minimise pollution and its impact on human health and the environment, it appears there are shortfalls at local and institutional levels of management of waste.

Following the enactment of the National Environmental Protection Bill of Bhutan in 2007, the Parliament passed a resolution to maintain 60% of the land under forest cover for all time. In the same year, the Ministry of Works and Human Settlement Thimphu Municipal Solid Waste Management Rules and Regulations (TMSWMR & R) were promulgated in the Kingdom. According to the TMSWMR & R, anyone caught littering or dumping waste in unidentified public places would be fined a sum of Ngultrum (Nu.) 500 (US $ 1 = Nu. 43.6) for dumping large quantities of domestic waste and Nu.5000 for industrial or commercial waste in undesignated areas (average daily wage in Bhutan is Nu.165). This includes government institutions. Therefore, if healthcare waste is found to be disposed of in undesignated areas and its origin established, the hospital administration from where it came can be fined.

The National Environment Commission’s main role is to set policies and liaise with various ministries, departments and agencies in the implementation of principles as outlined in the National Environmental Protection Act (NEPA) of Bhutan (NEC, 2007). According to the NEPA this can be achieved by protecting and promoting a healthy and a safe environment through prevention, control and reducing harm and pollution by setting standards for emission of pollutants, developing procedures for handling and disposal of hazardous wastes, as well as endorsing environmentally friendly and energy efficient technologies (NEC, 2007). It is important to recognise that health facilities that generate hazardous waste, must also comply with the principles as stipulated in the NEPA of Bhutan.

In August 2008, the first national solid waste management conference was held in Thimphu. This provided the opportunity to share knowledge, experience, challenges and solutions relating to waste management. Officers of the Ministry of Health participated in the conference and made a presentation on healthcare waste; extracts from the guidelines for infection control and healthcare waste were presented. The Ministry of Works and Human Settlement (MoWHS) expressed concerns that although it had the mandate to formulate national strategy and an action plan for integrated solid waste management (ISWM) in view of the emerging waste problem and without the full support and cooperation from other agencies, ministries, and organizations, it was difficult to tackle the problem of waste effectively (MoWHS, 2007).

A nationwide survey was conducted from November 2007 to January 2008 to obtain baseline information on solid waste in the country by the Department of Urban Development and Engineering Services. According to the survey findings, the largest proportion of municipal solid waste (MSW) consisted of domestic waste, followed by commercial waste (from general shops, restaurants, grocery stores and bars) and waste from offices, open markets and schools (Phuntsho, Yangden & Heart, 2008**)**. It is of concern that although health facilities also generate both infectious and non-infectious waste and contribute to the overall quantum of municipal solid waste, hospitals were not included in the survey. Other than this survey, there have been few studies on municipal waste conducted in the country and none have included healthcare wastes.

3.2.2. Risks of Poor Management of Municipal Waste

Improper municipal waste management has an impact on land, air and water (surface and ground water sources) quality. Solid wastes block drains, cause stagnation of water, provide breeding place for pests, rodents and other vectors, and cause floods during the rainy season. The use of polluted water by humans exposes them to diseases and risks of infection (Hoornweg & Thomas, 1999). According to Tchobanoglous, Theisen and Vigil (1993) 22 human diseases may be linked to the poor management of municipal waste. The outbreak of Severe Acute Respiratory Syndrome (SARS) in East Asia and plague in Algeria, were both associated with poorly managed urban waste (Paimela-Wheler, 2004). There is risk to public health from poorly managed municipal waste. Visvanathan and Trankler (2003) emphasise the importance of incorporating municipal waste management in overall urban environment and infrastructure planning. Hoornweg and Thomas (1999) highlight that it is not only improper urban waste management that is of concern, but also inadequate systems to manage wastewater and sewage, and increasing amounts of hazardous and toxic wastes generated by hospitals and industries.

The World Health Organization (2000) regularly reports that problems such as contaminated water, poor sanitation and vector borne diseases are all associated with poor environment and contribute to 25% of all preventable diseases in the world. Health problems associated with poor environmental conditions exist in Bhutan and account for the highest morbidity of patient case management in the country. According to the Ministry of Health (2009a), diarrhoeal disease is one of the top five morbidities in Bhutan.

3.3. THE HEALTH SYSTEM

The healthcare system in Bhutan is operated entirely by the Government and services are provided free. The Medical and Health Council, established in 2003, is the sole regulatory body and deals with all health professions in the country. There are no private hospitals or private practitioners. All healthcare facilities in Bhutan are under the authority of the Ministry of Health.

As stipulated in the Waste Prevention and Management Act of Bhutan (NEC, 2009) the Ministry of Health is responsible for ensuring a safe work environment for people managing infectious waste by imparting appropriate knowledge, instituting safety measures, and providing support and facilities to prevent occupational related health risks. Any health policy reforms or interventions, establishment of infrastructure, human resources management, training, recruitment and allocation of health professionals is managed at the central level with inputs from the districts. Health issues are discussed and debated during an annual health conference, attended mainly by medical officers and health supervisory officers from the districts, heads of institutions (NRH, the Royal Institute of Health Sciences (RIHS) and the National Institute of Traditional Medicine (NITM) and program personnel from the Ministry of Health. Relevant stakeholders from other ministries or agencies are also invited as and when required, depending on the issue under discussion at the conference.

There are 31 hospitals (including one national, two regional referral hospitals and one National Traditional Medicine Hospital (NTMH) in the country (Ministry of Health, 2009a). Table 3.1 shows the number and types of health facilities in Bhutan.

Table 3.1 Type and total number of health facilities in Bhutan (2009)

Health facilities	Total number
Hospitals	30
NTMH	1
Traditional medicine units	21*
Basic health units (BHUs)	178
Outreach clinics (ORCs)	519

(Source: Ministry of Health, 2009a and 2006*)

Healthcare is delivered through a four-tiered system consisting of the national referral hospital at the apex, followed by regional referral hospitals, district hospitals and basic health units (BHUs). The NRH in Thimphu is the biggest and also the only teaching hospital in Bhutan for nurses and other allied health students. The two regional referral hospitals are located in Mongar in the eastern region and Gelephu in the southern region.

Basic health units do not have in-patient facilities. Their purpose is to provide primary health care. District hospitals provide preventive, curative, promotive and emergency services and serve as the first level of referral. The regional referral hospitals provide a wider range of healthcare and serve as the second level referral to the third level of care, the NRH where there are more diagnostic facilities and specialist doctors. As of 2008, there were 1,814 health professionals working in Bhutan: 157 are doctors (general and specialists) and 559 nurses (all categories) (Ministry of Health, 2008).

The NTMH is located in Thimphu and provides various therapies which include acupressure, herbal and steam bath, nasal irrigation and massage with medicated oils. It also provides traditional indigenous medicine found to be effective for chronic diseases such as arthritis, asthma, rheumatism, liver problems and diseases related to digestive system (Wangchuk, 2005).Currently the hospital provides only day care health services as it does not have in-patient facilities.

Since the adoption of the primary healthcare (PHC) approach in 1979, the health status of the Bhutanese people has improved. Life expectancy has increased from 37 years in 1960 to 66 years in 1994. In 1960, the infant mortality rate (IMR) was 203 per 1000 live births, one of the highest in the Asia and in the world (Planning Commission, 2002). This had declined to 40.1 in 2007. Child immunisation coverage is maintained above 90% (Ministry of Health, 2010). Although the general health status of the Bhutanese people has improved (as shown in Table 3.2) many challenges remain. Due to a shift in disease patterns, curative services have become as important as the preventive services. Diseases, including respiratory infections, skin diseases and diarrhoea still top the list of morbidity in the country. The Ministry of Health is faced not only with challenges to combat communicable diseases, but also with the advent of the human immunodeficiency virus (HIV) and increasing incidences of HBV, HCV and non-communicable diseases including cardiovascular diseases, diabetes, cancer and liver cirrhosis.

The Ministry of Health has established various programs to combat both communicable and non-communicable diseases in the population. Infectious diseases, including hepatitis, acquired immunodeficiency syndrome (AIDS), meningitis, cholera, gastro-enteritis infections, measles, rabies, skin infections and tuberculosis are prevalent in the country. Therefore, it is vital that healthcare waste, especially the infectious waste generated in the process of treating patients with infectious diseases, is managed appropriately to prevent transmission of diseases.

Table 3. 2 Selected health indicators and demographic statistics for Bhutan

Indicators	1984	2005#	2007	2010*
Infant mortality rate (per 1000 live births)	102.8	-	40.1	-
Under 5 mortality rate (per 1000 live births)	162.0	-	61.5	-
Maternal mortality ratio (per 10,000 live birth)	77.0	-	25.5	-
Population density (person per square kilometer)	-	16	-	18.1
School enrolment	-	141,388	-	170,384
Child dependency ratio	-	53.1	-	47.4
Old age dependency ratio	-	7.5	-	7.4
Gross domestic product real growth (%)	-	***7.5***	-	6.7

(Source : National Statistics Bureau, Bhutan 2011* and 2005# ; Ministry of Health, 2009a)

Since the detection of the first case of HIV in 1993, the number of people infected with HIV has risen steadily over the years. As of July 2010, Bhutan had 217 people, 110 males and 107 females infected with the virus, including 18 children under 15 years age (National AIDS Control Program, 2010). Some 43 HIV infected patients have died as of July 2010. As reported by the program, the infected population includes people from all walks of life including government, international and corporate employees, housewives, businessmen, farmers, uniformed personnel, religious groups (monks), commercial sex workers, prisoners and labourers. The official data on the number of infected people does not specify a single instance of a health professional acquiring HIV infection, although it is possible that such cases may have been counted under the government employee category. According to the National AIDS Control Program (2010) 91.0% of infections are attributed to unsafe sexual practices (such as multiple partners, casual sex and low condom usage) and almost 1.0% attributed to non-prescribed intravenous drug use. In view of the prevalence of illicit drug use, especially in the urban areas, it is important that needles and syringes from hospitals are disposed of properly to prevent their reuse and the associated risks of transmission of blood-borne viral infections (HIV and Hepatitis).

In 1995, the Ministry of Health in Bhutan, conducted a study on the prevalence of hepatitis B. The study showed prevalence of hepatitis B serum antigen (HBsAg) in almost 6.0% of the general population that was surveyed, mostly affecting pregnant woman and children. The study identified vertical (mother to child) infection as the main route of transmission of the disease but did not discuss other possible modes of transmission. To reduce the incidence of hepatitis B infections, in 1997 the Ministry of Health introduced hepatitis B vaccination as part of the overall immunisation program in the country.

According to the Public Health Laboratory Report (2010), blood tests from voluntary blood donors, outpatients, in-patients and ad hoc surveillance showed an increasing prevalence of HBsAg positive from 3.4% in 2008 to 4.7% in 2009. The evidence of an increasing trend of blood borne infections in the population and the presence of non-prescribed intravenous drug users further reaffirms the importance of the effective management of infectious waste and sharps.

3.4. NATIONAL POLICY ON HEALTHCARE WASTE MANAGEMENT

Following the enactment of the Environmental Assessment Bill in July 2000, the NEC developed a set of guidelines with technical support and funding from DANIDA and the Asian Development Bank. The handling of waste is addressed in the Environmental Code of Practice (ECOP) for Solid Waste Management in Urban Areas and the Environmental Code of Practice (ECOP) for Hazardous Waste Management. Areas related to healthcare waste from these documents are discussed in Chapter 5.

The NEC is responsible for the overall coordination and implementation of the Act and has the authority to:

- establish guidelines and standards for the segregation of waste at the source and for its disposal;
- collect reports from respective implementing agencies (eg. Ministry of Health, Ministry of Agriculture, Ministry of Education and City Corporation) on waste production (amount), 3Rs (reduction, reuse and recycle) and disposal;
- prepare reports on the status of waste management in the country and provide advice to the Government and the Parliament; and
- monitor compliance by the respective agencies in accordance with the Waste Prevention and Management Act of Bhutan (NEC, 2009).

The Waste Prevention and Management Act of Bhutan (NEC, 2009) is not specific to healthcare waste but rather encompasses all categories of waste. In the Act, waste from health facilities is termed ‘medical waste’. Prior to the enactment of this Bill, there was no legislation on healthcare waste in the country. Various agencies and organisations have developed policy guidelines and rules related to waste in general. The Ministry of Health with technical support from WHO developed the Guideline for Infection Control (IC) and Healthcare Waste Management (HCWM) in Health Facilities in Bhutan in 2006. The principles of management of HCW from the guidelines are listed in Table 3.3.

Table 3.3 The principles of healthcare waste management as outlined in the Guideline for Infection Control and Healthcare Waste Management in Health Facilities (2006)

- The purchase policy which will minimise waste generation
- The 3Rs (reduce, reuse and recycle) concept
- The segregation of waste at the source
- The establishment and promotion of safe and sound handling, collection, storage (secure, accessibility to only authorized personnel), transportation (in approved packaging) system
- The use of the shortest route to dispose waste to minimise cross infection
- The minimisation of harmful exposure to people handling the waste and to the environment by establishing appropriate waste treatment facilities and disposal techniques both within and outside facilities

(Source: Ministry of Health, 2006a)

In the effort to improve HCWM the Ministry of Health has established infection control and healthcare waste management committees and also conducted a preliminary assessment of HCW in 2002 with consultants from DANIDA.

3.5. INFECTION CONTROL AND HEALTHCARE WASTE MANAGEMENT COMMITTEES

Two committees have been established in Bhutan, one at the policy-making level known as the HCWM Committee and the other, the Technical Committee for HCWM at the implementation level. The HCWM Committee comprises seven members: five from the Ministry of Health and one each from NEC and the City Corporation. The list of committee members is provided in Table 5.2 of Chapter 5. This committee is responsible for policy development related to HCW, review and endorsement of the HCWM plan and strategies submitted by the technical committee as well as approving the budget and facilitating implementation of the guidelines.

The Technical Committee for IC and HCWM consists of 12 people (a list is provided in Table 5.3 of Chapter 5) mostly the clinical departmental heads from the NRH, nursing managers, one each from NEC and the City Corporation, and relevant program personnel from the Ministry of Health. The technical committee not only plays an advisory role but also supports the HCWM Committee. They are also responsible for the revision of HCWM guidelines, development of standards, monitoring and supervision, conducting HCWM training programs, facilitating the implementation of IC and HCWM guidelines, and conducting waste audits.

3.6. DANIDA’S REPORT ON HEALTHCARE WASTE MANAGEMENT

In 2003, a preliminary assessment of HCWM was conducted by a DANIDA team in selected health facilities in Bhutan. The team reported that most health professionals were aware of good infection control practices and waste disposal but commented that, although basic waste segregation was carried out, treatment and disposal options were either limited or inadequate. The team expressed concerns about poorly managed incinerators with regard to use of incorrect temperature and emission control measures causing air pollution and its impact on the environment and people dwelling nearby. Concerns were also expressed about the dumping of infectious waste in open burial pits which posed a threat to the public (DANIDA, 2004).

The DANIDA team observed that, except for the NRH, most health facilities did not have a regulated disposal site. Concerns were also raised with regard to the poor management of sharps (DANIDA, 2004). Mehta (2005) stated that due to delays in the burning of waste in open pits, sharps remained exposed to the public. She also reported instances of municipal waste handlers finding sharps in municipal waste, indicating a failure in the segregation of waste.

There are no national data on the amount of waste generated by health facilities. To estimate the total volume of infectious waste and sharps generated is difficult due to poor segregation of healthcare waste. Therefore, DANIDA developed an estimated figure of 0.25 kilogram (kg) /patient day and 0.02kg /patient day for infectious waste and sharps respectively for hospitals. Based on these figures, it was estimated that hospitals annually generated 54,473 tons of infectious wastes and sharps as shown in Table 3.4 (Ministry of

Health, 2004a). From Table 3.4 it is evident that among the hospitals, the NRH in Thimphu is the principal generator of both infectious waste and sharps followed by the Regional Referral Hospital in Mongar.

Table 3. 4 DANIDA Report (2004) on the estimated amount of infectious waste & sharps generated from hospitals in Bhutan

Hospitals	Number of beds	Infectious waste (kg/year)	Sharps (kg/year)
Thimphu	242	17,311	1,385
Mongar	80	5,193	415
Trashigang	115	4,297	344
Samdrup Jongkhar	85	4,257	341
Samtse	79	3,068	245
Chhukha	57	2,750	220
Sarpang	52	2,552	204
Zhemgang	48	1,849	148
Paro	40	1,676	134
Pemagatshel	30	1,145	92
Punakha	29	1,421	114
Haa	20	913	73
Tashi Yangtse	23	830	66
Lhuntse	20	768	61
Tsirang	20	624	50
Bumthang	29	605	48
Trongsa	18	603	48
Wangdue Phodrang	48	577	46
Dagana*	0	N/A	N/A
Gasa*	0	N/A	N/A
Total	**1035**	**50,439**	**4,034**

(Source : Ministry of Health, Bhutan, 2004a)

(*Dagana and Gasa do not have district hospitals, therefore no data were collected on infectious waste and sharps. "N/A" – not applicable).

3.7. A HEALTHCARE WASTE MANAGEMENT PLAN FOR BHUTAN

Following the preliminary HCWM assessment by DANIDA, and with its assistance the Ministry of Health developed a draft HCWM Plan for Bhutan in 2004. The following activities were proposed:

- advocacy on waste reduction;
- development of HCWM guidelines;
- conducting HCWM training programs;
- integration of management of HCW within the overall healthcare activities;
- establishing a nationwide collecting system, liaise between other sectors and ministries on safe collection and disposal system of hazardous waste (including infectious wastes and sharps); and
- procurement of materials that have minimal impact on environment pollution (Ministry of Health, 2004a).

The draft HCWM Plan recommended autoclaving of infectious waste prior to its disposal in municipal landfill and the use of Nulife Dots devices to destroy needles and syringes to minimise related occupational risks from sharps (needle-stick injury and transmission of infection). The plan stipulated deep pit disposal of infectious waste and sharps in hospitals in districts which did not have municipal landfills. The plan also proposed four treatment centres for HCW, starting with the NRH. As an interim measure until the four treatment centres were established, the team recommended the use of simple drum incinerators (Ministry of Health, 2004a). However, Mehta (2005) advised against this recommendation in view of the emission of toxic pollutants found even in relatively sophisticated incinerators which did not meet the recommended parameters or standards. Instead, she recommended autoclaving infectious waste.

3.8. GUIDELINES

In view of the threat posed by the HIV/AIDS pandemic, the Ministry of Health in Bhutan initiated an infection control program under the National Sexually Transmitted Disease (STD) and AIDS Program in 1994. In 1996, guidelines for infection control were developed for health facilities and revised for the third time in 2006 in response to increasing rates of HIV and hepatitis infections, re-emerging tuberculosis and the threat of Severe Acute Respiratory Syndrome (SARS). As recommended by the HCWM committee and with the help of Mehta, the topic of HCWM was incorporated in the third edition of the renamed *Guideline for IC and HCWM* for *Health Facilities.* The guidelines provide standards to ensure proper management of HCW and a basis for training health professionals in Bhutan (Ministry of Health, 2006a).

3.8.1. Implementation of Healthcare Waste Management

For the proper management of hazardous waste (which includes infectious wastes and sharps), the NEC (2002) recommended adequate treatment facilities in Bhutan despite its smaller volume compared with domestic waste. To this effect, the Ministry of Health developed several strategies not only specific to hospital infectious waste but to promote safe management of HCW as a whole. The strategies are as listed in Table 3.5.

Table 3.5 The Ministry of Health's strategies to improve the healthcare waste management system in Bhutan

- Establish an infection control committee to review, assess and to implement a sound waste management system in all healthcare facilities;
- identify a person responsible for management of waste in every health facility;
- provide training (pre-service at RIHS and appropriate in-service) to staff;
- guideline up-dated regularly to address waste management;
- incorporate HCWM system into Five-Year Plans;
- create awareness on HCW amongst the public through media; and
- establish an emergency response program.

(Source : Ministry of Health, Bhutan, 2006a)

The Ministry stated that the changes in HCWM practices would take place over a period of time, depending upon the availability of resources, facilities, training and education of staff (Ministry of Health, 2006a).

3.8.2. Colour Coding and Type of Waste Receptacles and Waste Disposal Options

The recommended colour-coding of waste receptacles, type and disposal options for HCW as set out in the guidelines developed by the Ministry of Health are reproduced verbatim in Table 3.6.

Table 3.6 Recommended uniform colour-coding type of receptacles and disposal options for healthcare waste as in the Guideline for Infection Control and Healthcare Waste Management in Health Facilities published in 2006

Colour coding	Type of container	Waste type	Treatment Options
Red *(Infectious waste)*	Plastic bag / bucket marked waste type	Human anatomical waste, animal waste, microbial & biotechnological waste	Incineration / deep pit burial
Red *(Infectious Waste)*	Plastic bag / bucket	Microbial & biotechnological waste, solid wastes e.g. blood soaked swabs, plastic cannula, dressing etc.	Autoclaving / chemical treatment / land filling
Yellow / White *(Sharps)*	Safety box/ Puncture proof bag	Waste sharps, tubing, catheters, IV sets etc.	Autoclaving / shredding / burial / landfill
Green *(Non-infectious)*	Plastic bag / bucket	Office waste, disposable clothes	Municipal landfill
Blue *(Food waste)*	Plastic bucket	Food waste	Vendors/ Municipal landfill

(Source: MoH, 2006a, p.69)

3.8.3. Segregation of Healthcare Waste

As shown in Table 3.6, the guidelines stipulate that all infectious waste is to be collected in a red bucket or plastic bags, and sharps in yellow or white puncture-proof bags or in safety boxes supplied by the Ministry. Food waste is to be collected in blue buckets and non-infectious wastes such as office waste in green buckets (MoH, 2006a).

3.8.4. Treatment and Disposal Techniques

According to the guidelines all solid infectious waste is to be autoclaved and disposed of into municipal bins and liquid infectious waste is to be disinfected with hypochlorite solution. Health facilities that do not have autoclaving equipment are to dispose of both infectious waste and sharps into deep burial pits (MoH, 2006a).

Deep burial pit

The guidelines stipulate the site of the pit should be away from human habitats (although a distance is not mentioned), 50 metres away from any water source, and that the pit should be least two metres deep in impermeable soil (the depth and size to depend upon the volume of waste generated from the facility). Each time waste is thrown into the pit it should be covered with a 10 centimetre layer of soil. To prevent access by animals and human scavengers, the pit shoud be covered with galvanized mesh and the area fenced (the height and the type of fence are not mentioned in the guideline) (MoH, 2006a).

3.9. SUMMARY

This chapter presented the context for the study by describing the key players with the potential to influence the policy process. A democratic system of governance has been established since 2008 and is in the process of development. Bureaucratic dominance of policy process still persists because of the limited elite policy circle and a weak civil society. Although the press has started to report issues related to HCWM, it is yet to develop to its full potential in bringing about policy reforms through live public debates and discussions.

Municipal waste is an emerging problem in Bhutan and its discussion at a national forum started only in 2005. There were several studies conducted on municipal waste but healthcare waste has never been included in any of these, despite hospitals contributing to the total volume of municipal waste. With the inadequate infrastructure and facilities to manage municipal waste, including poor management of hospital infectious waste and sharps, there are potential risks to public health and the environment.

Despite the strongly articulated political commitment to preserve the pristine environment and minimise pollution to ensure safety of human health, there are shortfalls at local and institutional levels in the management of waste including infectious waste. Prior to 2009, there was no legislation related to waste in Bhutan. The Waste Prevention and Management Act of Bhutan govern all categories of waste generated in the country. The following chapter sets out the study's methodology, conceptual framework and methods of data collection.

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CHAPTER 4

CONCEPTUAL FRAMEWORK AND METHODOLOGY

This chapter presents the conceptual framework for the study and describes the research methods, and processes used to collect and analyse data. The rationale for choosing a mixed-methods research design is explained. Sampling strategies and ethical considerations are discussed. The data collection tools, which included survey questionnaires, in-depth interviews, focus-group interviews, observations and document analysis, are described. The process of data analysis is also outlined.

4.1. RESEARCH AIM

As indicated in Chapter 1, the study was designed to investigate gaps in current policy and practice related to hospital infectious waste management in Bhutan in order to propose policy reforms and interventions to improve and strengthen the hospital infectious waste management system.

4.2. RESEARCH QUESTIONS

In order to meet the aim of the study, research questions were developed to explore the views of policy makers, to assess the knowledge and attitudes of health professionals and hospital cleaners, and to identify occupational health and safety issues and risks associated with current practices. The research questions were:

1. What are the gaps and weaknesses present in the policy and practices related to hospital infectious waste management?
2. What risks are identifiable in the current practice of hospital infectious waste management?
3. What are the perceptions of policy makers on hospital infectious waste management?
4. What are the attitudes, knowledge and practices of the hospital staff (doctors, nurses and hospital cleaners) on the management of hospital infectious waste?
5. What measures need to be taken in order to improve both and policy and practice related to hospital infectious waste management?

4.3. CONCEPTUAL FRAMEWORK

A conceptual framework enabled the researcher to identify policy and practice gaps in the management of hospital infectious waste in Bhutan. The theory and models from which the framework was developed are explained below.

4.3.1. Performance Improvement Analysis

Swanson (2007) believes that systems theory used in the field of biology can be adapted to examine many other areas. Systems theorists examine a system as a whole rather than looking at it part by part, as each component in a system affects others. This whole-of-system approach is particularly relevant in the infectious waste management since there are many players at different levels, each with specific responsibilities within a specific work environment. A failure or weakness in the execution of responsibilities by any of these players can affect the outcome of the entire system. Therefore, it is important to study the system within the environment in which each element interacts with others in order to bring about the desired outcome or to meet organisational goals.

Poor outcomes often result from a lack of proper system analysis and inadequate linkages between performance improvement programs and organisational goals, needs and processes (Swanson, 2007). Swanson emphasises that to bring about change, a system analysis is critical as it enables management and leaders to define and develop subsequent steps at the organisational and individual levels to achieve desired goals or standards. Swanson identifies five phases of performance improvement: *analysis, design, development, implementation and evaluation*. Analysis is an essential phase as it defines and frames the whole process of performance improvement requirements to achieve the desired organisational goals and standards. Swanson (2007) cautions that mistakes can be made in any of the phases and that errors made in later phases of performance improvement, for example at the evaluation phase, are considered to have less of an impact than mistakes made in the analysis phase. Mistakes made in the analysis phase but found later in the evaluation phase may become costly to rectify and any damage done may be difficult to undo. Therefore, successful implementation will depend on how well the original system analysis is done.

4.3.2. A Performance Improvement Model

Adelson, Hepburn and Vanloy (1997) developed a performance improvement model with the aim of bringing about lasting changes in practice behaviour through the development of knowledge and skills. The stages in the change of behaviour of this model are described below:

Awareness stage – involves creating awareness among staff of the need for improvement. Awareness can be created through media, publications or by attending continuing education programs and by interacting with colleagues. This stage is a passive phase as it does not entail change of behaviour.

Competence stage – at this stage people must have developed appropriate knowledge and skills, and also positive attitudes toward incorporating changes into practice.

Performance stage –involves introducing changes into practice and integration of the changes into the organisational environment.

Whilst these three stages are considered important to bring about changes, the model also requires consideration of mediating factors which are crucial to performance improvement or for the successful execution of changes within the system: *predisposing, enabling* and *reinforcing* factors. The *predisposing factors* involve acknowledging the existence of a problem, the need for a change, and assessing the importance, effectiveness, cost benefits and appropriateness of bringing about the change. Adelson et al. (1997) consider *enabling* and *reinforcing factors* to be crucial in attaining the performance stage as these factors deal with the work and the organisation within which the change takes place. The *enabling factors* concern social and technical systems. The social system includes communication and staff interaction, motivation and commitment. Adelson et al. (1997) regard the social systems within the organisation to be the most powerful predictor of productivity. Technical systems include the operational system and adequate allocation of resources such as manpower, equipment and supplies, all of which contribute to outcomes and productivity.

The *reinforcing factors* take into account policies and procedures within the organisational vision, mission and values. These factors also reinforce the desired processes and procedures through performance appraisals and recognition of desired behaviours as positive.

4.3.3. The Discrepancy Model

Moore (1998) defines educational need in continuing medical education (CME) as the difference between current performance and desired performance, while discrepancy is described as a gap between *what is* and *what should be*.

According to Dixon (1978) the success of the CME is based on the following five criteria:

- *participation* – the number of people who attend the CME program;
- *perception* - the satisfaction of participants with regard to the conduct of the CME program;
- *learning* – the degree of change in knowledge, skills and attitude of participants as a result of undergoing CME;
- *performance* – the actual practice of knowledge gained as a result of undergoing CME; and
- *outcomes* – the overall standard of practice attributed as a result of participating in CME.

Moore (1998) has used the discrepancy model, based on the five criteria developed by Dixon, to identify educational needs for successful implementation of continuing medical education. However, Davis, Thomson, Oxman and Haynes (1995) maintain that conducting CME once would not produce a sustainable result. Rather, the authors reiterate the need for multiple CME sessions focussing on a particular behaviour in order to effect change. This discrepancy model could be applied to develop an effective training module for people dealing with infectious healthcare waste management.

4.3.4. Performance Discrepancy Analysis

Swart and Coulson (2003) used another model, the performance discrepancy approach, to identify training needs for healthcare waste management in Gauteng, South Africa. They indicated that this model could be used to identify areas of performance where the outcomes are less than optimal. They described *capacity* as *performance* and areas of *poor-functioning* as *gaps*. According to them, the most common gaps identified with regard to training are knowledge, attitude and skill. The emphasis of this approach is on the need to identify or explore other areas of discrepancy contributing to poor performance or outcomes. Swart and Coulson (2003) argue that a lack of training is often considered as the main cause of poor management of healthcare waste (HCW), but in reality this may not be the situation as people involved in HCW management have to work in a system where their performance could be influenced by other gaps or deficiencies within the system.

Although Swart and Coulson (2003) considered deficiencies in knowledge, skill and attitude as the three major gaps related to training, they also identified other deficiencies such as, infrastructure, policy and procedures, organisational management and monitoring systems, all of which may contribute to an ineffective system for healthcare waste management (HCWM) if not taken into account while assessing the gaps to rectify the system. Each of these areas of potential deficiency is outlined below in relation to the management of infectious waste.

Knowledge

People involved in the management of waste from health facilities should have a basic knowledge of healthcare waste. This includes knowledge of types of HCW, the waste management process from segregation to disposal, and occupational health and safety issues (Swart & Coulson, 2003). Possessing knowledge not only creates awareness but is likely to facilitate in providing the required support and commitment for optimal performance.

Skill

According to Swart and Coulson (2003) putting knowledge into practice involves specialist skills. For example, in healthcare waste management (HCWM) segregating and putting wastes into appropriate receptacles, using appropriate personal protective equipment, the correct handling of equipment and the capacity to follow instructions correctly are specific skills (Swart & Coulson, 2003).

Attitude

Swart and Coulson (2003) state that with negative attitudes, even if one possesses the required knowledge and skills, practice standards can be adversely affected. For the effective management of healthcare waste, it is necessary for staff to have a positive attitude towards protecting the environment, work place safety, and maintaining practice standards, combined with an eagerness to learn and a commitment to improve the HCWM system (Swart & Coulson, 2003).

Infrastructure and technology

The availability of infrastructure, supplies, appropriateness of equipment, and maintenance facility and capability will have an impact on performance outcomes (Swart & Coulson, 2003). Maintenance is important for optimal function of the equipment and there has to be a back up service in the event of breakdown.

Policy and procedure

Regulations, policy guidelines and procedures on HCWM are important elements to support the HCWM system and implement correct waste management practices. These also help to make people accountable and responsible for the tasks assigned to them. Lack of or inadequate policy and procedures create gaps or weakness in the effective operation of the system (Swart & Coulson, 2003). Any weakness in these could hamper in achieving an effective HCWM system.

Organisational management and monitoring system

Swart and Coulson (2003) maintain that for the smooth functioning of a system within an organisation everyone should understand the organisational structure, channels of communication and lines of command. People involved in the management of HCW should know their own roles and responsibilities, and be accountable for their own work. To ensure proper functioning of a HCW system, supervision and monitoring tools must be in place. The system needs to be evaluated to assess efficiency and effectiveness and to make changes for improvement.

Swart and Coulson (2003) assert that whilst it is important that the staff involved in the management of infectious wastes are equipped with the appropriate knowledge, required skills and have appropriate attitudes, it is equally important that their performance is not hampered by other deficiencies within the system.

4.3.5. Policy Implementation

Najam (1995) discusses two main theoretical perspectives of policy implementation: a *top-down* approach which starts with the decision makers at the centre, setting policy objectives which follows down through the hierarchical administrative system to where procedures are followed to meet the set goals; and a *bottom-up* approach which begins with an analysis by people involved in the process of implementation of the policy, and working back to outcomes and impacts of the policy with regard to strategies taken on board by relevant people in response to the policy adopted. Gardner and

Barraclough (1992) argue that for effective implementation of policy there is often a need for a *bottom-up* rather than *top-down* approach as those who are affected by the policy are commonly the ones who know the problems and how best to find solutions. Najam (1995) reiterates that both approaches provide useful insights into the policy implementation process and have strengths as well as weaknesses.

Mazmanian and Sabatier (1989) define policy implementation as an execution of policy decisions, often commencing with a statute. The process involves a number of stages starting from the passage of the statute, followed by policy decisions or outputs, compliance of target groups or institutions with those decisions, and the impact of policy outputs leading to revision of the statute depending upon the outputs. The stages of policy implementation are considered as "dependent variables" as the success will depend upon various factors that Mazmanian and Sabatier (1989) identify as "independent variables", grouped under three broad categories:

Tractability of the problems – consists of technical difficulties, diversity of target group behaviour and the extent of behaviour change required. Applying this category to the management of HCW, there is no prescribed technology that is considered the best to treat and dispose of healthcare wastes. The choice of technology will depend upon country needs, the volume and category of waste and other local situations, including people with the expertise in the area to help make right choices. Mazmanian and Sabatier (1989) claim that when policies are being implemented, the greater the requirement for change of behaviours, the greater the challenge will be for successful implementation.

Ability of a statute to structure implementation –policy makers can significantly affect the attainment of policy outputs by laying down clear and precise objectives, rules and regulations to enforce the implementation process, developing standard operating procedures, and providing financial support (Mazmanian & Sabatier, 1989). Although the Waste Prevention and Management Act of Bhutan is in place, yet in the absence of rules and regulations, and poor standard operating procedures the implementation of safe infectious waste management cannot be enforced effectively.

Nonstatutory variables affecting implementation – include socioeconomic conditions, public support, attitudes and resources of constituency groups, and the commitment and leadership skills of implementing officials (Mazmanian & Sabatier, 1989). As we have seen in Chapter 3, Bhutan has a nascent civil society, which has a limited ability to influence or scrutinize policy implementation in what is a newly-established democratic system of governance.

The management of hospital infectious waste involves many players from policy makers to hospital cleaners, each with specific important roles and responsibilities. In order to strengthen the HCWM system in Bhutan, areas of deficiency or gaps at each level within the system must be explored. Several authors maintain that performance gaps may be associated with legislation and policy framework, leadership and commitment, monitoring and supervision, supplies, infrastructure, overall management issues, resources, training and communication (Swanson, 2007; Swart & Couslon, 2003; Moore, 1998; Adelson et al., 1997; Mazmanian & Sabatier, 1989). As any of these areas can be weak, considering only a single area or gap in a multifaceted system may lead to wrong or incorrect conclusions. The success of the system will depend on how effectively individuals and departments execute their roles and responsibilities at every level within an environment that should be supportive and enabling.

Based on the models discussed earlier, a conceptual framework was developed to guide this study (see Figure 4.1).

Although the Ministry of Health's vision, mission and priorities will influence the development of policies and related practices, the overall implementation of policies will depend to a considerable degree upon political commitment, economic conditions and cultural forces within the country. Practice can influence policy and vice versa. In order to examine gaps and weaknesses, the factors which are likely to influence the effective infectious management system, have been broadly categorised under three main headings: *national, institutional and individual levels*. Policy outputs can be reviewed and findings fed back into the policy making process for further improvement or changes. At a national level, issues related to regulatory frameworks, policy guidelines, and monitoring and evaluation systems were explored. At an institutional level, the study examined gaps in the actual practice of infectious waste management areas, support systems and occupational health and safety issues. At an individual level, knowledge and attitudes, commitment, communication and team work spirit, and views on infectious waste management were explored.

The rest of this chapter discusses methods used to the answer the research questions with regard to hospital infectious waste management in Bhutan.

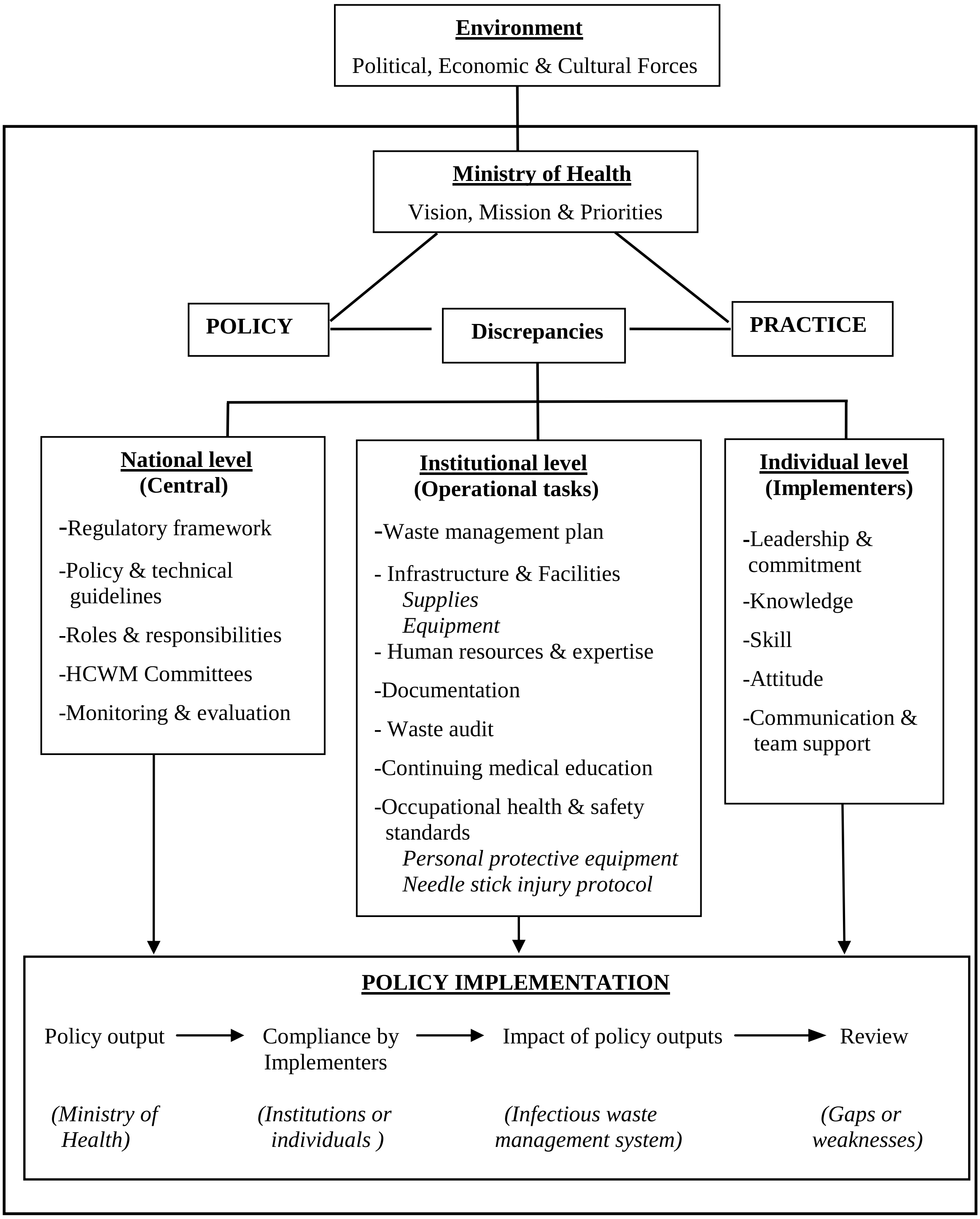


Figure 4. 1 The conceptual framework for the study

(Source : Adapted and developed from Swanson, 2007; Swart & Coulson, 2003; Adelson et al., 1997; Moore, 1998 and Mazmanian & Sabatier, 1989)

4.4. METHODS

A researcher has to find an approach that best helps in answering the research questions. The research questions elicited information from participants at different levels about the management of infectious hospital waste in Bhutan. In addition to conducting interviews with policy makers and focus group interviews with hospital cleaners, the research involved analysis of policy documents, a survey of doctors and nurses from selected hospitals and observation of infectious waste management practices at the National Referral Hospital (NRH).

A mixed-method design was employed to collect data concurrently using different techniques including: document analysis, in-depth interviews, focus group interviews, surveys and observations. The findings were integrated, compared and interpreted. Creswell, Plano Clark, Gutmann and Hanson, (2003 p.212) have defined mixed-methods as " the collection or analysis of both qualitative and quantitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of data at one of more stages in the process of research"

Creswell (2003) and Bryman (2006) maintain that the use of one method alone is inadequate to investigate the complexity of issues in social contexts. Thus, research methodology is changing to enable researchers to provide answers, considering the ever increasing complexity of research questions that are being asked.

In any research, the highest quality data are essential in the progression of knowledge. According to Axinn and Pearce (2006), mixed-method data collection approaches enable the combination of one method such as survey questionnaires with another method, such as interviews, in a sequence or a concurrent design. Mixed-method approaches enable researchers to acquire new insights because they provide avenues to use many sources of information to address the issue or to understand the phenomena under study (Bazeley, 2010; Whitehead & Elliott, 2007). However, Bryman (2007) maintains that the end product of mixed-methods research should be more than the sum of what individual qualitative or quantitative approaches provide. Therefore, a mixed-method study design has been used in this study with the aim of obtaining a comprehensive understanding of hospital infectious waste management status in Bhutan, which may not have been possible by using only a qualitative or quantitative study. All methods have strengths as well as weaknesses but many authors have stated that the use of more than one method may not only compensate for the weaknesses of a single method of research inquiry, but also strengthen research reliability, validity and the scope of the study (Creswell 2009; Creswell & Plano Clark, 2007; Schneider, Whitehead, Elliott, Lobiondo- Wood & Haber, 2007; Axinn & Pearce, 2006; Bryman, 2006).

Bryman (2007a) argues that the mere convergence of data from qualitative or quantitative methods does not necessarily ensure validity. Bazeley (2003) states that it is not the issue of whether qualitative or quantitative approaches have been applied, since data will eventually be either coded into numbers or into words; rather, what is important and useful is the difference in the statistical analysis of numerically coded data and the interpretive analysis of data coded as text. Therefore, it is important to select an appropriate research design that best answers research questions, and identify data collection methods and the units of analysis.

A mixed-method study can focus either on generating a representative sample when using quantitative mode of study or use a sampling method that produces rich information when using qualitative methods. As Teddlie and Yu (2008) point out, a combination of these two approaches enables the researcher to produce data complementary in both in depth and breadth on the topic under study. The present study has not been designed to test hypotheses or to establish cause and effect relationships, but rather to explore policy and practice weaknesses and gaps in order to advocate policy and practice to strengthen the infectious waste management system in Bhutan. Thus, the application of a mixed-method approach for this study is considered appropriate as the study design enables the use of different tools to collect data from different sample groups within an organisation involved in the management of infectious waste, and reach valid conclusions of the research problem under study.

4.4.1. Study Design

Creswell et al., (2003) and Morse (2003) suggest that in a concurrent triangulation design both qualitative and quantitative data are collected within the same time frame (also known as single-phase timing). The findings are usually analysed separately and are brought together at the end of the study to make comparisons and identify differences during the interpretation (Creswell & Plano Clark, 2007). As stated by several authors (Creswell & Plano Clark, 2007; Schneider et al., 2007; Patton, 2002) the ability to get different but complementary information on the particular issue from different perspectives by bringing together the strengths of quantitative method (larger sample size, generalisability and trends) with those of qualitative methods for example, in-depth interviews revealing perceptions, experiences and thinking of participants, provides a better understanding of the issue under study.

According to Patton (2002) and Denzin and Lincoln (2000) the term *triangulation* can be described as a *concept*, *strategy*, *technique* or *process*, and often presented as a useful technique for strengthening research rigor by combining multiple methods. Denzin (1989) outlines four types of triangulation: *data triangulation* - using range of data sources; *investigator triangulation* - using more than one researcher; *theory triangulation* – using multiple theories to interpret a single data set; and *methodology triangulation* – using several research methods to study an issue. As with any other study design, triangulated designs have potential problems as well as benefits. Creswell and Plano Clark (2007) comment that despite methodology triangulation being the most popular mixed-methods design, it is also perhaps the most challenging compared with other mixed-methods designs.

This study used Creswell and Plano Clark's (2007) *triangulation design*, incorporating a *multilevel model variant* to collect both qualitative and quantitative data from people at different levels (*policy makers, health professionals* and *hospital cleaners*) in the management of hospital infectious waste in Bhutan. The multilevel model is one of the variants of triangulation design described by Creswell and Plano Clark (2007).

The multilevel model enables the researcher to explore different levels within a group or an organisation to draw conclusions from the findings. Data from each level can be merged and interpreted. The *triangulation design* with a *multilevel model variant* was employed as the methodological framework for this study (see Figure 4.2). *Level 1* involved data collection from policy makers and examination of official documents, *Level 2* involved doctors and nurses from the 11 selected hospitals, *Level 3* involved the hospital cleaners from the NRH and *Level 4* involved observations at the NRH to examine actual practices of infectious waste management.

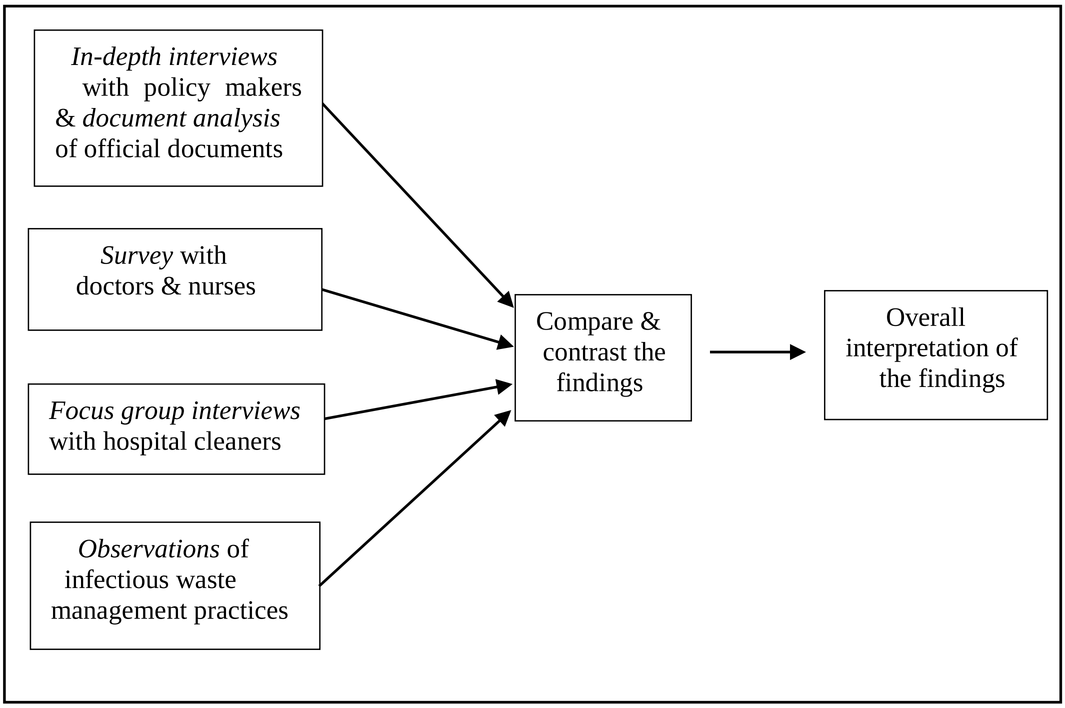


Figure 4. 2 Triangulation Design (Multilevel Model Variant): Study of hospital infectious waste management

(Source: Adapted from Creswell & Plano Clark, 2007,pp.63 & 64)

4.4.2. Sampling

Sampling is a process to enable the researcher to select participants representative of the population of interest (Gray, 2009; Minichiello, Sullivan, Greenwood & Axford, 2004)

Creswell, Plano Clark, and Garrett, (2008) affirm that the main intent in qualitative studies is to obtain in-depth information with regard to individual views, beliefs, experiences and feelings, and in the context in which they hold these views on the topic under investigation. By contrast, in quantitative studies the intent is to select a whole population or a representative subset of the general population that is being studied to identify effects that are generalisable to the whole population or situation (Minichiello et al., 2004; Kemper, Stringfield and Teddlie, 2003). Table 4.1 shows the study population and participation rate of different categories of study samples.

Table 4.1 Study population, categories and the size of the study samples

Category	Study * Population	Invited	Participated	Participation rate (%)
Policy makers	13	13	12	92.3
Doctors	157	69	64	92.8
Nurses	559	322	295	91.6
Hospital** cleaners	40	40	31	77.5
Total	**769**	**444**	**402**	**90.5**

*** Only from the National Referral Hospital*

(Source: * Ministry of Health, 2008)

Sampling bias occurs when units from the sampling population do not have an equal opportunity to be included in the study (Last, 2001) or when there is a difference between characteristics of participants selected for the study and the ones that are not (Beaglehole, Bonita & Kjellström, 2006; Last, 2001). This results in invalidating generalisations and conclusions which may otherwise be drawn from the study (Last, 2001).

In this study, a non-random sampling strategy by location was used. Each element of the sampling population for the survey in this study had an equal opportunity to be included in the study based on the eligibility criteria. As shown in Table 4.1 from the study population of 769, some 444 participants were eligible for the study, based on location.

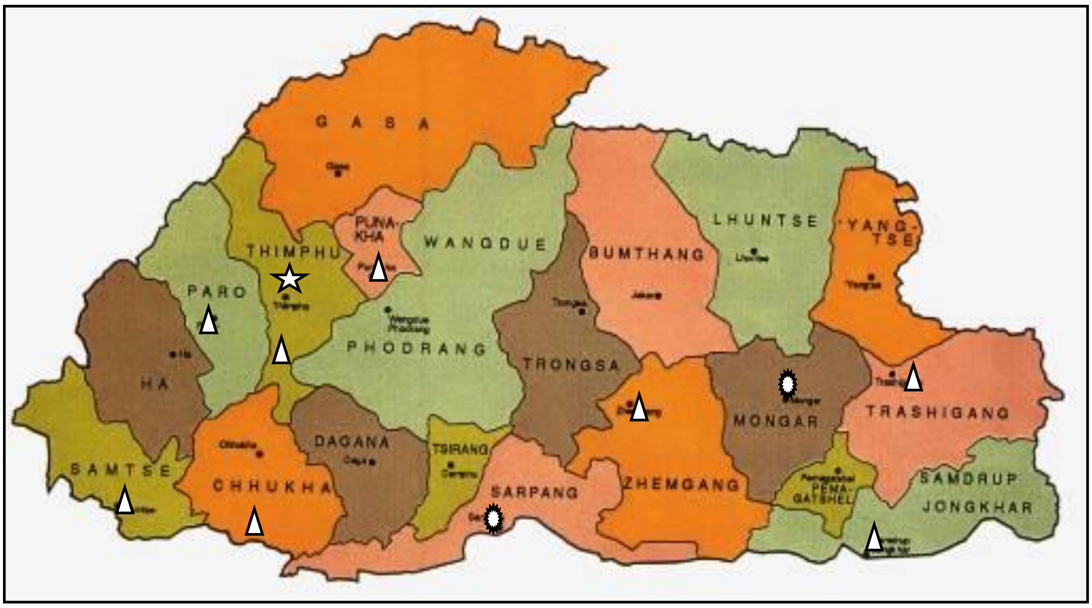
Confounding occurs when the effect of two variables cannot be separated; this has an influence on the outcome that may be concluded as an effect of one rather than both variables. To control confounding, various methods such as *randomisation*, *restriction* and *matching* can be used either in the study design or at the analysis of data stage including *stratification* and *statistical modelling* (Beaglehole et al., 2006). This study used statistical modelling during the analysis of survey data to control confounders and to estimate strength of the association between the variables.

Locations

As stated earlier in Chapter 3, there are 31 hospitals (one national and two regional referral hospitals, and one National Traditional Medicine Hospital (NTMH) located throughout the country (Ministry of Health, 2009a). The hospitals in the study were identified according to the maximum annual generation of infectious waste and sharps, obtained from the Danish International Development Agency (DANIDA, 2004) preliminary assessment of healthcare waste management report submitted to the Ministry of Health, in Bhutan. Even though the NTMH did not have in-patient services it produced a small amount of infectious waste and sharps. The NTMH, was not mentioned in the report submitted by DANIDA and would not have met the selection criteria for this study. The following selection criteria were used to identify hospitals from which to invite participants for the survey:

- annual generation of infectious waste ≥1000 kilograms (kgs);
- annual generation of sharps ≥ 100 kgs; and
- in-patient services with an average bed occupancy rate of 42% or more.

Eleven hospitals were selected for the study. These included the national referral hospital in Thimphu, two regional referral hospitals (one in Mongar and the other in Gelephu in Sarpang district), and eight district hospitals (Paro, Punakha, Samtse, Trashigang, Samdrup Jongkhar, Yebilepcha in Zhemgang district, Gidakom in Thimphu district, and Phuntsholing in Chhukha district). The location of the selected hospitals is shown in Figure 4.3 and the characteristics of the selected hospitals are described and presented in Table 4.2.



☆ National referral hospital ⭘ Regional referral hospitals Δ District hospitals

Figure 4.3 Location of hospitals in Bhutan selected for the study

(Source: Planning Commission, 2002)

In this study, several population-based methods were used to select the participants. For the qualitative data, a non-probability, purposive sampling method was employed to select the participants. Several methodology texts explain that purposive sampling involves the conscious recruitment of participants who possess the best knowledge on the issues that is being explored so that they can provide rich information for in-depth study of the topic (Teddlie & Yu, 2008; Brink, Walt & Rensburg, 2006; LoBiondo-Wood & Haber, 2012 & 2006; Polit & Beck, 2010 & 2006). For the survey, all doctors and nurses from the 11 hospitals selected according to the criteria described earlier were included. All hospital cleaners from the NRH were invited to participate in the study.

Table 4.2 Characteristics of the hospitals in Bhutan selected for the study (2008)

Location	Type of hospital	Number of beds	Type of ward
Thimphu	National Referral	200	Gynaecology & Obstetric, Paediatric, Eye, Ear, Nose & Throat, Intensive Care Units (Paediatric, Adult & Neonate), Medical, Surgical, Orthopaedic, Dialysis, Oncology, Dermatology & Psychiatric, Casualty, Neurology, Urology,
Mongar	Eastern Regional Referral	60	Gynaecology & Obstetric, Surgical, Orthopaedic, Eye, Ear, Nose & Throat, Medical, Paediatric, Neonates & Intensive Care Units (Paediatric, Adult & Neonate)
Gelephu*	Central Regional Referral	60	General
Gidakom	District	40	General, Tuberculosis & Leprosy
Paro	District	40	General
Punakha	District	40	General
Phuntsholing	District	40	General
Samtse	District	40	General
Samdrup Jongkhar	District	40	General
Trashigang	District	40	General
Yebilepcha	District	40	General

* *Areas of specialty medical services yet to be developed.*

(Source: Personnel Section, Ministry of Health, Bhutan, 2008)

Study participants and eligibility

In this study whole system approach was used to investigate policy and practice related to hospital infectious waste management. It was important to obtain information from different perspectives within the organisation in order to obtain a comprehensive understanding of the system. Therefore, three categories of study participants were identified: *policy makers*, *doctors and nurses*, and *hospital cleaners.*

Category I –the *policy makers* are responsible in the development of appropriate policy guidelines, monitoring and evaluation, allocation of resources, and staff support and training for the effective management of infectious waste. All major policy makers and managers from the Ministry of Health, members of the Infection Control (IC) and Healthcare Waste Management (HCWM) Committee and heads of health training institutions were included in the study.

Category II- the *doctors and nurses* engaged in providing patient care produce infectious waste and sharps. Therefore, it was important to obtain their views on the topic. All doctors and nurses from the 11 hospitals were invited to participate in this study.

Category III- the *hospital cleaners* have an important role in the management of hospital infectious waste as they are the main people involved from collection to its final disposal and the cleanliness of the facility. In order to understand issues related to infectious waste management from their perspective, all hospital cleaners from the NRH were invited to participate in the study.

All the policy makers in the Ministry of Health were approached for in-depth interviews and all doctors and nurses from the selected hospitals were invited to participate in the survey questionnaire. For the focus group interviews, participants included all the hospital cleaners from the NRH and not from other regional referral hospitals. This was due to inability to travel to outlying hospitals because of their remote location as well as cost constraints. As explained in Chapter 1, the NRH being the biggest hospital in Bhutan is the main producer of infectious waste and sharps. The hospital has the largest number of hospital cleaners employed at the facility. Therefore, focus group interviews were conducted with the hospital cleaners of NRH responsible for the highest volume of waste of any hospital in Bhutan.

4.5. RESEARCH ETHICS AND ACCESS

In Australia, the National Health and Medical Research Council (NHMRC) requires all research conducted through Australian institutions involving human participants to be reviewed and approved by a properly constituted human ethics committee prior to commencement of data collection (NHMRC, 2007).

Since the study described in this thesis was conducted in Bhutan, approval was obtained from the Ministry of Health in Bhutan before seeking ethics approval from La Trobe University. As stated earlier, research in the health sector in Bhutan is in an early stage of development. At the time this study was conducted, no research ethics committee or board had been established in Bhutan. Therefore, approval to conduct the study was sought from the Ministry of Health (see Appendix A). Although, data were collected from 1l different hospitals, approval from individual hospitals was not required as all hospitals in Bhutan are under the jurisdiction of Ministry of Health. However, a copy of the Ministerial approval letter was sent to respective hospital administrators for their information and also to seek their support for the study (see Appendix J).

The main ethical issues of concern for this study included informed consent, autonomy, respect, confidentiality, privacy and security of project documents. All these issues were explained in detail in the application to the La Trobe University Human Research and Ethics Committee. Ethics approval was granted for data collection in Bhutan (see Appendix B).

Prior to data collection, oral informed consent was obtained from participants of both in-depth and focus group interviews. A copy of the Participant Information Statement was given to all the participants of both in-depth and focus group interviews (see Appendices C & D respectively). No names or identifying details of the participants were requested or used. Participant codes were used to maintain confidentiality. For the survey questionnaires no documented consent was recorded as participation was voluntary and anonymous, but a copy of the Information Statement for the Participants was sent along with each questionnaire. The Information Statement for the Participants (see Appendix E) contained information about the study and intended use of information ensuring confidentiality, and stressed that there were no penalties or adverse consequences for not participating.

During observations, numerous breaches of guidelines and occupational health risks were identified. A preliminary finding report of observation was therefore submitted to the Ministry of Health and NRH administrators on February 17, 2009 to alert them to the risks.

4.6. DATA COLLECTION TECHNIQUES

Sources of data for this study included primary official documents related to healthcare waste, policy-makers from the Ministry of Health, doctors and nurses from the selected hospitals and hospital cleaners from the NRH. Data collection techniques used were: *document analysis, in-depth interviews, focus group interviews, observations* and *survey questionnaires.* Data collection techniques and analysis methods are summarised in Table 4.3.

Table 4. 3 Data collection and analysis methods used in this study

Data sources	Methods	Tools	Data analysis
Official documents	Document analysis, examination of excerpts from correspondence, passages and minutes of meeting	Reading and item extraction,	Content analysis
Policy makers	In-depth interviews	Semi-structured, open-ended guides, field notes	Transcribe audio recording & thematic analysis of transcription
Doctors and nurses	Survey Questionnaires	Open and closed-ended questions	Descriptive statistical analysis using $\chi 2$ test and logistic regression
Hospital cleaners	Focus group interviews	Semi-structured, open-ended guides	Translated audio recording & thematic analysis of the translated transcription
Different units of NRH	Observations	Check-list and field notes	Content analysis

4.6.1. Primary Official Documents

Official Bhutanese documents related to healthcare waste management were obtained from the Ministry of Health, National Environment Commission and Royal Audit Authority. The documents included the following:

- Waste Prevention and Management Act of Bhutan
- National Environment Protection Act of Bhutan
- Environmental Code of Practice for Solid Waste Management in Urban Areas
- Environmental Code of Practice for Hazardous Waste Management
- Bhutan Medical and Health Council Regulations
- Guideline for Infection Control and Healthcare Waste Management in Health Facilities
- Minutes of IC and HCWM Committee meetings
- Curricula for Nurses and Allied Health Workers
- Audit Report on Medical Waste Management and
- Bhutan Environment Outlook

The documents were explored to identify strengths and weaknesses in the existing legislation, policies and guidelines related to healthcare wastes.

4.6.2. In-depth Interviews

A list of Ministry officials in designated posts was obtained from the personnel section of the Ministry of Health. These officials were contacted to provide information about the study and to seek their agreement to participate. A copy of the Participant Information Statement (Appendix-C) was given to each potential participant.

In-depth interviews were conducted with policy makers and managers in the Ministry of Health, heads of health training institutions, and members of the IC and HCWM Committee. Informants' experience working in the field ranged from 10 to 27 years. The interview sought to explore concerns, perceptions, policy issues, thoughts and feelings with regard to infectious waste management for analysis of the situation from a policy and administrative perspective. Semi-structured question guides were employed to obtain information from informants.

Structured interviews facilitate acquiring information based on preset questions, while the semi-structured interview is more flexible and may allow other information to emerge during the course of discussion (Dawson, 2009; Whitehead & Annells, 2007a).

According to Axinn and Pearce (2006), semi-structured or unstructured interviews are thought to be demanding and intensive if conducted with large number of informants.

For this study, in-depth interviews were conducted with twelve informants. Three females and nine males were interviewed using a semi-structured question guide (see sample question guide Appendix F). Semi-structured, open-ended guides help the researcher to keep the focus on issues to be covered and avoid collecting unnecessary information. According to Polgar and Thomas (2000), open-ended questions allow respondents to answer in their own words besides enabling the informant to take on a more active role in the conversation.

All interviews were audio-tape recorded with the prior consent of the informants. The duration of the interviews ranged from 60 to 90 minutes. As the interview progressed and new ideas emerged from the discussion, related questions were asked to explore further understanding of the issue. In addition, notes were taken during the interview for subsequent transcription and analysis of data.

4.6.3. Focus Group Interviews

A focus group interview is a group interview with a small group of people for the duration of one to two hours on a specific topic (Flick, 2002) to generate information based on group interaction (Green & Thorogood 2004). The focus group interview is a tool to collect qualitative data to explore or explain a phenomenon by obtaining collective views and experiences with some additional explanation, ideas and experiences of participants (Hennink, 2007).

Focus group interviews involve informants interacting within a group in response to a moderator's questions. The moderator seeks responses by guiding discussion and further probing in order to understand reasons that underlie group responses (Bloor, Frankland, Thomas, & Robson, 2001), their thoughts and experiences as well as issues related to the phenomena under study (Freeman, 2006). Morgan (2002) and Flick (2009) both emphasise that the researcher's main role in a focus group interview should be to initiate the discussion so that participants bring up issues to discuss among themselves which otherwise may need to be probed by the moderator. This should give participants more control of issues raised during the discussion and make them feel in control by talking amongst themselves rather than directly with the moderator, and participants may feel more confident and relaxed being in a group which may persuade them to make comments (Axinn & Pearce, 2006) or disclose beliefs and explain feelings, attitudes and experiences which may not be possible through other methods such as survey or observation (Schmidt & Brown, 2009; Hennink, 2007; Litoselliti, 2003). The method also provides an opportunity for respondents to elaborate each others' responses to generate richer data from the discussion (Fontana & Frey, 2000; Krueger & Casey, 2000).

However, Johnson and Turner (2003) caution that what is revealed through focus group interviews may not necessarily reflect what participants actually practise in their work place. Holloway (2008) warns researchers to be cognizant of creating barrier against openness and honesty among respondents because of familiarity amongst members, and their personalities, education and backgrounds which may influence the outcome of the discussion leading to potential biasness even within a homogenous group. Whilst this method allows the group to move into related areas, it also helps the moderator to bring discussion back to the topic when required. The method enables the researcher to obtain informants' views and their level of awareness of the issue, and explore any differences, variations and agreement on the topic and beliefs as well as allowing observation of both verbal and non-verbal behaviours of respondents (Minichiello et al., 2004; Polgar & Thomas, 2000).

Focus group interviews can be used as the sole research method or used to triangulate data collected through other methods (Johnson & Turner, 2003). They may be used to add to the information or find out issues that have emerged during the conduct of study from other methods or help to evaluate, elucidate or authenticate findings from in-depth interviews, survey questionnaires and observation (Minichiello et al., 2004; Johnson & Turner, 2003). However, the intent of the focus group interview with the hospital cleaners for this study was to assess their awareness of risks associated with handling infectious waste, identify problems they faced while handling such waste, and explore their perspectives, experiences and concerns as they are the main people who eventually handle and dispose of infectious wastes.

The hospital cleaner in-charge at the NRH was contacted to request a suitable day, time and convenient place to conduct focus group interviews with the hospital cleaners so that there was no disruption at the work place whilst they attended the interviews. Prior to commencing each focus group participants were given an oral briefing based on the Participant Information Statement (see Appendix D) the background of the study, informing them that their participation was completely voluntary and that no names would appear anywhere in the study. They were also told that information obtained from them would be kept confidential and anonymous. Before commencing each session, oral consent was obtained from each group both for their participation and to audio-tape the discussion. Since the majority of the participants had not been to a formal school, and had therefore not learnt English, the interviews had to be conducted mainly in the local language. Focus group interviews were conducted using a question guide (see sample question guide Appendix G). From a total of 40 hospital cleaners, 31 chose to participate in the study. The first two groups consisted of nine and eight participants respectively, whereas the other two groups, each consisted of seven participants. The duration of sessions ranged from one to one and half hours. The findings from focus group interviews are reported in Chapter 7 of the thesis.

4.6.4. Observations

The observation method provides the opportunity to see the infectious waste management being practised in the actual environment. This assists the researcher to try to understand the actual situation, identify gaps and differences in actual practices, and make comparisons with information obtained from other methods. Sandelowski (2000) regards any discrepancy between what participants report, and what they actually do, and what is observed, as reflecting the true scenario.

According to the Census Commission (2005), among the 20 different administrative districts of Bhutan, Thimphu is the most populous with 15.5% of the total population residing there. The NRH located in the capital has the maximum bed capacity (350) in the country. It is both the apex hospital in Bhutan and the teaching hospital for students from RIHS and also for medical students in the future. The hospital has the maximum number of experienced, highly qualified and trained health professionals, and nursing students are posted there for their clinical experience. All difficult medical cases from district and regional referral hospitals are brought to this hospital for further management because of the availability of a greater number of specialty services, treating physicians and more diagnostic and support facilities. The NRH therefore has the highest patient load (both in numbers and complicated case management). As revealed in DANIDA (2004) Report, NRH is the principal producer of infectious HCW (17,311 kilogram (kg) / year (yr) and sharps (1,385 kg/yr) compared with other health facilities. Considering these factors, the NRH was selected as the site for the observational study.

Unlike other methods of data collection, observation is a method of collecting data by observing in the natural setting, as the researcher is able to see the actual practices and interactions as they occur, and can make use of field-notes, drawings and photographs to record actions and events for subsequent analysis (Johnson & Turner, 2003; Kellehear, 1993). Johnson and Turner (2003), and Polgar and Thomas (2000) caution that although observations reflect the actual scenario of events or actions occurring in the natural environment, they do not provide reasons for their occurrence. A checklist was developed (see sample checklist Appendix I) and used to maintain consistency and quality of data from the observation of infectious waste management.

Observations can also be used together with other data to confirm information gathered. However, it is important to bear in mind the caveat of Goffman (1996) that most social behaviour is *front-stage behaviour:* people exhibiting what and how they want to be seen. By contrast, *back-stage behaviour* is what people would otherwise say or do normally. Thus, unobtrusive observation can enable the researcher to see the back-stage behaviour which may not be possible from other methods of data collection.

Johnson and Turner (2003) have identified three approaches to the observation method: *complete participant*, with the researcher becoming one of the group members without informing them that they are being observed; *participant-as-observer* whereby the researcher spends a good amount of time with the participants and also informs them that they are being studied; and *complete observer*, with the researcher observing as an outsider. The complete observer approach is also referred to as non-reactive or unobtrusive observation. Several authors (Johnson & Turner, 2003; Polgar & Thomas, 2000; Kellehear, 1993) state that since unobtrusive observation does not involve talking with participants or interrupting them, the participants are supposedly ignorant of being observed. However, it can be argued that one can claim to be unobtrusive but actually it is not possible for people not to take note of the researcher's presence and actions.

Although permission to conduct the study had already been obtained from the Ministry of Health, a copy of the letter was handed in person to the medical director, nursing superintendent and administrative officer of the NRH. These people were again informed by telephone prior to commencing observations at the hospital. Permission had to be sought from the nurse in-charge of the operation theatre because of entry restrictions for outsiders.

The observations were not made specific to the actions of individual persons or groups performing infectious waste management practices, therefore cannot comment on the category of health workers or individuals contributing to poor waste management practices. There is possibility of errors being made by a minority of those working at the facility. Rather this study employed unobtrusive observation, focusing on the result of waste management practices, enabling the researcher to explore the differences between *what ought to be*, *what was reported* and *what was being done*.

The different areas observed at the National Referral Hospital, and also the municipal landfill, are shown in Figure 4. 4. Since, the municipal landfill is open to public there was no need to seek permission for the visit to the site. Observation also provided the opportunity to see the process of infectious waste management from the point of generation to that of disposal. During observations attention was paid to the safety and risks aspects of the process of management infectious waste. Photographs and field-notes were also taken during the observation as evidence of the problems associated with practices of infectious waste management in the hospital and at the municipal landfill.

In-patient wards

- Medical and Surgical
- Private cabin
- Orthopaedic
- Dialysis
- Gynaecology & Obstetrics
- Eye, Ear, Nose & Throat
- Dermatology
- Psychiatric
- Paediatric & Neonate
- Intensive Care Units

Others

- Operation theatre
- Reproductive Health unit
- Autoclaving unit
- Hospital waste disposal site
- Municipal landfill site

Out-patient department

- Emergency & Casualty
- Dental unit
- Public health laboratory
- General laboratory
- Blood transfusion unit
- Injecting room
- Dressing room
- Minor operation room

Figure 4. 4 The areas of NRH and the municipal landfill where observation was conducted (November 2008 - February 2009)

4.6.5. Surveys

DeVaus (2002) defines surveying as a systematic method of data collection enabling systematic comparison of the same characteristics between cases, usually conducted with a complete or a representative sample. According to DeVaus (2002) the main characteristic of a survey is standardised questions, but many social scientists acknowledge that participants' understanding of questions is not standardised. However, this would entirely depend on how questions are structured. A badly structured question is likely to obtain poor data.

In the present study, self-administered survey questionnaires were used to obtain information from doctors and nurses. The hospital administrators of the selected hospitals were contacted by letter (see Appendix J) seeking their support in data collection by distributing the survey questionnaires to doctors and nurses in their hospital. Along with this letter, a copy of the Ministerial approval letter (see Appendix A), and Participant Information Statement (see Appendix E), a follow-up letter (see Appendix - K) and questionnaires (see Appendix H) were sent. No names and contact details of participants were sought as the questionnaires were anonymous. Participation was voluntary. The completed survey questionnaires were to be returned to the researcher in the stamped self-addressed envelope provided to them.

Questionnaire development

Questionnaires for the survey were developed based on infectious waste management literature. In order to improve reliability and validity, questions were pilot tested with 15 nurses and seven doctors from hospitals not included in the study. Feedback and comments received from them were incorporated and some items restructured before finalising the questions. While developing the questionnaire, an effort was made to ensure that participants had a sufficient range of options from which to choose. Closed-ended questions were developed and an appropriate range of responses were provided in an effort to avoid bias. DeVaus (2004) states that providing a range of response options enables participants to respond according to their level of agreement or disagreement with the statement and be able to reflect their attitude or opinion to questions asked.

Items were developed to assess participants' knowledge of infectious waste, identify occupational health and safety issues, identify gaps in the management of hospital infectious waste, explore training gaps and opportunities (both in pre-service and in-service period), and examine perceptions of individual responsibility and personal opinions of the existing quality and safety of infectious hospital waste management. Lastly, participants were asked to give general comments on how the infectious waste management system might be improved. Survey items were developed to obtain information on various categories, as discussed below.

Participants' characteristics

It was important to establish each participant's basic level of school education, professional qualification (certificate versus degree and beyond), number of years in the health service, and place of work (type of hospital) to determine whether any of these factors were associated with their knowledge or practice with regard to managing infectious waste.

Knowledge

People involved in the management of infectious waste should possess the required knowledge for good quality and safe practice. Items were developed to find out if participants had obtained pre-service and in-service training on healthcare waste management and also to assess their knowledge on the topic.

Waste management practice

Questions were designed to investigate issues related to infectious waste management practice such as, type and colour of infectious waste receptacles, labelling of waste, segregation of waste at the source, mode of transportation of waste to the disposal site, treatment prior to disposal, and disposal methods. Information from these items enabled evaluation of any deviation from the Guideline on IC and HCWM in Health Facilities and existing policy on healthcare waste management. Items on the type and colour of infectious waste receptacles provided five different response options. A category of "others (please specify)" was also used to allow for unanticipated responses from participants.

Occupational health and safety

There is always a potential risk of contracting infection and sustaining needle-stick injuries whilst handling infectious waste and sharps. Therefore, it is important that occupational health and safety issues are not overlooked by hospital administrators. Moreover, poor management of infectious waste and sharps not only put communities at public health risks but also adversely impact the environment. Items in this area focused on two aspects:

Needle-stick injury – questions were designed to determine participants' awareness of the needle-stick injury protocol in the guidelines, their recollection of number of incidents of needle-stick injuries sustained, infection acquired from the injury, whether the incidents were reported and, if not reported, the reasons for not reporting. Reponses ranged from dichotomous to six response options. "I do not remember" and "other reasons (please specify)" were also used as response option to the question.

Personal protective equipment – the items were developed to explore whether necessary personal protective equipment (PPE) was supplied and, if so, whether the participants used them whilst handling infectious waste. Participants were asked to choose one of the alternatives "always, sometimes, rarely" and "never" in response to the question.

Perceptions of individual responsibility

Items were developed to explore the views of participants with regard to their responsibilities for waste reduction, correct handling and disposal of infectious waste, implementation of the Guideline, and monitoring and supervision of staff, including staff orientation. Likert scale response options ranging from “strongly agree” to “strongly disagree” were provided.

Personal opinion

Participants were asked to rate the current system and the safety of infectious waste management practices a Likert scale with points ranging from zero to five. The item responses for the current system included “unable to rate, very poor, poor, good and very good, poor, and for safety the responses included “unable to rate, unsafe, rarely safe, sometimes safe and always safe”. In addition, they were also invited to give comments on improving the infectious waste management system.

4.7. DATA ANALYSIS

According to Macnee (2008) data analysis brings information together to provide a picture of the information gathered but does not translate or explain the implications of data. Irrespective of what data are collected, data analysis includes description, comparison and explanation of information gathered.

This study generated both numerical and textual data that required specific strategies for analysis. Therefore, data analysis is discussed for both quantitative and qualitative data. The surveys generated primarily quantitative data, except for the last question where the researcher sought comments from participants on how to improve the infectious waste management system. The remaining data from official documents, in-depth and focus group interviews, and observation were qualitative data.

4.7.1. Quantitative Data Analysis

Each returned survey questionnaire was coded according to the type of hospital, category of participant and code number for the participant. For example, NRH-D-1, the first three letters denote the hospital, the other letter denotes category of participant and the number denotes the number of the participant in that category. Use of coding enables the researcher to track the original source of information for verification. After coding, the raw data were entered into EpiData software for subsequent data analysis. Each variable was defined and given a label. Responses without a numeric value were assigned with a numeric value to enable statistical analysis. During data entry, restriction to certain data entry values were made, text descriptions converted to numerical codes were entered, and the sequence for data entry was specified. This restriction served to maintain validity of data by preventing incorrect data entry into the software. A face validity check of survey data was carried out by developing check files using a random sequence generator from the Internet (www.random.org/sequences). Thirty-six numbers were randomly generated and these questionnaires cross checked with the original source of information. Necessary corrections were made and incorporated accordingly and the data updated

Different categories of data were categorised and recoded again for easier comparison and better test results. For example, there were six levels of professional qualification ranging from certificate to master's degree. These categories were collapsed into three categories, below degree, degree, and postgraduate and above.

EpiData software was used for data entry and to perform descriptive and comparative statistical analyses. Key variables such as, participants' professional and education level, waste segregation practices, types of waste receptacles, and rating of infectious waste management in respective hospitals of participants were analysed using Chi-Square test to make group comparisons either between participants or between hospitals. Data were manipulated into binary variables, and files converted to Stata 10 for subsequent logistic regression to adjust for confounding.

4.7.2. Qualitative Data Analysis

Hennink (2007) describes the different stages of qualitative data analysis. Stage one involves development of textual data or transcript from tape-recorded information, and cleaning, labelling and anonymising data. This process needs to be done carefully so that transcripts reflect accurately the textual data. Stage two involves identifying themes from transcription and putting them into smaller meaningful segments or categories and sub-categories for effective management of data. Stages three and four involve labelling or coding of data and analysis respectively. Data obtained from in-depth interviews were transcribed verbatim for thematic analysis following the stages suggested by Hennink (2007). To maintain confidentiality and anonymity of informants, participants were coded with a letter "P" and a number. Repeated careful listening to the tapes and reflecting on the content allowed the emergence of themes.

According to Hennink (2007) data from focus group interviews are different from other types of qualitative data. The analysis of data obtained from focus group interviews is challenging because of interruptions during discussion leading to incomplete speeches, partial ideas, contradiction of views, disagreement and misinterpretations between participants. Data analysis requires more time.

Findings from focus group interviews are presented in Chapter 7. These interviews were not transcribed verbatim, as the participants spoke mostly in the local language. Therefore, the researcher translated the dialogue into English from the audio-tape. Following the translation themes were identified by using the following stages as described by Ritchie and Spencer (1994):

familiarization - listening to the audio-tape of group interview sessions and transcripts as well the notes taken during discussions to code the emerging themes;

identifying themes - themes were drawn from the aims and objectives of the study as well as from the discussions of participants. Notes were made in the margin of the text to develop categories and sub- categories;

indexing- sorted data by sifting and highlighting them cutting and pasting of similar quotes or contents;

charting, mapping and interpretation - re-arranged data under the newly developed appropriate thematic content. The findings were interpreted in line with overall research aims and objectives.

Document analysis involved reading and examination of passages from the documents and excerpts from correspondence, making notes of the content for subsequent categorisation.

Data from each record of observations were summarised for content analysis. Areas of breaches and safety issues were illustrated with photographs.

4.8. SUMMARY

This chapter presented the conceptual framework for the application of research methods to identify gaps in policy and practice related to the management of hospital infectious waste in Bhutan. The rationale for choosing a mixed-method approach using a triangulation study design with a multilevel model variant to answer research questions was provided and the use of various study samples and data collection and analysis techniques was discussed. The importance of research ethics and access was explained. The following chapter provides the first set of findings on policy, drawn from primary official documents and in-depth interviews with the policy makers from the Ministry of Health with responsibilities related to infectious waste management.

CHAPTER 5

POLICY ANALYSIS

Research findings of the study are presented in four separate chapters. This first findings chapter concerns policy related to hospital infectious waste management in Bhutan. The findings from policy analysis are reported in two sections: Part One, findings derived from official documents of the Ministry of Health, the National Environment Commission, the Royal Audit Authority Report and minutes of meetings of the Infection Control (IC) and Healthcare Waste Management (HCWM) Committees; and Part Two, findings from in-depth interviews with policy makers and managers, including those from the Ministry of Health, heads of health training institutions (the Royal Institute of Health Sciences (RIHS) and the Institute of Traditional Medicine) and members of the Infection Control and Healthcare Waste Management Committees.

PART ONE

5.1. DOCUMENT ANALYSIS

Official documents were perused to explore the existing legislation and policies governing healthcare waste management. The conceptual framework was used to identify gaps or weaknesses in the existing rules and regulations, policies and guidelines at the national level. The Royal Institute of Health Sciences pre-service training Curricula for Nurses and Allied Health Workers were examined to assess components of healthcare waste management being taught to nursing and allied health students. The Ministry of Health Infection Control and Healthcare Waste Management Committee meeting minutes were also examined to identify issues discussed and decisions or recommendations made by the committee. Document analysis involved content analysis of excerpts from correspondence, passages and minutes of meetings. The official documents explored are listed and categorised in Table 5.1.

Table 5.1 Official documents included in the healthcare waste management policy analysis (1998 -2009)

Document	Year	Type
Waste Prevention and Management Act of Bhutan	(2009)	*Legislation and Regulations*
National Environmental Protection Act of Bhutan	(2007)	
Bhutan Medical and Health Council Regulations	(2005)	
Environmental Code of Practice for Solid Waste Solid Waste Management	(2000)	*Codes of Practice*
Environmental Code of Practice for Hazardous Waste Management	(2002)	
Minutes of Infection Control and Healthcare Waste Waste Management committee meetings		*Minutes of the meeting*
Guideline (sic) for Infection Control and Healthcare Waste Management in Health Facilities	(2006)	*Guidelines*
Curricula for Nurses and Allied Health Workers	(1998)	*Curriculum*
The Audit Report on Medical Waste Management	(2008)	*Reports*
Bhutan Environment Outlook	(2008)	

5.1.1. Legislation and Regulations

Prior to 2009 there was no legislation specific to waste management in Bhutan. Although the National Environmental Protection Act of Bhutan 2007 addressed some aspects of waste, it mainly encompassed environment protection and pollution. However, guidelines and codes of practice to manage waste had been developed by the Bhutanese Government.

Medical and Health Council Regulations

The Medical and Health Council Regulations (MHCR) of Bhutan came into effect in 2005 following the passing of the Medical and Health Council Bill in 2002. Part II, Section 5.19.3 of the Regulations state that:

All public health professionals possessing special training shall act responsibly in prevention and containment of potential life threatening outbreak situations

(Ministry of Health, 2005, p.36).

The Medical and Health Council Regulations stipulate that all health professionals must play their role in the proper management of infectious waste to protect the public and the environment (Ministry of Health, 2005).

The National Environmental Protection Act of Bhutan

The National Environmental Protection Bill of Bhutan was developed by the National Environment Commission (NEC) and enacted by the Parliament in 2007. The main focus of the document is environment protection and not on waste management *per se*. However, in Chapter IV under the section dealing with Protection of Environment Quality, there is a sub-section concerning the handling of hazardous substances, environmental pollutants, and waste management:

> *55. No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed under national and international instruments.*
>
> *56. No person shall discharge or be permitted to discharge or emit any pollutants in excess of such standards as may be prescribed.*
>
> (NEC, 2007, p.21).

The Waste Prevention and Management Act of Bhutan

The Waste Prevention and Management Bill of Bhutan was enacted in June 2009 and applies to all categories of waste generated in the country. The purpose of the Act is to protect and sustain human health through protection of the environment by:

a) *reducing the generation of waste at source;*
b) promoting the segregation, reuse and recycling of wastes
c) disposal of waste in an environmentally sound manner; and
d) effective functioning and coordination among implementing agencies.

(NEC, 2009,p.3)

In accordance with the Act, the NEC is the responsible regulatory authority for issues related to waste in Bhutan and must coordinate and monitor compliance with the Act by the implementing agencies. Responsibility for the actual implementation of the Act lies with various agencies, for example the Ministry of Health (healthcare waste) and City Corporation (municipal waste). The NEC has to collect reports on the status of waste (generation, reduction, reuse, recycling and disposal) and act as an advisory body to the government for policy development related to management of waste. Chapter II of the Act, under Fundamental Right and Duty, Section 6 states that:

> *A person has the fundamental right to a safe and healthy environment with equal and corresponding duty to protect and promote the environmental well-being of the country as enshrined in the Constitution of the Kingdom of Bhutan.*
>
> (NEC, 2009, p.3).

Chapter II of the Act, under the Principle of 3 Rs (reduce, recycle and reuse) and Waste Minimisation Hierarchy, states that in order to achieve the purpose of the Act, everyone shall:

- *Reduce the generation of waste from the manufacture and use of products.*
- *Reuse products and packaging materials.*
- *Recycle material from waste for production of new and useful products.*
- *Recover material form waste for energy production and other uses.*
- *Treat and dispose waste to reduce and eliminate harms to the environment.*
- *Treat and dispose waste to avoid harm to human health.*

(NEC, 2009, p.4)

In the Act, healthcare waste is termed *medical waste* and categorised as hazardous but different types of medical waste are not further categorised. The Act stipulates that the implementing agency, the Ministry of Health, is required to ensure minimisation, correct storage, appropriate treatment and proper disposal of waste in a manner that is safe and has minimal impact on the environment (NEC, 2009).

5.1.2. Codes of Practice

Environmental Code of Practice for Solid Waste Management in Urban Areas

The NEC published the Environmental Code of Practice (ECOP for Solid Waste Management in Urban Areas to encourage community participation and responsibility sharing in managing solid waste in urban areas by creating awareness through training programs. In accordance with the ECOP for Solid Waste Management in Urban Areas, for easy identification of category of healthcare waste (HCW), the use of colour-coded waste receptacles is recommended but the Code does not specify the colour for each category of waste. Similarly, the ECOP identifies the need to treat infectious waste prior to its disposal, but does not specify the type of treatment for the category of HCW (NEC, 2000).

Environmental Code of Practice for Hazardous Waste Management

The ECOP for Hazardous Waste Management was developed by the National Environment Commission in June 2002 in consultation with various stakeholders in the country, with technical assistance and funding from the Danish International Development Agency (DANIDA) under the Environmental Sector Programme Support (ESPS). The aim of the code is to promote safe environmental practices in managing hazardous waste and to help authorities in assessing the potential environmental impact from such wastes. In the urban sector, 13 areas have been identified that require ECOP, and hazardous waste management is one of them. Since hospital infectious waste is categorised as hazardous, its management must conform to the code of practice (National Environment Commission, 2002).

The policy document emphasises the need for the respective implementing agencies to develop occupational health and safety standards and establish appropriate facilities to ensure safe management of hazardous wastes. Furthermore, requirements for proper segregation of waste at the source, use of appropriate receptacles with labels (type of waste) in both English and *Dzongkha* (the Bhutanese national language), proper waste storage places, waste treatment facilities and disposal of waste in approved sites are also stipulated in the ECOP for Hazardous Waste Management. If waste is to be incinerated, the importance of maintaining correct temperatures and proper emission control devices, proper maintenance of the equipment, appropriate incinerator location, monitoring systems and documentation of the amount and category of waste are emphasised. According to the ECOP, if infectious waste needs to be transported off-site, a Chain of Custody System is to be established to enable tracking back of the waste to the point of generation in the event of an incident or an outbreak of a disease. The importance of providing training and creating awareness of waste management at all levels, and understanding of organisational as well as individual responsibilities are also identified (NEC, 2002).

5.1.3. Minutes of the Meetings

The minutes of the committee meetings were obtained from the IC and HCWM Program in the Ministry of Health. The first committee meeting was held in November 2004. The minutes of the committee show that members expressed the need to form a technical committee for IC and HCWM in order to strengthen and improve the infection control and healthcare waste management system in the country. Following this meeting, the Ministry of Health wrote to the National Environment Commission and the City Corporation requesting nominees for the technical committee. The first meeting of the technical committee was held in December, 2004.

The IC and HCWM Committee consist of seven members, mostly from the Ministry of Health (Table 5.2). The technical committee includes 11 members, mainly doctors from the National Referral Hospital (NRH) and unit heads from the Ministry of Health as shown in Table 5.3. There are also representatives from the NEC and the City Corporation on both committees. The technical committee acts as an advisory body to the IC and HCWM committee besides being responsible for reviewing existing guidelines, developing standards, and conducting training and continuing education related to healthcare waste for all health workers in the country.

Table 5.2 Infection Control and Healthcare Waste Management Committee members, by designation (2004)

- Secretary, Ministry of Health (Chairman)
- Director, Department of Health Services, Ministry of Health
- Director, Department of Public Health, Ministry of Health
- Medical Director, NRH
- Director, Royal Institute of Health Sciences
- Thrompon (District Commissioner),
- Representative from City Corporation, Thimphu
- Representative from NEC, Thimphu

(Source: Ministry of Health, 2006a)

Table 5.3 Technical Committee members for Infection Control and Healthcare Waste Management, by designation (2004)

- Medical Director, NRH (Chairman)
- Medical Superintendent, NRH
- Head, Surgical Department, NRH
- Head, Medical Department, NRH
- Pathologist, NRH
- Nursing Superintendent, NRH
- Joint Director, Communicable diseases, Ministry of Health
- Joint Director, Quality Assurance and Standard Division, Ministry of Health
- Joint Director, Health Infrastructure Development Project, Ministry of Health Representative from NEC, Thimphu
- Representative from City Corporation, Thimphu

(Source: Ministry of Health, 2006a)

Although both committees had decided to meet quarterly, minutes of subsequent meetings revealed that since the formation of the committees in 2004, as of December 2008, the technical committee had met only four times. The policy level committee had met only once.

5.1.4. Guidelines

The Guideline for Infection Control and Healthcare Waste Management in Health Facilities

The technical committee recommended the incorporation of a chapter on HCWM in the third edition of the infection control guidelines published by the Ministry of Health. In 2006 the publication was renamed to incorporate HCWM in the title. The guidelines outline the need to form an infection control team (ICT) in all district hospitals and appoint an infection control nurse (ICN) in every health facility to execute infection control activities through maintaining an infection surveillance program, disseminating infection control policies to staff, and conducting needs assessment and training programs for staff in coordination with the IC and HCWM Program in the Ministry (Ministry of Health, 2006a).

The Guideline for Infection Control and HCWM in Health Facilities is a 123-page document which includes various topics ranging from infection control practices and universal precautions, hospital acquired infections (HAIs), modes of transmission of infection from healthcare waste, prevention and control of selected HAIs (such as respiratory tract infections, urinary tract infections, surgical site infections, tuberculosis, meningococcal meningitis and HIV) and how to conduct a survey of hospital waste. Further, the IC and HCWM Program vision and objectives including some aspects of policy are also included in the document. Although the guidelines contain some instructions on managing HCW, because of inconsistencies and differing terminology, some of the contents are confusing. These issues will be discussed in Chapter 9.

There is no substantive policy document specific to HCWM. But the existing Guideline document contains a one page policy statement entitled “National Policy and Strategy on Handling of HCW” and another half page entitled “Waste Segregation Policy”. The policy on management of HCW is based on the principles summarised in Table 5.4 which states that HCWM starts from the process of purchase of products and ends with the final disposal of waste. No written purchasing policy has been developed as yet. It is therefore not clear what sort of purchasing policy needs to be put in place in order to reduce the generation of waste. The policy on segregation of waste will be discussed under categories of waste later in this chapter.

Table 5.4 The principles of managing healthcare waste as stated in the Guideline for Infection Control and Healthcare Waste Management in Health Facilities, Bhutan

- Institute purchase policy that will minimise generation of waste;
- Segregation of waste at the source;
- Introduce reuse and recycle policy;
- Establish and promote safe and sound handling, collection, storage facilities for minimal contact with waste for staff, patients and the public;
- Transportation of waste in appropriate receptacles; and
- Treat infectious waste with the proven technology to render it non-infectious, and disposal techniques to minimise environmental impact and health risk.

(Source: Ministry of Health, 2006a)

Minimal standards for healthcare waste management

The minimal standards for HCWM in a health facility as stipulated in the guidelines are summarised in Table 5.5. Some of the instructions under the minimum standards for HCWM are vague. For example, the guidelines stipulate use of a three-receptacle system with colour-codes but do not specify the colour code against each category of waste. To identify the source of waste, the guidelines state the need to put a date on the waste but do not stipulate the need to identify the unit from where the waste was collected. Thus, tracking back to the source of the waste may be difficult.

Table 5.5 The minimum standards for healthcare waste management set by the Ministry of Health, Bhutan

- Conducting training for all categories of staff on management of HCW and use of personal protective equipment (PPE);
- Using a three-receptacle waste receptacle system in clinical areas with colour-codes;
- Filling up of waste receptacles up to three-quarters of it, then sealed, labelled type of waste and dated to identify the source;
- Placing green and red buckets in different locations of the facility to avoid mixing up of wastes;
- Identifying a waste storage place for infectious waste, and storage time not more than 48 hours;
- Fixing date and time for collection of different types of waste;
- Pre-treating all infectious waste (solid waste- autoclave, liquid waste – use hypochlorite as chemical disinfectant); and
- Using a separate trolley to transport waste infectious waste and taking the shortest route within the facility to transport waste

(Source: Ministry of Health, 2006a)

Categories of healthcare waste

There is no consistency with regard to the classification of HCW in the guidelines. Table 5.6 illustrates how HCW is classified into ten categories (excluding food and general office waste), but under the waste segregation policy HCW is classified into three categories and in another section within the same document, it is categorised into four types. The guidelines state that highly infectious waste, sharps, genotoxic/cytotoxic and radioactive wastes are to be considered as highly hazardous requiring special attention, but do not explain or specify what the special attention entails.

As shown in Table 5.6 general waste from health facilities is not included as a category of HCW. Yet in the waste segregation policy section of the guidelines, this category is included and HCW is categorised as *general waste*, *hazardous waste* and *highly hazardous waste* (Ministry of Health, 2006a). The term hazardous is not defined in the guidelines.

Table 5.6 Categories of healthcare waste as stipulated in the Guideline for Infection Control and Healthcare Waste Management in Health Facilities, Bhutan

1. Infectious waste *(faeces, urine, blood and other bodily secretions)*
2. Highly infectious waste *(microbial cultures, stocks from medical analysis laboratories)*
3. Sharps
4. Pathological and anatomical wastes (*organs, tissues, human body part/s)*
5. Hazardous pharmaceutical waste
6. Hazardous chemical wastes
7. Pressurized receptacles
8. High-content of heavy metals
9. Genotoxic /cytotoxic
10. Radioactive wastes

(

(Source: Ministry of Health, 2006a)

In the guidelines, liquid waste including urine, blood and other bodily secretions is categorised as *infectious waste* whereas organs, tissues, human body part(s) or fluid are classified as *pathological* or *anatomical waste* but considered as *potentially infectious waste*. Microbial cultures from laboratories are categorised as *highly infectious waste*. In the document (p.69), the Table showing recommended colour coding, receptacles and disposal options for HCW, has categorised HCW into four types as, *infectious waste, sharps, non-infectious and food waste*. It is not clear whether HCW is to be segregated into three, four or 10 categories. The instructions in the guidelines are inconsistent and are confusing and unclear.

<u>Colour-coding of waste receptacles and disposal options</u>

The table of recommended uniform colour-coding, type of receptacles and disposal options for healthcare waste in the guidelines, reproduced verbatim in this thesis as Table 3.6, in Chapter 3, shows discrepancies between the title and the contents. The table reflects only four categories of HCW- *infectious, sharps, non-infectious* and *food waste* and does not mention the remaining categories of HCW, which include pharmaceutical, chemical, pressurised containers, radioactive, high content metals, and geno-toxic and cytotoxic wastes. There is no specification of the type of waste receptacle to be used, other than its identification as a bucket. Furthermore, '*plastic bag'* is listed in the receptacle column of the table, but whether it is to be used as a lining inside the waste receptacle or alone as a receptacle is not indicated. Although the title of the table stipulates disposal options, the heading of one of the columns reads "treatment options" but the text contains both treatment and disposal options.

According to the ECOP for Hazardous Waste Management document, the type and the source of waste are to be labelled both in English and *Dzongkha* but this requirement is not stipulated in the guidelines.

Waste treatment

A statement in the guidelines: "treat infectious waste with the proven technology to render it non-infectious" does not provide clear direction for practice. Firstly, it is not clear what " proven treatment technologies" means; secondly, the proven technology may not be available or applicable in Bhutan; and thirdly the recommended treatment technology for Bhutan needs to be identified according to the level of health facilities in the country. However, under the 'handling of sharps and infectious waste' section of the guidelines some instructions are given.

Sharps

According to the guidelines, sharps are to be collected in safety boxes (a specific purpose receptacle supplied by the Ministry of Health) or alternatively in an empty plastic receptacle with a lid. The receptacle is to be labelled and when three-quarters full, autoclaved and disposed of along with the general waste. In the absence of an autoclave, the receptacle filled with sharps is to be disposed of into a deep pit (Ministry of Health, 2006a).

Infectious waste

The guidelines recommend infectious waste to be collected in red-colour receptacles, ranging from 25 to 40 litres capacity with a lid and foot-pedal, lined with red plastic bags. When the receptacle is three-quarters full, waste is to be transported on wheeled trolleys for autoclaving and then disposed of into municipal waste bins (Ministry of Health, 2006a).

Standard for deep pit burial

In Bhutan, deep pit burial is the recommended waste disposal method to be used (in the manner explained in Chapter 3). The specifications given in the guidelines with regard to the site and type of soil for the pit are not clear. For example, the guidelines stipulate that the pit has to be situated in impermeable soil but does not explain further. Another statement with regard to the distance of the pit from residential buildings is also unclear. The guidelines state that the “pit to be away from residential areas” but does not specify the actual distance.

5.1.5. Curriculum for Nurses and Allied Health Students

The Royal Institute Health Sciences (1998) pre-service training Curricula for Nurses and Allied Health Workers contains little information on HCWM. The only topics included are segregation and colour coding of waste receptacles, as part of infection control. In view of the risks of transmission of infections and occupational health hazards posed by infectious wastes, the information provided to students could be improved. This was later confirmed with a faculty member of the Institute.

5.1.6. Reports

The Royal Audit Authority (RAA) Report on Medical Waste Management

In accordance with the Audit Act of Bhutan, (RAA, 2006) Chapter 5: section 44 (c), the Royal Audit Authority has a duty to:

> *Promote economy, efficiency and effectiveness of the use of public resources through its reports and recommendations* (p.19)

Further, Chapter 6: section 56, states that:

> *The Authority shall establish auditing, reporting standards and practices that will meet the highest auditing and reporting standards* (p.22)

As mandated by the Audit Act of Bhutan 2006, the Royal Audit Authority conducted an audit on standards and practices of medical waste management in two hospitals, the NRH and Phuntsholing hospital, from December 2007 to February 2008. The objectives of the audit were to:

- investigate the recording of quantity and composition of waste generated;
- assess the effectiveness of the waste management system; and
- identify opportunities to improve the current system of waste management.

The Medical Waste Management Report was submitted by the auditors (Gurung, Wangmo & Choedup, 2008). The audit findings from both the NRH and Phuntsholing are summarised in Table 5.7.

Table 5.7 A summary of Medical Waste Management Audit Report, 2008

- No documentation system with regard to the amount and composition of waste generated in the hospitals
- Lack of knowledge on medical waste management among cleaners who were observed by the inspecting team, handling wastes without any personal protective equipment (PPE)
- No specific autoclaving bags; infectious wastes were collected in ordinary plastic bags and autoclaved
- No system in place to deal complaints related to Occupational Health and Safety (OHS) issues and Hospital Acquired Infections (HAIs); incidents of needle-prick injuries were neither recorded nor followed up
- No rules and regulations on medical waste; a lack of accountability and no one responsible for managing the healthcare waste
- The need to establish a dedicated team to manage waste in the facility
- In the absence of budget allocated by the government hospital administrators do not consider management of waste to be a core function of the hospital

(Source: Gurung, Wangmo & Choedup, 2008)

The Bhutan Environment Outlook

The Bhutan Environment Outlook is a report published in 2008 by the National Environment Commission reporting on the status of the environment in the country. In the document, the overall inadequacy of a solid waste management system and lack of detailed information on various types of waste generated in the country is highlighted. The absence of segregation of waste and the use of existing landfills as rubbish dump sites without any measures to manage emission of pollutants, scavenging and leaching of contaminants are mentioned as concerns. The report further identifies an urgent need for solid waste management strategies taking into account various types of waste including waste from healthcare facilities and recommends instituting proper segregation of waste at the source and landfill management practices. The document also draws attention to the need to develop adequate infrastructure and facilities for management of healthcare waste (National Environment Commission, 2008).

The preceding analysis of documents provides the context for Part II of policy analysis: findings from in-depth interviews with the policy makers.

PART TWO

IN-DEPTH INTERVIEWS

In-depth interviews were conducted with a total of 12 policy makers (including decision-makers and managers from the Ministry of Health, Infection Control and Healthcare Waste Management Committee members, and heads of health training institutions from the Royal Institute of Health Sciences and Institute of Traditional Medicine). As stated in Chapter 4, the objectives of the interviews were to examine the scope of policy related to infectious waste management, identify and describe problems related to policy implementation from the informants' perspectives and to explore their views on the importance of infectious waste management in the delivery of quality healthcare services. Policy makers were contacted, as described in Chapter 4, and data collected by audio-recording during face-to-face interviews conducted using an interview guide (Appendix F). Interviews were transcribed and analysed thematically. Quotes from informants are represented by the letter " P " with numbers.

5.2. LACK OF RULES AND REGULATIONS

Informants indicated that there were no formal rules and regulations in place pertaining to healthcare waste, except for the guidelines published by the Ministry of Health. However, some thought that the enactment of the Waste Prevention and Management Bill would establish measures to improve the management of waste system in Bhutan.

5.3. INEFFECTIVE IC AND HCWM COMMITTEES

During the interviews, some committee members reported difficulties in executing their roles and responsibilities, as stipulated in their terms of reference, due to lack of time and other more urgent issues demanding their immediate attention. A few acknowledged that they did not attend meetings on regular basis. Reasons for non-attendance were that they may have been out on field trips in other districts, engaged with urgent office work, attending meetings or out of the country. In such instances, they would send a subordinate as their replacement, but if none was available, no one would attend the meeting.

Views on the role of IC and HCWM committee were sought from informants who were not members of the committee. Two views were:

P_3

> *The committee is not very active. Maybe they do not consider it* [their role as committee members] *as a priority at the moment, so not very important.*

P_5

> *I think they* [committee members] *know the importance of proper management of hospital waste but then in the process of delivery their other responsibilities they tend to overlook it. So this aspect does not get much attention as required. The other thing is that they are not made accountable.*

The guidelines stipulate the need to form an infection control team (ICT) in larger hospitals and to identify a focal person in smaller health facilities to manage safe management of healthcare waste. The interviews revealed that the National Referral Hospital has an ICT and a few other hospitals each have a focal person. However, informants stated that the team or focal persons were unable to execute their roles and responsibilities effectively as this was an additional responsibility, and other tasks took precedence over the management of healthcare waste.

5.4. STATUS OF INFECTIOUS WASTE MANAGEMENT PRACTICES

The general consensus of the informants was that the current system of infectious waste management is not up to the expected standard and that much more needs to be done to make it safer. This included conducting training programs for all health professionals, ensuring adequate supplies of personal protective equipment (PPE), providing facilities, and regular monitoring and supervision.

Other views were that the management of infectious waste is an emerging issue and to bring about new changes in the old system may take some time to become effective. The informants stated that:

P_7

We are in the beginning stage and waste management, particularly infectious waste management is the very current notion. So, it will take time.

P_5

Moreover, this system of using different colour code for waste receptacle was not there before, and to get [this] *into the system is going to take time. That is why even the committee* [IC and HCWM] *do not supervise or monitor seriously.*

However, views of informants differed on the standard of infectious waste management in hospitals compared with basic health units :

P_1

Management of infectious waste in major hospitals, I mean NRH and Mongar Regional Referral Hospital are of [a] *little acceptable standard but rest of the district hospitals and basic health units, I think management is still very poor.*

According to one interviewee, an acceptable standard meant that there was at least proper segregation of waste at the source, correct transportation of waste, and a suitable storage place. The informant acknowledged that the treatment aspect of infectious waste management was weak due to lack of appropriate treatment facilities and budgetary constraints.

P_2

Basic health units are much better [in managing infectious waste] *than district hospitals. The situation is not very impressive when it comes to the NRH. This I guess is, mainly due to large* [number of] *staff working and patients, therefore, coordination may be a problem.*

This informant considered the basic health unit (BHU) practice “better” because whatever waste was produced at basic health units was burnt therefore, no waste was left lying around in the facility. The informant further commented that the management of the waste also depended on the person in-charge of the facility or the unit. For example:

P_2

Trashigang hospital, they had eight waste segregation buckets, I was impressed. Some districts hospitals had two coloured receptacles, red or blue, red or green and then waste is mixed. At the NRH segregation is not good. When [the] *autoclave breaks down, all waste is mixed and disposed behind maternity ward into city* [municipal] *receptacle*

Another informant commented that the management of infectious waste was weak, not only in the implementation, but also at the policy level.

P_6

I would say that we are much behind in terms of management, starting from the policy, guidelines and implementing those guidelines into action, which means that we need to do much more.

The following comment, made by another informant further indicates that despite being cognisant of infectious waste management as an issue, but not much attention has been accorded to it.

P_5

I think we have not taken the issue [the management of infectious waste] *seriously. If* [the] *Ministry takes these seriously, these are all "doable" things.*

5.5. MANAGEMENT OF INFECTIOUS WASTE

Informants expressed concerns regarding management of infectious waste especially with the prevalence of infectious diseases in the country. Some of the informants also acknowledged that the management of infectious waste was not receiving due attention and support as required. One of the informants commented on the medical waste audit that was conducted by the Royal Audit Authority:

P_5

The Royal Audit Authority had conducted medical waste audit at the NRH and Phuntsholing hospitals. Actually, it should have been the Ministry of Health, taking the lead role. So, we could say that when it comes to the management of hospital waste, may be, they [Ministry of Health] *do not think that it is a big issue.*

The interviews revealed that it is not clear which department in the Ministry of Health is responsible for the management of HCW. Some thought because hospitals were under the jurisdiction of Department of Medical Services, that this Department was responsible. Others suggested that because infectious waste is a public health issue, therefore, the Department of Public Health was responsible for its management. Others thought that responsibility rested with respective hospital administrators or the IC and HCWM Program in the Ministry of Health. The following were some of the views expressed by the informants during the interview:

P_1

> *The Department of Medical Services (DMS) has put this as number one priority in terms of patient safety and public health point of view, but may be there is not much resource in it or donor support…The government is also taking this matter very seriously and exerting pressure on NEC, but not on* [the] *Ministry of Health.*

$P_{\mathbf{6}}$

> *It is a public health issue and the Department of Public Health should be playing a vital role.*

$P_{\mathbf{3}}$

> *Unfortunate thing is that the IC and HCWM unit has been floating back and forth between the Ministry and the hospital.*

The researcher sought informants' views on the current practice of managing liquid infectious waste by either disposal down the toilet or into drains with some disinfectant, or sometimes without disinfectant.

$P_{\mathbf{5}}$

> *Liquid waste is difficult to collect, therefore, directly discarded into the sewerage. If the sewerage system is very good, then all the liquid may go into the municipal sewage collection area, I do not mean to say that it is safe, at least it is not in the open. But then most often you will find open drainages and infectious liquid waste may land up in that open drainage. I think we should not take this as less risky or safe but institute proper disposal.*

$P_{\mathbf{7}}$

> *For the liquid* [infectious waste] *as of now we do not have clear cut guidelines on how to manage.*

5.6. LACK OF SUPERVISION AND MONITORING TOOLS

The interviews revealed that there were no apparent monitoring and supervisory tools in place. Informants acknowledged the importance of monitoring and evaluation tools and indicated there are plans to develop in the near future. According to some of the informants, respective administrators of health facilities were responsible for the day-to-day monitoring and supervision to ensure proper management of healthcare in accordance to the guidelines. However, there were different views expressed on the issue.

P_3

> *There is lack of supervision and reinforcement. Health professionals do not take the responsibility of waste management rather* [they] *think it is sweepers* [hospital cleaners] *responsibility.*

P_2

> *I think* [the] *main emphasis was in training not that much* [on] *monitoring. But now I feel that monitoring & supervision is more important to get it implemented.*

P_8

> *Right now it* [monitoring tool] *is not there and it has a long way to go. It all costs money and needs people. I think these are all new policy directives that we need to give* [develop].

One of the informants commented that people who had undertaken training in the specific area are placed in different fields, thus not given the responsibility to perform the task they are trained in. As a result, people without knowledge of healthcare waste may not be given the responsibility to manage the program. The informant held the Ministry of Health responsible for such a situation, stating:

P_5

> *Mismatch of trained people not being in the right place. Which I think to some extent we [*decision makers in the Ministry of Health*] are greatly responsible for such oversights.*

5.7. TRAINING

The interviews revealed that training programs on HCWM had been conducted by the IC and HCWM Program but mainly focussed on nurses and in the last three years trainings were provided to hospital cleaners also. Doctors were never included in the sessions. However, one of the informants commented that providing training only once may create some awareness among staff but not necessarily develop the competence to execute tasks effectively. Therefore, reiteration was needed in the form of continuing education. Informants' views were sought on the non-inclusion of doctors in the training of HCWM. One of the informants commented that doctors may not attend because the training programs were conducted by the nurses. Other views were:

P_7

Considering the amount of waste generated, it is basically nurses and sweepers [cleaners] *who are handling it… we will first focus on* [them] *and then gradually come to doctors. Doctors do not generate as much* [waste] *as health workers do. Moreover, doctors do not have enough time to concentrate… and they do not need two to three days workshop like for nurses.*

P_2

I do not think doctors need to undergo training on healthcare waste management, may be they just need little briefing. So, doctors are our last priority.

P_8

…we have looked at is the volume, who is coming in contact [with waste] *most frequently… Because of financial constraints, where we think would have the maximum impact* [training is focussed at] *but I do not agree that they should be targeting only specific groups.*

P_5

It is wrong to assume that doctors know and therefore, [they] do not need training in healthcare waste management.

Although many training sessions pertaining to HCW had been initiated and conducted by the IC and HCWM Program, two informants commented on the poor design of the training package in which there were still knowledge and practice gaps:

P_5

The training program is not designed properly to have the desired effect. Not only to segregate and to dispose waste, but also the knowledge at every step is important. The knowledge of the complete process of waste management is very important and there is a massive gap.

P_8

I think, there is serious deficiency in the knowledge as well as in the implementation, a huge gap. Whatever knowledge they have, the way they implement, is done incorrectly, knowledge and practice gap. I think the whole system is not geared particularly towards infectious waste [management].

A few informants commented that although guidelines on healthcare waste management had been developed by the Ministry, no training on the proper use of guidelines had been conducted and may have been one of the contributing factors for the poor management of infectious waste in health facilities.

5.8. MANAGEMENT OF NEEDLE-STICK INJURIES

Most informants stated that all health workers in Bhutan are aware of the needle-stick injury protocol. Awareness was created through the Human Immunodeficiency Virus (HIV) training program and the Guideline on IC and HCWM. Although, they raised the issue of poor compliance with the protocol by staff and the absence of any follow-up or evaluation was conducted to investigate the reasons for this. Some of the informants' perspectives of reasons for poor compliance were:

P_6

Although needle-prick injury protocol is there, staff compliance is very poor. I think [staff] *at NRH practice but that also not by everyone. I do not know why they do not keep record and follow-up on this. This needs some reinforcement from the Ministry.*

P_9

Maybe they do not think it is important to maintain the record. They are well aware of the risk involved but I do not know why they are not doing it.

P_5

It is individual who should be responsible. Some are very particular and they immediately do blood test... But now I think it has become increasingly important because you cannot leave it to chance. So this protocol also needs to be strengthened and implemented.

Two informants commented that, to date, there were no reports submitted to the Ministry of Health of staff contracting infections from needle-stick injury:

P_3

So far, I do not remember any report on staff having contracted infection from needle-[stick] *injuries.*

P_6

As of now we in the Ministry have not received any report on staff contracting infection from needle [stick] *injuries.*

5.9. CONSTRAINTS

During the interview, informants were asked to identify constraints on the implementation of proper healthcare waste management system. The main constraints highlighted by the informants are reported below.

5.9.1. Lack of Human Resources

Given the constraints of inadequate human resources, some of the informants were of the view that staff was overburdened with other tasks and not able to implement the guidelines. Informants also raised concerns on the availability of expertise for the safe management of HCW in the country. Some also identified the need for adequate monetary support and people with dedication to do the job effectively.

5.9.2. Lack of Information

Some informants indicated that the Ministry lacked information with regard to volume of healthcare waste generated, including the impact of poor management of HCW. In addition, no reports had been submitted by hospital administrators in relation to problems encountered in managing the waste. Therefore, the informants were of the view that a study may be required in order to make policy interventions.

5.9.3. Inadequate Infrastructure, Facilities and Financial Support

Some informants commented on the distance between the locations of some of the health facilities. Thus building infrastructure to treat waste in each facility was felt to be the biggest challenge for the Government. Installing waste treatment equipment in each health facility is considered as not cost-effective besides risking being under-utilised because of the small volume of waste generated in some of the facilities. Informants felt this to be a waste of resources, given budgetary constraints. However, in recognition of the importance of managing infectious waste, the need to look for alternative means to manage waste was also expressed. For example, one informant stated that if some private firms took up the responsibility of installing treatment and disposal facilities, the Ministry of Health would be happy to use the facility and pay the charges for the service. The informant viewed this as a better option, as the Ministry would not have to worry about the installation or maintenance costs, nor worry about under utilisation of the equipment.

A few informants commented that the hospital planners in Bhutan were ignorant of the need to incorporate waste management facilities, therefore these were not included in the initial plans for hospitals:

P_5

The present hospital was built long time back and it does not have waste management system as it was not designed at that time.

P_8

If we look at our situation especially while constructing infrastructure like hospitals and basic health units, this is not given due consideration. Therefore, we are finding difficulties in implementing some of these policies [on infectious waste management].

One interviewee remarked that even the newly-built National Referral Hospital did not have a separate waste storage room or pathway to transport waste either to the waste treatment room or to the disposal site.

According to one of the informants, there was limited financial support either from the government or donor agencies because of the failure of the Ministry to submit a good project proposal to draw the attention of the Government and the donors to problems of the HCWM system.

During the interviews the issue of shortages of disposal sites within hospital premises, especially for the NRH, emerged. Informants stated that certain measures, such as waste reduction by using reusable items and segregation of waste at the source had been initiated to reduce the volume of infectious waste generated. However, one of the interviewees felt that hospitals' main responsibility was to make the infectious waste non-infectious and then it was the municipality's responsibility to dispose of it into a designated site.

One informant commented on the inadequate and irregular supply of waste receptacles:

P_3

Poor support from hospital administration, inadequate and disrupted supplies, for example, sharps boxes, waste receptacles and plastic bags.

5.10. FACTORS CONTRIBUTING TO POOR INFECTIOUS WASTE MANAGEMENT PRACTICES

Informants' views on factors contributing to poor management of infectious waste in hospitals are reported below.

5.10.1. Lack of Commitment and Positive Attitudes

Some of the factors contributing to poor management of infectious waste that emerged from the interviews were : lack of support and commitment because of a poor working environment; mismatch of people, whereby people who possessed the knowledge and training on HCWM were made to perform other tasks, which was acknowledged by the informant as being an oversight from the Ministry; and negative attitude of hospital staff whereby the management of infectious waste is seen as the sole responsibility of the hospital cleaners and not a matter for team work. Furthermore, the problem of bad practices of some staff throwing waste into any available receptacle located nearby was identified. Some informants commented that because doctors were not made responsible for managing healthcare waste, they did not consider it as being part of their duties.

Examples of comments from the informants are given below:

P_2

Behaviour change of the implementers, health workers and hospital cleaners [hospital cleaners] *is the main problem. So to change the behaviour is very difficult and practice is related to their behaviour.*

P_6

It [infectious waste management] is seen as a different component and not [as a] part of the treatment. We wish that everybody considers infection control as one the main pre-requisites in patient management.

P_1

Doctors are the main producers of infectious waste but they feel that it is the sole responsibility of the sweepers [cleaners]*…Compliance by this highly qualified health professional* [doctors] *is also the worst and they make the life of sweepers very difficult.*

5.10.2. Alternative Measures During Break Down of Autoclaving Machine

Some informants stated that in the event of the breakdown of autoclave machine at the NRH, there was no standby autoclaving machine or alternative means to treat infectious waste. The existing system was that the hospital would be without the machine until it was repaired which may take from a few days to several months, depending on the extent of the damage. During such a period infectious waste was to be disposed of in a deep pit within the hospital premises.

5.10.3. Manual Sorting of Infectious Waste

The researcher sought informants' views regarding the practice of manual sorting of infectious waste that was observed at the NRH. The general view was that such a practice was unsafe and risky and that the cleaners should not be doing it. However, one of the informants (closely involved in providing training on healthcare waste management) said:

P_7

> *Sometimes we see needles and broken glasses in green bags which are non-infectious. When we put in the shredder it does not shred needles & glasses. We instruct the cleaners to separate these before transporting the waste for autoclave, but tell them to use gloves and to be careful, but practically I do not know what problems they face.*

5.10.4. Guidelines on Healthcare Waste Management

Some of the informants commented that because of thickly written guidelines, staff may not refer to the document as often as required. Another complained that the contents were too technical and that staff may require training to be able to follow the instructions correctly. A few informants suggested the need to make the guidelines more "user-friendly" in the next edition.

5.11. MEASURES TO IMPROVE THE SYSTEM

Informants' views were explored to identify measures to strengthen and improve the existing infectious waste management system. The general views that emerged from the interviews were: encouraging waste minimisation strategies (reduce, reuse, recycle) as there will never be a stage where there is no waste or "*zero*" amount of waste; making people responsible for managing waste generated by their work; regular monitoring and evaluation of the whole process of waste management to identify the areas of weakness; and liaising with stakeholders both within and outside the Ministry of Health to collaborate on waste management. Other views were:

P_4

… has to be a multipronged approach… Firstly policies being reviewed & guidelines set appropriately. Secondly, involving hospital administrators and doctors from the beginning in the management of waste... Create opportunity to discuss issues related to waste, seek support and financial aid.

P_5

… start at a unit level and later on go into the whole hospital system.

P_9

Just having a guideline is not enough. We have to have rules and regulations to enforce it.

5.11.1. Survey of Healthcare Waste Generation

In the absence of information on the amount of HCW generated from health facilities, informants' views were sought on the idea of conducting a survey to obtain baseline information on the amount and category of HCW to aid in developing policy interventions. Although, most felt that this would serve as a useful tool to plan and develop interventions and the information could be used to seek funding from the government and donor agencies, some felt that weighing waste in the present situation with shortage of staff would be difficult to implement.

5.11.2. Personal Protective Equipment

From the in-depth interviews with the policy makers, most of them felt that there is an adequate supply of personal protective equipment which was accessible to staff and hospital cleaners whilst handling infectious waste.

5.11.3. Budget

Although, the findings from the interviews revealed lack of budget allocation specifically for HCWM, funds were allocated under programs and specific units in the Ministry. For example, the IC and HCWM Program had some budget to conduct continuing education for staff. The purchase of large items and equipment was funded through the central procurement section, but small items like waste receptacles were purchased locally by the respective hospital administrators from the overall hospital budget.

5.11.4. Pre-service Training Curricula

As stated earlier, HCWM is taught as part of the infection control unit to nursing and allied health students at the Royal Institute of Health Sciences. Informants' views were sought regarding the suggestion to incorporate HCWM as a separate unit in the pre-service training curriculum at RIHS. Most of the informants felt that incorporating HCWM in the curriculum was a good measure to create awareness of the importance of managing HCW, and to assist students and staff to understand it as an integral aspect of the overall delivery of healthcare services. One of the informants remarked:

P_6

> *Their basic knowledge at pre-service level will be more beneficial than trying to push everything after they are trained.*

5.12. FUTURE DEVELOPMENT OF INFECTIOUS WASTE MANAGEMENT

With the enactment of the Bill on Waste Prevention and Management of Bhutan, some of the informants considered that both Government and donor agencies may not only come forth with financial allocations, but also assist in strengthening the proper management of healthcare waste by developing rules and regulations, occupational health and safety standards, measures to re-enforce legislation, and monitoring and supervisory tools. The following are some of representative comments made by the informants:

P_5

> *We do not have internal auditing system and accountability. Until and unless we have this system in place, the issue cannot be addressed properly….the Royal Audit Authority has already started auditing HCW, likewise do the audit in other areas. Gradually then the hospital management is made accountable.*

P_6

> *In 10* [Five-Year] *Plan we would like to see the basic manpower being put in place with equipment. IC and HCWM units being set up in hospitals, if possible a department of IC and HCWM at least within bigger hospitals with qualified people. We want to see that IC and HCWM is not seen as an extra activity of health workers but an inherent part of the activity of the health worker or the health system. So it will be very important for us from the policy makers to put in resources.*

5.13. SUMMARY

The chapter presented findings from the analysis of official documents and in-depth interviews with policy makers. The analysis revealed inadequate translation of policy decisions into operational tasks thereby affecting the effectiveness of infectious waste management.

The policy makers indicated they understand the importance of proper management of infectious waste. They acknowledged the overall standard of infectious waste was poor and yet it had not received due attention in the absence of any reported incidents or people contracting infection from infectious waste or from needle-stick injuries. However, in view of the prevalence of infectious diseases in the country and health risks associated with infectious waste, some measures have been initiated such as formation of IC and HCWM Committees, incorporating some aspects of HCWM in pre-service training curriculum, updating guidelines and conducting in-service training, although mainly focussing on nurses .

The guidelines published in the *Guideline for Infection Control and Healthcare Waste Management in Health Facilities* are not specific, and are inconsistent, vague and confusing. There is a high possibility of staff misinterpreting the instructions affecting correct practice of waste management. Some of the factors contributing to poor management of infectious waste have been lack of commitment and leadership roles, inadequate human resources and lack of expertise in the area to draw attention of the stakeholders to the magnitude of associated problems. Other factors have been infrequent meetings of the IC and HCWM Committees, and a lack of reinforcement of legislation including monitoring systems and accountability.

Policy makers were hopeful that the enactment of Waste Prevention and Management Bill in 2009 would enable the Ministry of Health to secure funds and develop human resources to improve the standard of infectious waste management practices in Bhutan.

The following chapter presents findings related to the practice of healthcare waste management from the survey questionnaires administered to doctors and nurses from selected hospitals in Bhutan.

CHAPTER 6

SURVEY OF DOCTORS AND NURSES

This chapter reports the findings from a survey of infectious waste management practices in selected hospitals in Bhutan. A questionnaire was used to obtain information from doctors and nurses working in the selected hospitals. As described in Chapter 4, from the total of 31 hospitals in Bhutan, based on the selection criteria, 11 hospitals (one national referral, two regional referrals and eight district hospitals) were selected for the study. Survey questionnaires (see Appendix H) were distributed to all doctors and nurses of these hospitals. Both open-ended and closed-ended questions were used to acquire information about participants' knowledge, practice and personal views on the management of infectious waste, and their awareness of needle-stick injuries protocol. Suggestions to improve infectious waste management were also sought. Data from the survey enabled group comparisons among participants and between hospitals. In this study hospitals are classified as district, regional and national hospitals and findings are reported according to the type of hospital.

As explained in Chapter 4, respective hospital administrators of the selected hospitals were contacted by letter seeking their support in data collection by distributing the survey questionnaires in their hospital. Questionnaires were distributed to a total of 391 participants (69 doctors, 322 nurses). Some 359 participants (64 doctors and 295 nurses) completed and returned the questionnaire, an overall response rate of 91.8%. Of the total number of participants, 171 (41 doctors, 130 nurses) were from the national referral hospital (NRH), 68 (8 doctors, 60 nurses) from regional referral hospitals (RRH) and 120 (15 doctors, 105 nurses) from district hospitals. As shown in Table 6.1 the participation rate of participants from district hospitals was a little higher compared with the national and regional and district hospitals for both doctors and nurses.

Table 6.1 Participation rate of doctors and nurses according to hospitals

Hospital	**Doctors**		**Participation rate (%)**	**Nurses**		**Participation rate (%)**	**Overall participation rate (%)**
	Invited	*Participated*		*Invited*	*Participated*		
National (1)	44	41	93.2	146	130	89.0	171/190 (90.0)
Regional 2)	9	8	88.9	67	60	89.6	68/76 (89.5)
District (8)	16	15	93.8	109	105	96.3	120/125 (96.0)
Total (11)	**69**	**64**	**92.9**	**322**	**295**	**91.6**	**359/391 (91.8)**

The survey findings are reported under the following main headings: which include *profile of participants, knowledge, waste management practices, occupational health and safety, and general comments from the participants.*

6.1. PROFILE OF PARTICIPANTS

The participants for the survey were doctors and nurses working at the selected hospitals. Doctors included general physicians, surgeons and specialists in various medical fields, while nurses included assistant, deputy and nursing superintendents, chief nurses, staff nurses, auxiliary nurse midwives and assistant nurses.

In this study, the participants are grouped and reported as "*Doctor", "Group A Nurses",* and *"Group B Nurses*". Nurses at certificate level, auxiliary nurse midwives (ANM) and assistant nurses (AN) are placed in "Group A Nurses", and nurses with diploma qualifications and above (including staff nurses (SN), chief nurses (CN), assistant nursing superintendents (ANS), deputy or nursing superintendents (DNS/NS) in "Group B Nurses". All categories of doctors are grouped as "Doctors". Overall, Group A Nurses constituted 32.0% of the participants, Group B Nurses, 50.1% and Doctors constituted 17.8% (see Table 6.2).

Table 6.2 Participant groups

Participants		**N**	**(%)**
Group A Nurses	(AN and ANM)	115	**(32.0)**
Group B Nurses	(SN, CN, ANS, DNS and NS)	180	**(50.1)**
Doctors	(General physicians, surgeons, and specialists)	64	**(17.8)**
Total		**359**	

6.1.1. Characteristics of Participants

Characteristics of participants include *school education, professional qualification* and *years of service*

School education

Table 6.3 shows that from the total of 359 participants, 225 (62.6%) were nurses who had not completed year 12 of schooling. None of the Group A Nurses were educated to year 12, and nearly two-thirds (64.3%) had only attended school up to year eight or lower. Unlike Group A Nurses, a greater proportion of Group B Nurses had completed school between year nine and 11, and 38.9% had completed year 12 or higher. In the doctors group, all had year 12 or higher education.

Table 6.3 School education of participants

Participants	Year 8 or lower N (%)	Year 9 – 11 N (%)	Year 12 or higher N (%)	*Total*
Group A Nurses	74 (64.3)	41 (0.9)	0	***115***
Group B Nurse	3 (1.7)	107 (59.4)	70 (38.9)	***180***
Doctors	0	0	64 (100.0)	***64***
Total	***77 (21.4)***	***148 (41.2)***	***134 (37.3)***	***359***

Professional qualification

As can be seen in Table 6.4, 71.9% of participants, all nurses, did not have a university degree. Comparisons between the groups show that fewer than 2.0% of Group A Nurses reported that they had been able to enhance their professional qualification to an undergraduate or postgraduate degree, whereas almost 20.0% of Group B Nurses indicated that they had done so. Unsurprisingly, all the doctors had completed a medical degree and 68.8% had also acquired a postgraduate professional degree.

Table 6.4 Professional qualifications of participants

Participants	Below degree N (%)	Undergraduate N (%)	Postgraduate degree N (%)	*Total*
Group A Nurses	113 (98.3)	1 (0.9)	1 (0.9)	***115***
Group B Nurse	145 (80.6)	30 (16.7)	5 (2.8)	***180***
Doctors	0	20 (31.3)	44 (68.8)	***64***
Total	***258 (71.9***	***51 (41.2)***	***50 (13.9)***	***359***

Placement of participants

Survey findings show that a higher proportion of staff employed at the NRH possess a postgraduate degree compared with the regional and district hospitals (see Table 6.5).

Table 6.5 Participants' placement by professional qualification

Hospital	Below degree N (%)	**Undergraduate N (%)**	**Postgraduate degree N (%)**	***Total***
District (8)	97 (37.6)	19 (37.3)	4 (8.0)	***120***
Regional (2)	52 (20.2)	7 (13.7)	9 (18.0)	***68***
National (1)	109 (42.2)	25 (49.0)	37 (74.0)	***171***
Total (11)	***258 (71.9)***	***51 (41.2)***	***50 (13.9)***	***359***

Years of service

Some 48.7% of participants had 11 years or more of work experience, and 24.2(%) had five years or fewer (see Table 6.6). The data show that 96.5% of Group A Nurses have work experience of six or more years compared with the Group B Nurses (62.8 %) and Doctors (75.0%). There is a statistically significant difference in the years of work experience between the different participant groups, with Group A Nurses having worked for more years than participants in other groups.

Table 6.6 Participants by years of service

Participants	Up to 5 years N (%)	**6 to 10 years N (%)**	**11 years or more N (%)**	***Total***
Group A Nurses	4 (3.5)	38 (33.0)	73 (63.5)	***115***
Group B Nurse	67 (37.2)	48 (26.7)	65 (36.1)	***180***
Doctors	16 (25.0)	11 (17.2)	37 (57.8)	***64***
Total	**87 (24.2)**	**97 (27.0)**	**175 (48.7)**	***359***

$\chi 2$= 48.93 df(4) p<0.01

Staff at regional hospitals had fewer years of work experience than staff working at the national or district hospitals (see Table 6.7).

Table 6.7 Reported work location of participants by years of service

Hospital	Up to 5 years N (%)	**6 to 10 years N (%)**	**11 years or more N (%)**	***Total***
District (8)	23 (19.2)	46 (38.3)	51 (42.5)	***120***
Regional (2)	23 (33.8)	18 (26.5)	27 (39.7)	***68***
National (1)	16 (24.0)	33 (19.3)	97 (56.7)	***171***
Total (11)	**87 (24.2)**	**97 (27.0)**	**175 (48.7)**	***359***

$\chi 2=16.50$ df(4) $p<0.01$

6.2. KNOWLEDGE

For an efficient and effective implementation of infectious waste management system, relevant knowledge is crucial. All people involved in the management of infectious waste must have the required knowledge to enable them to function competently in the work place and to provide support to co-workers for effective outcomes. To assess their knowledge, participants were asked in the survey to identify the correct definition of infectious waste from a list of options. Statistically there is a significant difference between doctors and nurses, with doctors identifying the correct definition more often (see Table 6.8), although one in eight doctors and just over one in four nurses did not identify the right response.

Table 6.8 Comparison of identification of correct definition of infectious waste between doctors and nurses

Participants	Correct N (%)	**Incorrect N (%)**	***Total***
Nurses	219 (74.2)	76 (25.8)	***295***
Doctors	56 (87.5)	8 (12.5)	***64***
Total	**275 (76.6)**	**84 (23.4)**	***359***

$\chi 2= 5.16$ df(1) p 0.02

A $\chi 2$ test was conducted to examine whether the number of years of service made any difference in selecting the correct definition of infectious waste. There was no significant difference in identifying the correct definition of infectious waste between participants who have worked fewer or more than five years (see Table 6.9).

Table 6.9 Comparison of identification of correct definition of infectious waste by years of service

Years of service	Correct N (%)	Incorrect N (%)	Total
Less than 5	68 (78.2)	19 (21.8)	***87***
More than 5	207 (76.1)	65 (23.9)	***272***
Total	**275 (76.6)**	**84 (23.4)**	***359***

$\chi 2$= 0.16 df(1) p 0.69

6.2.1. Factors Affecting Correct Identification of Infectious Waste

Participants were asked whether they had received any training on healthcare waste management (HCWM) either during pre-service or in-service periods.

Pre-service training

Forty-six percent of participants reported that the topic of HCWM was covered during their training in medical college or nursing school (see Table 6.10). Compared with doctors, significantly more nurses reported having covered the topic during their pre-service training.

Table 6.10 Comparison of pre-service training on healthcare waste management undertaken by doctors and nurses

Participants	Yes N (%)	No N (%)	Total
Nurses	143 (48.5)	152 (51.5)	***295***
Doctors	22 (34.4)	42 (65.6)	***64***
Total	**165 (46.0)**	**194 (54.0)**	***359***

$\chi 2$= 4.21 df(1) p 0.04

In-service training

The majority of participants (71.3%) reported that since commencing employment they had not undertaken any refresher course or in-service training on HCWM. Statistically there is no significant difference between doctors and nurses in whether or not they had undertaken in-service training program (see Table 6.11).

Table 6.11 Comparison of in-service training on healthcare waste management undertaken by doctors and nurses

Participants	Yes N (%)	**No** **N (%)**	***Total***
Nurses	86 (29.2)	209 (70.8)	***295***
Doctors	17 (26.6)	47 (73.4)	***64***
Total	**103 (28.7)**	**256 (71.3)**	***359***

$\chi 2$= 0.17 df(1) p 0.68

A logistic regression model was used to examine association between the identification of *correct definition* of infectious waste and other variables including *doctors, nurses, obtained healthcare waste management (HCWM) pre-service, or in-service training, professional qualifications* and *work experience*.

Overall, the model shown in Table 6.12 does not identify any significant associations between any of the independent variables and the identification of the correct definition of infectious waste. However, people who had pre-service training and had more than five years of work experience appear to be less likely to identify the correct definition.

Table 6.12 Factors associated in identifying the correct definition of infectious waste

Logistic regression	Number of observations	= 359
	LR chi2 (8)	= 11.82
	Prob > chi2	= 0.11
Log likelihood = -189.40	Pseudo R2	= 0.03

Variables	**OR (95% CIs)**	**p-value**
Have had pre-service training on HCWM	0.61 (0.36 - 1.03)	0.06
Have had in-service training on HCWM	1.37 (0.75 - 2.50)	0.30
Doctors	1.11 (0.25 - 5.00)	0.89
Group B Nurses	0.84 (0.45 - 1.54)	0.57
Possessing postgraduate professional qualification	1.53 (0.37 - 6.37)	0.56
Without an undergraduate professional qualification	0.69 (0.27 - 1.72)	0.42
Work experience > 5 yrs	0.61 (0.30 - 1.24)	0.17

(*Group A Nurses* were dropped because of collinearity; *OR*- Odds Ratio; *CI* –Confidence interval; > 5 yrs indicates more than five years)

6.3. WASTE MANAGEMENT PRACTICE

To explore waste management practices in the respective selected hospitals, questions related to *waste receptacles* (type and colour coding of waste receptacles, labeling of waste, the level of waste in the receptacle), *segregation of waste*, *treatment of waste* (before disposal), *the mode of transportation* (specific waste trolley or manual), *storage facilities* and *mode of disposal of waste*, were included in the survey questionnaires.

6.3.1. Infectious Waste Receptacle

According to the Guideline for Infection Control and Healthcare Waste Management in Health Facilities published by the Ministry of Health in 2006, infectious waste receptacles must be leak-proof and non-penetrable to prevent leakage of waste and trauma to people handling the waste. Some 69.4% of participants reported using the appropriate waste receptacle (bucket) to collect infectious waste; 30.6% reported using various non-recommended receptacles including cardboard boxes and ordinary waste receptacles (see Table 6.13). Similarly, four out of five reported using a safety box (a specific-purpose receptacle supplied by the Ministry of Health) to collect sharps, including used needles and broken ampoules; however, one in five reported using other improvised sharp waste receptacles which included bottles, empty medicine receptacles and plastic bags (see Table 6.13).

Table 6.13 The reported use of infectious waste and sharps receptacles

Infectious waste receptacle	**Participant response N (%)**
Bucket	249 (69.4)
Plastic bag	174 (48.5)
Ordinary receptacle	60 (16.7)
Cardboard box	35 (9.7)
Don't know	3 (0.8)

359 participants with 521 responses

Sharps receptacle	**Participant response N (%)**
Safety box	287 (79.9)
Cardboard box	78 (21.7)
Bottles	19 (5.3)
Plastic bag	5 (1.4)
Don't know	2 (0.6)

359 participants with 391 responses

The guidelines indicate that "buckets" and "safety boxes" are the recommended waste receptacles for infectious waste and sharps respectively. In the survey the reported correct usage of sharps receptacle is greater than the infectious waste receptacle by 10.5% (see Table 6.14). Statistically, there is no significant difference identified by participants in the reported use of correct receptacles for infectious waste between hospitals but there is a significant difference in the use of correct sharps receptacle between hospitals (see Table 6.14). The use of a safety box as well as infectious waste receptacle is lowest at the NRH compared with the regional and district hospitals.

Table 6.14 Comparison between hospitals the use of correct waste receptacles as reported in the survey

Infectious waste receptacles

Hospital	Bucket N (%)	Others N (%)	Total
District (8)	84 (70.0)	36 (30.0)	**120**
Regional (2)	48 (70.6)	20 (29.4)	**68**
National (1)	110 (64.3)	61 (35.7)	**171**
Total (11)	**242 (67.4)**	**117 (32.6)**	**359**

$\chi 2 = 1.71$ df(2) p 0.43

Sharps receptacles

Hospital	Safety box N (%)	Others N (%)	Total
District (8)	117 (97.5)	3 (2.5)	**120**
Regional (2)	66 (97.1)	2 (2.9)	**68**
National (1)	149 (87.1)	22 (12.9)	**171**
Total (11)	**332 (92.5)**	**27 (7.5)**	**359**

$\chi 2 = 13.62$ df(2) $p < 0.01$

Colour of waste receptacles

In the guidelines, the recommended colour for infectious waste receptacles is red, and for sharps is yellow or white. In the survey, 92.8% of participants reported using red receptacles and 7.2% reported the use of other colours, including yellow, blue and green. Although the use of non-recommended colour receptacles were reported from all hospitals, the highest percentage (9.4%) use of incorrect coloured receptacles for infectious waste, as well as for sharps (13.5%) was reported from NRH, followed by district hospitals (5.8%) for both infectious waste as well as for sharps (see Table 6.15). There is no statistically significant difference in the use of correct colour receptacles for infectious waste between the hospitals but there was for sharps, with staff from NRH again reporting higher use of non-recommended receptacles.

Table 6.15 Comparison between hospitals the use of correct colour coded waste receptacles for infectious waste and sharps as reported in the survey

	Colour coded infectious waste receptacles		
Hospital	**Red** **N (%)**	**Others** **N (%)**	**Total**
District (8)	113 (94.2)	7 (5.8)	**120**
Regional (2)	65 (95.6)	3 (4.4)	**68**
National (1)	155 (90.6)	16 (9.4)	**171**
Total (11)	**333 (92.8)**	**26 (7.2)**	**359**

$\chi 2 = 3.02$ df(2) p 0.22

	Colour coded sharps receptacles		
Hospital	**Yellow / white** **N (%)**	**Others** **N (%)**	**Total**
District (8)	113 (94.2)	7 (5.8)	**120**
Regional (2)	67 (98.5)	1 (1.5)	**68**
National (1)	148 (86.5)	23 (13.5)	**171**
Total (11)	**328 (91.4)**	**31 (8.6)**	**359**

$\chi 2 = 14.33$ df(2) $p<0.01$

Labeling of waste

According to the guidelines, all infectious waste must be labelled as *infectious waste* or *sharps* for the safety and prevention of injury to people handling waste and the general public. Staff indicated that infectious waste and sharps were not always labelled as recommended in the guidelines. According to 55.2% of participants, infectious waste was always labelled and 74.9% said that sharps were always labeled (see Table 6.16).

Table 6.16 Reported practice of labeling of infectious waste and sharps

Label	Infectious waste N (%)	***Sharps*** ***N (%)***
Always	198 (55.2)	***269 (74.9)***
Sometimes	54 (15.0)	***33 (9.2)***
Rarely	23 (6.4)	***7 (1.9)***
Never	84 (23.4)	***50 (13.9)***
Total	***359***	***359***

To compare practices of labeling of receptacles for infectious waste and sharps between hospitals, response "always" is reported as "yes" and all the other responses are reported as "no". Table 6.17 shows a significant difference in the labeling of infectious waste between hospitals. Staff at the regional hospitals reported the best practice of labeling of both infectious waste (69.1%) and sharps (85.3%) compared with the NRH or district hospitals. Staff from the NRH reported the worst practice of labeling for both infectious waste (46.8%) as well as for sharps (67.8%).

Table 6.17 Comparison between hospitals the correct labeling of infectious waste and sharps as reported in the survey

Infectious waste receptacles

Hospital	**Yes** **N (%)**	**No** **N (%)**	**Total**
District (8)	71 (59.2)	49 (40.8)	**120**
Regional (2)	47 (69.1)	21 (30.9)	**68**
National (1)	80 (46.8)	91 (53.2)	**171**
Total (11)	**198 (55.2)**	**161 (44.8)**	**359**

$\chi 2$= 10.71 df(2) p <0.01

Sharps

Hospital	**Yes** **N (%)**	**No** **N (%)**	**Total**
District (8)	95 (79.2)	25 (20.8)	**120**
Regional (2)	58 (85.3)	10 (14.7)	**68**
National (1)	116 (67.8)	55 (32.2)	**171**
Total (11)	**269 (91.4)**	**90 (25.1)**	**359**

$\chi 2$= 9.50 df(2) p 0.01

Level of waste in the receptacle

The guidelines stipulate that waste should never be filled to the brim or allowed to overflow from the receptacle, but emptied when the receptacle is three-quarters full. The overall correct practice of level of waste reported by participants is 66.6% for infectious waste and 66.3% for sharps. To compare between hospitals, the correct practice of level of waste in the receptacle at three-quarters full is been reported as "correct" and remaining options such as: brim, overflow and do not know as "incorrect" (see Table 6.18).

Statistically there is a significant difference in the reported practice of maintaining a correct level of waste in the receptacle for both infectious waste and sharps between hospitals. Staff at the NRH reported a much lower percentage of practising correct level of infectious waste and sharps in the receptacle compared with the regional and district hospitals (see Table 6.18).

Table 6.18 Comparison between hospitals the reported practice of maintaining correct level of infectious waste and sharps in waste receptacles

Infectious waste receptacles

Hospital	Correct level N (%)	Incorrect level N (%)	Total
District (8)	91 (75.8)	29 (24.2)	**120**
Regional (2)	50 (73.5)	18 (26.5)	**68**
National (1)	98 (57.3)	73 (42.7)	**171**
Total (11)	**239 (66.6)**	**120 (33.4)**	**359**

$\chi 2 = 12.60$ df(2) $p < 0.01$

Sharps

Hospital	Correct level N (%)	Incorrect level N (%)	Total
District (8)	92 (76.7)	28 (23.3)	**120**
Regional (2)	43 (63.2)	25 (36.8)	**68**
National (1)	103 (60.2)	68 (39.8)	**171**
Total (11)	**238 (66.3)**	**121 (33.7)**	**359**

$\chi 2 = 8.08$ df(2) $p<0.05$

6.3.2. Segregation of Infectious Waste

Correct segregating of infectious waste at the source will not only reduce the volume of infectious waste and the need for special treatment and management facilities but will also minimise associated occupational health and public health risks to people handling the waste and to the general public. Overall, some 95% of participants reported that sharps were always segregated, whilst infectious waste was only reported to be segregated routinely by three-quarters of those surveyed (see Table 6.19).

Table 6.19 Comparison of segregation of infectious waste and sharps as reported in the survey

Segregation	Infectious waste N (%)	***Sharps N (%)***
Always	269 (74.9)	***343 (95.5)***
Sometimes	58 (16.2)	***8 (2.2)***
Rarely	18 (5.0)	***2 (0.6)***
Never	14 (3.9)	***6 (1.7)***
N = 359		

The *always* option response for the segregation of waste has been recoded as "*yes*" and the remaining options reported as "*no*". As shown in Table 6.20 the segregation of both infectious waste and sharps were reportedly performed best by Group A Nurses (despite their lower qualification) than the Group B Nurses or the Doctors group. Statistically, there is a significant difference in the reported practice of segregation of infectious waste between nurses and doctors, with doctors being less likely to do so.

Table 6.20 Comparison of reported practice of segregation of infectious waste and sharps between doctors and nurses

Segregation of infectious waste

Participants	Yes N (%)	No N (%)	*Total*
Group A Nurses	95 (82.6)	20 (17.4)	***115***
Group B Nurse	134 (74.4)	46 (25.6)	***180***
Doctors	40 (62.5)	24 (37.5)	***64***
Total	**269 (74.9)**	**90 (25.1)**	***359***

$\chi2$= 8. 90 df(2) p 0.01

*Segregation of s**harps***

Participants	Yes N (%)	No N (%)	*Total*
Group A Nurses	112 (97.4)	3 (2.6)	***115***
Group B Nurse	170 (94.4)	10 (5.6)	***180***
Doctors	61 (95.3)	3 (4.7)	***64***
Total	**343 (95.5)**	**16 (4.5)**	***359***

$\chi2$= 1.44 df(2) p 0.49

A logistic regression was performed to look at association between segregation of infectious waste with other relevant variables including *no training, pre-service* and *in-service training, doctors, Group B Nurses* and *work experience of over five years* (see Table 6.21). The overall model shows that together the variables contribute significantly, to the probability of correctly segregating the infectious waste. Although not statistically significant, staff who have undergone pre-service or in-service training on HCWM are more likely to segregate infectious waste; and Doctors and Group B Nurses, who have a higher level of education and professional qualifications contribute negatively and significantly to the model.

Table 6.21 Factors associated with the correct segregation of infectious waste

Logistic regression	Number of observations	= 359
	LR chi2(10)	= 23.41
	Prob > chi2	= <0.01
Log likelihood = -190.44	Pseudo R2	= 0.06

Variables	**OR (95% CIs)**	**p-value**
No training	0.96 (0.28 - 3.33)	0.95
Pre-service training	1.97 (0.66 - 5.89)	0.22
In-service training	2.29 (0.85 - 6.18)	0.10
Doctors	0.32 (0.16 – 0.67)	<0.01
Group B Nurses	0.47 (0.25 – 0.89)	0.02
Work experience (over 5 years)	0.78 (0.4 – 1.48)	0.45

(*No training*- participants who had not undergone training on HCWM either during pre-service or in-service period; Group A Nurses were dropped because of collinearity; *OR*-Odds Ratio*; CIs* – confidence interval)

6.4. TREATMENT OF INFECTIOUS WASTE

Participants were asked to indicate whether infectious waste was treated (autoclaving of solid infectious waste and chemical disinfection of liquid infectious waste) prior to disposal. The response option "*always*" is reported as "*yes*" and the remaining responses reported as '*no*' in Table 6.22. In the survey 22.8% of the participants reported that they believed waste is autoclaved (solid infectious waste) and 25.9% reported a belief that chemical disinfection of liquid infectious waste occurs before disposal.

Table 6.22 also shows the overall reported percentage of treatment of infectious waste to be less than 30%. Staff at the regional hospitals reported a significantly higher rate of autoclaving. Chemical disinfection is reportedly practised more often in the district hospitals than the NRH.

Table 6.22 Comparison of reported treatment of infectious waste between hospitals

Autoclaving of solid infectious waste

Hospital	Yes N (%)	No N (%)	Total
District (8)	20 (16.7)	100 (83.3)	**120**
Regional (2)	30 (44.1)	38 (55.9)	**68**
National (1)	32 (18.7)	139 (81.3)	**171**
Total (11)	**82 (22.8)**	**277 (77.2)**	**359**

$\chi 2 = 22.68$ df(2) $p < 0.01$

Chemical disinfection of liquid infectious waste

Hospitals	Yes N (%)	No N (%)	Total
District (8)	52 (43.3)	68 (56.7)	**120**
Regional (2)	14 (20.6)	54 (79.4)	**68**
National (1)	27 (15.8)	144 (84.2)	**171**
Total (11)	**93 (25.9)**	**266 (74.1)**	**359**

$\chi 2 = 28.36$ df(2) $p < 0.01$

6.5. TRANSPORTATION OF WASTE

The guidelines state that the infectious waste is to be transported in closed receptacles, using the shortest route, through a pathway separate from that used by patients, staff or visitors, to the disposal site. They also state that equipment used for transporting waste should not be used for any other purpose. In the survey some 30.6% of participants reported using dedicated waste trolley to transport waste to the disposal site and the remaining 69.4 % reported manual transportation of the waste. At the NRH, the proportion of staff who said that waste was transported either manually or by a dedicated waste trolley are almost equal, whereas in the regional and district hospitals, a higher proportion of staff reported waste being transported manually.

Table 6.23 shows a statistically significant difference in the reported mode of transportation of waste among hospitals, with staff from regional and district hospitals reporting a lower percentage of transportation of waste by a specific waste trolley.

Table 6.23 Mode of transportation of waste as reported in the survey

Hospital	**Manual** **N** (%)	**Trolley** **N** (%)	**Total**
District (8)	103 (85.8)	17 (14.2)	**120**
Regional (2)	61 (89.7)	7 (10.3)	**68**
National (1)	85 (49.7)	86 (50.3)	**171**
Total (11)	**249 (69.4)**	**110 (30.6)**	**359**

$\chi2= 60.05$ df(2) $p< 0.01$

6.6. DISPOSAL OF WASTE

The guidelines recommend infectious wastes to be disposed of into a deep pit in the absence of an autoclaving facility; while placentae, body parts and sharps are to be buried irrespective of the availability of autoclaving facilities. In the survey 35.7% of the reported disposal method of infectious waste conforms to the guidelines and the remaining 64.3% which include burning or discarding into municipal receptacles and open pits do not. Among the hospitals, the highest proportion of reported responses for not knowing the disposal method for infectious waste 13.1% (n=24) and sharps 19.2% (n=35) were from the NRH. The highest rate of correct disposal of infectious waste was reported by staff from district hospitals. For regional hospitals the most common reported disposal of infectious waste was discarding into municipal receptacles, whereas for the NRH, it was burning (see Table 6.24).

In accordance with the guidelines, sharps are to be disposed of into a deep pit burial. The survey indicates only 41.5% reported correct disposal method (see Table 6.24), with the remainder suggesting the use of other methods, including open pit (1.8%), municipal receptacles (4.7%) and burning (38.3%). Overall 13.6% participants reported not knowing how sharps were disposed of.

The Table 6.24 also indicates that sharps in district hospitals are reportedly more often likely to be disposed of correctly compared with the NRH or regional hospitals. Both at the NRH and the regional hospitals, as reported by the participants, burning appears to be the most common method of disposal of sharps.

Table 6.24 Disposal methods of infectious waste and sharps in hospitals as reported by participants in the survey

Infectious waste

Hospital	Deep pit burial N (%)	Burning N (%)	Municipal bin N (%)	Open pit N (%)	Don't Know N (%)	Total
District (8)	80 (55.9)	17 (11.9)	27 (8.9)	16 (11.2)	3 (2.1)	**143**
Regional (2)	21 (33.3)	7 (11.1)	23 (36.5)	7 (11.1)	5 (7.9)	**63**
National (1)	38 (20.8)	98 (53.6)	14 (7.7)	9 (4.9)	24 (13.1)	**183**
Total (11)	**139 (35.7)**	**122 (31.4)**	**64 (16.5)**	**32 (8.2)**	**32 (8.2)**	**389**

359 participants with 389 responses

Sharps

Hospital	Deep pit burial N (%)	Burning N (%)	Don't know N (%)	Municipal bin N (%)	Open pit N (%)	Total
District (8)	87 (67.4)	28 (21.7)	6 (4.7)	6 (4.7)	2 (1.6)	**129**
Regional (2)	20 (28.6)	27 (38.6)	11 (15.7)	8 (11.4)	4 (5.7)	**70**
National (1)	51 (28.0)	91 (50.0)	35 (19.2)	4 (2.2)	1 (0.5)	**182**
Total (11)	**158 (41.5)**	**146 (38.3)**	**52 (13.6)**	**18 (4.7)**	**7 (1.8)**	**381**

359 participants with 381 responses

6.7. OCCUPATIONAL HEALTH AND SAFETY

For occupational health and safety, infectious waste management is very important to prevent work-site injuries and to protect the health of staff. In the survey, questions related to *needle-stick injury* (protocol, reporting of incidents of injury, contraction of any infection from the incident) and availability of *personal protective equipment* and its use by the participants were asked.

6.7.1. Awareness of Needle-Stick Injury Protocol

Overall, some 54.0% participants reported being aware of the needle-stick injury protocol. A χ^2 test shows no statistical significant difference between doctors and nurses on the awareness of the needle-stick injury protocol (see Table 6.25).

Seventy one percent of participants from regional hospitals reported being aware of the needle-stick injury protocol compared with 64% of staff from district hospitals and 40% of staff from the NRH (see Table 6.25). There is a difference in the awareness of the needle-stick injury protocol between the participants of the different levels of hospital, with a statistically significantly lower proportion of staff from the NRH apparently knowing about the protocol.

Table 6.25 Reported awareness of needle-stick injury protocol

Participants	**Yes** N **(%)**	**No** **N (%)**	**Total**
Group A Nurses	65 (56.5)	50 (43.5)	**115**
Group B Nurses	95 (52.8)	85 (47.2)	**180**
Doctors	34 (53.1)	30 (46.9)	**64**
Total	**194 (54.0)**	**165 (46.0)**	**359**

$\chi 2$= 0.42 df(2) p 0 .81

Hospital	**Yes** **N (%)**	**No** **N (%)**	**Total**
District (8)	77 (64.2)	43 (35.8)	**120**
Regional (2)	48 (70.6)	20 (29.4)	**68**
National (1)	69 (40.4)	102 (59.6)	**171**
Total (11)	**194 (54.0)**	**165 (46.0)**	**359**

$\chi 2$= 25.20 df(2) p<0 .01

6.7.2. Incidents of Needle-Stick Injury

The response options to the question on needle-stick injury at work included *no injury, one to five pricks,* and *more than five pricks*. *No injury* has been reported as “no” and all the other options grouped as “yes” in Table 6.26. According to the survey findings, 80.5% of participants reported experiencing at least one needle-stick injury at work. Significantly more nurses reported having sustained a needle-stick injury compared with doctors.

Reports of needle-stick injuries among staff from different types of hospitals are not significantly different. Table 6.26 shows that staff from district hospitals reported more incidents of needle-stick injuries than from the NRH or regional hospitals.

Table 6.26 Reported incidents of needle-stick injuries

Participants	Yes N (%)	No N (%)	Total
Nurses	245 (83.1)	50 (16.9)	**295**
Doctors	44 (68.8)	20 (31.3)	**64**
Total	**289 (80.5)**	**70 (19.5)**	**359**

$\chi 2= 6.85$ df(1) $p<0.01$

Hospital	Yes N (%)	No N (%)	Total
District (8)	106 (88.3)	14 (11.7)	**120**
Regional (2)	52 (76.5)	16 (23.5)	**68**
National (1)	131 (76.6)	40 (23.4)	**171**
Total (11)	**289 (80.5)**	**70 (19.5)**	**359**

$\chi 2= 5.90$ df(2) p 0.12

Needle-stick injury reporting

It appears that not all incidents of needle-stick injuries are formally reported. Less than two-thirds of participants said that they reported all incidents (see Table 6.27 Percentage of incidents of needle-stick injuries). A χ^2 test did not identify a significant difference to the reporting of all incidents of needle-stick injuries between doctors and nurses.

Table 6.27 Percentage of incidents of needle-stick injuries reported in the survey

Participants	Yes N (%)	No N (%)	Total
Group A Nurses	69 (60.0)	46 (40.0)	**115**
Group B Nurses	124 (68.9)	56 (31.1)	**180**
Doctors	40 (62.5)	24 (37.5)	**64**
Total	**233 (64.9)**	**126 (35.1)**	**359**

$\chi 2= 2.63$ df(2) p 0.27

Reasons for not reporting incidents of needle-stick injury

To explore why incidents of needle-stick injuries (NSIs) were not reported by the participants, a list of possible explanations were provided. Responses presented in Table 6.28 show overall ranked frequencies reported by the participants, and indicate that responses of staff for not reporting the incidents of NSIs differ between hospitals.

Table 6.28 Ranked reported reasons of participants' not reporting needle-stick injuries among hospital

Reasons (in order of frequency)	District N=120 (%)	Regional N=68(%)	National N=171(%)	Total N=359 (%)
Not sure how and whom to report	31 (26.3)	13 (18.3)	48 (24.9)	92 (24.1)
Busy schedule	27 (22.9)	7 (9.9)	35 (18.1)	69 (18.1)
Did not know had to be reported	22 (18.6)	10 (14.1)	32 (16.6)	64 (16.8)
Other reasons	6 (5.1)	11 (15.5)	36 (18.7)	53 (13.9)
No response	14 (11.9)	6 (8.5)	19 (9.8)	39 (10.2)
Not important to report	8 (6.8)	13 (18.3)	14 (7.3)	35 (9.2)
Fear of blame or consequences	10 (8.5)	11 (15.5)	9 (4.7)	30 (7.9)
Total	**118**	**71**	**193**	**382**

359 participants with 382 responses

Comparisons of ranking of responses among different staff groups revealed differences. For example, Group B Nurses gave *other reasons* (28.6%) as the main reason of not reporting, *fear of blame or consequences* (8.3%) as the last, whereas nurses in Group A Nurses ranked *not sure how and whom to report the highest* (27.7%) *and other reasons* (5.0%) the last, and Doctors ranked *fear of blame and consequences* as the last reason (1.4%) for not reporting incidents of NSIs (see Table 6.29). Other reasons reported by participants were: an absence of an identified member of staff responsible to follow-up after incidents were reported, lack of any form of compensation, and no uniform system of reporting, inadequate training on management of healthcare waste, and poor supervision and monitoring.

Table 6.29 Comparison of participants' reported responses for not reporting incidents of needle-stick injuries

Reasons (in order of Frequency)	Group A Nurses N=115 (%)	Group B Nurses N=180 (%)	Doctors N=64 (%)	Total N=359 (%)
Not sure how and whom to report	33 (27.7)	43 (22.4)	16 (22.5)	92 (24.1)
Busy schedule	24 (20.2)	32 (16.7)	13 (18.3)	69 (18.1)
Did not know had to be reported	24 (20.2)	26 (21.8)	14 (19.7)	64 (16.8)
Other reasons	6 (5.0)	34 (28.6)	13 (18.3)	53 (13.9)
No response	11 (9.2)	21 (10.9)	7 (9.9)	39 (10.2)
Not important to report	8 (6.7)	20 (10.4)	7 (9.9)	35 (9.2)
Fear of blame or Consequences	13 (10.9)	16 (8.3)	1 (1.4)	30 (7.9)
Total	**119**	**192**	**71**	**382**

359 participants with 382 responses

Infection from needle-stick injury

Although overall 80.5% of participants reported experiencing a needle-stick injury at their work place, only 4.2% of those reported acquiring an infection (the type of infection was not asked). All those who reported acquiring some kind of infection were nurses (five from Group A Nurses and the remaining 10 from Group B Nurses). None of the doctors reported acquiring an infection through a needle-stick injury.

6.8. PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) includes surgical gloves, utility gloves, masks, eye shields (spectacles), aprons and gumboots. Questions were asked to explore the availability and use of this equipment whilst handling infectious waste and the options were "always, sometimes, rarely and never".

6.8.1. Availability of Personal Protective Equipment

From the list of personal protective equipment, as reported in the survey 95.8(%) said that surgical gloves were always available followed by aprons (68.0%) and masks (64.6%) with eye shields (24.8%) the least available PPE (see Table 6.30).

Table 6.30 Reported availability of personal protective equipment

Personal protective equipment	Always N (%)	Sometimes N (%)	Rarely N (%)	Never N (%)
Surgical gloves	344 (95.8)	14 (3.9)	1 (0.3)	0
Apron	244 (68.0)	82 (22.8)	17 (4.7)	16 (4.5)
Mask	232 (64.6)	109 (30.4)	11 (3.1)	7 (2.0)
Gumboot	199 (55.4)	62 (17.3)	27 (7.5)	71 (19.8)
Utility gloves	114 (31.8)	110 (30.6)	54 (15.0)	81 (22.6)
Eye shield	89 (24.8)	107 (29.8)	54 (15.0)	109 (30.3)

N = 359

To make comparisons and to identify differences with regard to the reported availability of PPE between hospitals, the responses indicating when equipment is "always available" are shown in Figure 6.1. The figure shows surgical gloves to be the most available PPE and eye shields the least available. As reported by staff, comparison between hospitals showed eye shields and gumboots were more available in district hospitals than in NRH or regional hospitals but surgical gloves and masks were more available at the NRH than in district or regional hospitals.

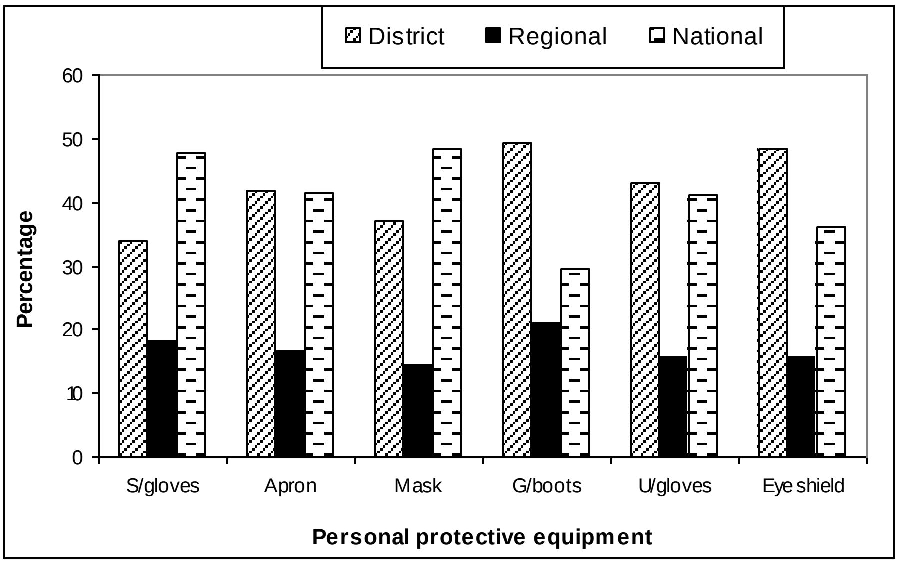


Figure 6.1 Reported consistent availability of personal protective equipment in hospitals by 359 respondents

6.8.2. Factors Affecting the Overall Use of Personal Protective Equipment

The comparison of data with regard to the reported use of PPE indicates that nurses are more likely than the doctors to use the PPE while handling infectious wastes. Among the participants, there was no difference in the reported wearing of surgical gloves between doctors and nurses but there were statistically significant differences in the wearing of masks, aprons, gumboots and eye shields.

A logistic regression was performed to assess the extent to which routine PPE use was associated with the availability of the various types of PPE. The overall model presented in Table 6.31 suggests that together the variables significantly contribute to the probability of using PPE while handling infectious waste. The availability of mask, eye shield, apron and gumboots have a positive association in the use of PPE although only one variable, eye shields have a statistically significant association. Conversely the routine use of gloves and gown do not seem to have any association with availability, probably because gloves are reported by almost all participants as being routinely available.

Table 6.31 Logistic regression of using personal protective equipment

Logistic regression	Number of observations =	359
	LR chi2(11) =	27.43
	Prob > chi2 =	<0.01
Log likelihood = -96.48	Pseudo R2 =	0.12

Variables	**OR (95% CIs)**	**p-value**
Gloves	0.23(0.20-1.35)	0.10
Mask	1.39 (0.50-3.88)	0.52
Eye shield	4.63 (1.95-11.00)	0.01
Gown	0.93 (0.27-3.24)	0.91
Apron	2.98 (0.68-12.99)	0.15
Gumboots	1.08 (0.10-2.91)	0.88

(*OR*- Odds Ratio; *CIs* – confidence interval)

6.9. PERCEPTION OF PERSONAL RESPONSIBILITY IN MANAGING INFECTIOUS WASTE

To explore how participants perceived their responsibility in managing infectious waste, views were sought in the areas of *implementation of guidelines*, *waste minimisation, correct handling and disposal of waste, monitoring and supervision*, and *staff orientation*. Responses *strongly agree* and *agree* are reported as *agree, does not agree* and s*trongly does not agree* have been reported as *does not agree* and the response *not sure* reported as it is. The areas of personal responsibility in managing infectious waste are shown in Table 6.32. Except for the area of the correct disposal of waste, most participants reported being personally responsible for managing infectious waste. However, there were a few participants ranging from 2.5% to 8.0% who were not sure of their personal responsibilities in the management of infectious waste (see Table 6.32). Of note, not a single participant felt that correct disposal of waste was their personal responsibility.

Table 6.32 Participants' reported acknowledgement of personal responsibility in managing infectious waste

Personal responsibility	Agrees N (%)	Does not agree N (%)	Not sure N (%)	Total
Implement guidelines	319 (88.9)	11 (3.1)	29 (8.0)	**359**
Waste minimisation	324 (90.2)	21 (5.9)	14 (3.9)	**359**
Safe handling of infectious waste	343 (95.5)	6 (1.7)	10 (2.8)	**359**
Correct disposal	0 (0.0)	345 (96.1)	14 (3.9)	**359**
Monitoring & supervision	336 (93.6)	14 (3.9)	9 (2.5)	**359**
Staff orientation	331 (92.2)	16 (4.5)	12 (3.3)	**359**

6.9.1. Implementation of Guidelines

All health professionals are expected to follow the guidelines to implement correct infectious waste management practices; however, 11.1% of participants reported not having personal responsibility in implementing the guidelines (see Table 6.33). A χ^2 test did not show statistical significance difference between doctors and nurses with regard to their reported perception of personal responsibility in implementing the guidelines.

Table 6.33 Participants' reported acknowledgement of personal responsibility in implementing the guidelines

Participants	Agrees N (%)	Does not agree N (%)	*Total*
Group A Nurses	96 (83.5)	19 (16.5)	***115***
Group B Nurse	164 (91.1)	16 (8.9)	***180***
Doctors	59 (92.2)	5 (7.8)	***64***
Total	**319 (88.9)**	**40 (11.1)**	***359***

$\chi 2$= 5. 00 df(2) p 0.08

6.9.2. Waste Minimisation

Doctors and nurses are the main generators of infectious waste in the process of patient care. If they make a conscious effort to minimise waste at source (without compromising the quality of services) a smaller volume of waste would require special handling and associated risks from handling of such wastes would be reduced. Table 6.34 shows that 90.3% participants reported understanding that they have a responsibility to minimise waste at its source. Statistically there is no significant difference of opinion between doctors and nurses positively acknowledging responsibility for minimising the volume of waste.

Table 6.34 Participants' reported acknowledgement of personal responsibility in minimising waste

Participants	Agrees N (%)	**Does not agree N (%)**	***Total***
Group A Nurses	103 (89.6)	12 (10.4)	***115***
Group B Nurse	164 (91.1)	16 (8.9)	***180***
Doctors	57 (89.1)	7 (10.9)	***64***
Total	**324 (90.3)**	**35 (9.7)**	***359***

$\chi 2$= 0.32 df(2) p 0.85

6.9.3. Proper Handling of Waste

Doctors and nurses are responsible for ensuring that infectious waste and sharps are handled properly in the work place at all times. Although 95.5% participants agreed that they had personal responsibility for the proper handling of waste, some 4.5% disagreed. There is no significant difference between doctors and all nurses with regard to reportedly believing they are responsible for the proper handling of waste (see Table 6.35).

Table 6.35 Participants' reported acknowledgement of personal responsibility in the proper handling of waste

Participants	Agrees N (%)	**Does not agree N (%)**	***Total***
Group A Nurses	106 (92.2)	9. (7.8)	***115***
Group B Nurse	176 (97.8)	4 (2.2)	***180***
Doctors	61 (95.3)	3 (4.7)	***64***
Total	**343 (95.5)**	**16 (4.5)**	***359***

$\chi 2$= 5.19 df(2) p 0.07

6.9.4. Correct Disposal

The disposal of waste into the correct receptacles prevents the mixing of different types of waste and unnecessarily increasing infectious waste volume and associated health risks to waste handlers and the general public. However, as shown previously in Table 6.32, not a single participant agreed that they were responsible personally for the correct disposal of infectious waste.

6.9.5. Monitoring and Supervision

With regard to the role of monitoring and supervision in the proper management of infectious waste sharps, almost 97.0% of participants reported having a role. Statistically, there is no significant difference in the reported perception of the role between doctors and nurses' groups (see Table 6.36).

Table 6.36 Participants' reported acknowledgement of personal responsibility in monitoring & supervision

Participants	Agrees N (%)	Does not agree N (%)	Total
Group A Nurses	105 (91.3)	10 (8.7)	**115**
Group B Nurses	170 (94.4)	10 (5.6)	**180**
Doctors	61 (95.3)	3 (4.7)	**64**
Total	**336 (93.6)**	**23 (6.4)**	**359**

$\chi2= 1.54$ df(2) p 0.46

6.9.6. Staff Orientation

Orientation for new members of staff in waste management is important for correct waste management practices. Sixty-eight percent of participants acknowledged responsibility for providing orientation to new staff and the remainder disagreed. Although not statistically significant, the proportion of doctors supporting staff orientation is lower than in the nurse groups (see Table 6.37).

Table 6.37 Participants' acknowledging personal responsibility in providing orientation to new staff

Participants	Agrees N (%)	**Does not agree N (%)**	***Total***
Group A Nurses	77 (67.0)	38 (33.0)	***115***
Group B Nurse	126 (70.0)	54 (30.0)	***180***
Doctors	41 (64.1)	23 (35.9)	***64***
Total	**244 (68.0)**	**115 (32.0)**	***359***

$\chi 2$ = 0.84 df(2) p 0.66

6.10. PARTICIPANTS' VIEW ON THE SAFETY AND STATUS OF INFECTIOUS WASTE MANAGEMENT

Participants' views were sought on the safety and status of the current infectious waste management system in their hospital. Responses included *very good, good,* p*oor, very poor* and *unable to rate*. Participants were asked to tick the response they felt was appropriate. Responses *very good* and *good* have been grouped and reported as *good* and responses *poor* and *very poor* reported as *poor.* The response *unable to rate* is reported as it is in Table 6.38.

6.10.1. Rating of Current System of Infectious Waste Management

Overall 68.2% of participants reported the rating of the current system of infectious waste management as *good.* A higher proportion of nurses have rated the infectious waste management system as good compared with the doctors. Group A Nurses have likely to rate the system more positively than Group B Nurses (see Table 6.38). Compared with other hospital types, a much lower percent of staff of NRH reported the belief that infectious waste management was good.

Table 6.38 Reported rating of infectious waste management system

Participants	**Good N (%)**	**Poor N (%)**	**Unable to rate N (%)**	**Total**
Group A Nurses	90 (78.3)	16 (13.9)	9 (7.8)	**115**
Group B Nurses	117 (65.0)	55 (30.6)	8 (4.4)	**180**
Doctors	38 (59.4)	19 (29.7)	7 (10.9)	**64**
Total	**245 (68.2)**	**90 (25.1)**	**24 (6.7)**	**359**
Hospital	**Good N (%)**	**Poor N (%)**	**Unable to rate N (%**	**Total**
District (4.2)	92 (76.7)	23 (19.2)	5 (4.2)	**120**
Regional (2)	51 (75.0)	15 (22.1)	2 (2.9)	**68**
National (1)	102 (59.6)	52 (30.4)	17 (9.9)	**171**
Total (11)	**245 (68.2)**	**90 (25.1)**	**24 (6.7)**	**359**

6.10.2. Safety of Current Infectious Waste Management Practices

Responses to the question on the safety of current practices included *always safe, sometimes* s*afe, rarely safe, unsafe* and *don't know.* The response option *always safe* is reported as *safe* and the response *unable to rate* has been reported as it is; whereas all the remaining options are reported as *unsafe.* Only 23.1% of participants considered the current infectious waste management practice to be safe. Nurses in Group B Nurses and doctors have rated the existing practices to be more unsafe than the nurses in Group A (see Table 6.39). In the comparison of perceived safety of infectious waste management practices between hospitals, participants from the district hospitals rated safety higher than those from the NRH or regional hospitals (see Table 6.39).

Table 6. 39 Reporting rating of safety of infectious waste management system

Participants	**Safe N (%)**	**Unsafe N (%)**	**Unable to rate N (%)**	**Total**
Group A Nurses	42 (36.5)	66 (57.4)	7 (6.1)	**115**
Group B Nurses	31 (17.2)	146 (81.1)	3 (1.2)	**180**
Doctors	10 (15.6)	49 (76.6)	5 (7.8)	**64**
Total	**83 (23.1)**	**261 (72.7)**	**15 (4.2)**	**359**
Hospital	**Safe N (%)**	**Unsafe N (%)**	**Unable to rate N (%**	**Total**
District (4.2)	38 (31.7)	80 (66.7)	2 (1.7)	**120**
Regional (2)	13 (19.1)	49 (72.0)	6 (8.8)	**68**
National (1)	32 (18.7)	132 (77.2)	7 (4.1)	**171**
Total (11)	**83 (23.1)**	**261 (72.7)**	**15 (4.2)**	**359**

6.11. GENERAL COMMENTS FROM PARTICIPANTS

Comments or suggestions for improving infectious waste management system were sought from participants. These are grouped (see Table 6.40) and reported in the following sections and illustrated with quotes. Letters have been used to maintain anonymity of participants. The first letter denotes type of hospital and the second letter indicates whether the participant is a doctor or a nurse. For example D-N indicates a district hospital nurse.

Table 6.40 Comments from participants

Comments	**Frequency N (%)**
Training on HCWM	115 (54.2)
Supplies & facilities	40 (18.9)
Monitoring & supervision	20 (9.4)
Focal person	9 (4.2)
Pre-service curriculum	4 (1.9)
Others	24 (11.3)
Total	**212**

359 participants with 212 responses

Training

The most common suggestion made by almost one-third of participants was on training (in the form of workshops, refresher courses, and advocacy to create awareness among all stakeholders including patients, visitors, health professionals and support staff) on healthcare waste management. From the total of 115 comments on the need for training, 75 specifically mentioned training for hospital cleaners and other support staff. Others commented on the need for a continued education program based on training needs assessment.

> *All the health staff and support staff needs to be trained properly and on regular basis. Quality of training to be evaluated and monitored time to time. It is not appropriate and adequate to train only programme and policy level people, who mostly deal with paper and does not actually know how to implement practically.* (D – N)

One of the participants also commented on the quality of the training conducted by the Infection Control and Healthcare Waste Management Program.

> *Hospitals are given short theoretical lectures on IC & HCWM, but the impact ends on leaving the hall or even before the lunch is digested* (N- D)

Monitoring and supervision

Twenty participants expressed the need to institute a proper and continuous monitoring system to ensure effective waste management practices.

> *Our people tend to throw waste in what ever receptacle they find easy in the pretext of not having time, staff shortage or being busy. Monitoring system in place will go a long way in ensuring correct waste management practices* (N- N)

> *There should be* [a] *constant monitoring and evaluation if you want to build in a proper system* (N- N)

One of the participants commented on the lack of monitoring and supervision being due to an absence of expertise in the area. Two participants commented on the efficacy of the IC and HCWM Committees.

Complacency of [waste] *Infection Control and Healthcare Waste Management Committees in executing their roles* (N-D)

The IC & HCWM Committees should be efficient and actively involved (N- N)

Supplies and facilities

Forty participants commented that just imparting knowledge was inadequate for the effective management of healthcare waste, highlighting the need for support such as regular, adequate and appropriate supply of items (in terms of appropriateness, quality and various sizes of gloves and waste receptacles that are convenient to use, and personal protective equipment) to facilitate the proper management of infectious waste and ensure safety of staff.

So much resources is spent in training health staff on IC & HCWM but their knowledge and skills are not put into use due to lack of availability of necessary supplies. (D –D)

Two participants suggested the waste receptacles should be purchased by the Ministry of Health, and then distributed to all health facilities, in order to maintain uniformity and standard of waste receptacles and recommended colours.

Two participants commented on the need for suitable facilities to be able to implement infectious waste management in accordance with the guidelines.

The guidelines say to autoclave infectious waste but autoclave is not available [in all the hospitals]. *Even to autoclave instruments and gauzes, we have to borrow from other places.* (D- N)

We would like to have proper waste storage room, segregation and disposal sites. (D- N)

Need specific waste transportation trolley to transport waste. (N- N)

Pre-service training curriculum

Four participants suggested the inclusion of HWCM in the pre-service training curriculum at the Royal Institute of Health Sciences (RIHS) to assist graduates to understand the importance of correct management of HCW.

Focal person for infectious waste management

Nine participants suggested either having an infectious waste management committee or identifying a staff member to be responsible for infection control and healthcare waste management in every health facility, and who could also follow up on reported incidents of needle-stick injuries sustained by staff.

Others

<u>Leadership, Responsibility, Accountability, and Commitment</u>

Comments were made that the management of healthcare waste should be a team effort with everyone (from policy makers to hospital cleaners) executing their responsibilities effectively and being committed to improve the waste management system in hospitals. Some of the comments were:

> *Infectious waste management is not a one man task. The subject should be understood by all, and every one should shoulder the responsibilities collectively* (N- N)

> *Accountability at individual levels is very important. Sadly, this is missing at various levels in our system* (R-D)

> *There is no proper IC& HCWM program in place. I seriously doubt the level of administrative commitment in such programs.* (N – D)

One of the participants commented that despite having the Infection Control and Healthcare Waste Management Program in the Ministry, leadership and expertise to make the program effective was lacking.

<u>Inadequate number of hospital cleaners</u>

Three participants commented on the need to increase the number of hospital cleaners for better management of waste in the facility.

6.12. SUMMARY

The results of the survey indicated breaches in the practice of infectious waste management from the use of receptacles, and segregation to disposal of waste. The findings show that possessing higher qualifications, having more years of work experience and or undertaking training programs on HCWM does not necessarily indicate that effective waste management practices will be implemented.

The National Referral Hospital is the apex hospital and the designated clinical training institute for nursing and allied health students of the Royal Institute of Health Sciences. the highest number of doctors and nurses with higher professional qualifications and with more years of service are employed at the NRH. Therefore it is a hospital where it would be expected to find the safest infectious waste management system and practice in Bhutan. However, the survey results show otherwise. The use of non-recommended infectious waste and sharps receptacles as well as the non-recommended colour coded waste receptacles are higher at the NRH than in regional or district hospitals. The percentages of labelling of both infectious waste and sharps are higher in district and regional hospitals. The staff of NRH have given a lower rating of infectious waste management practices and safety than did the staff from the district or regional referral hospitals. A higher number of staff from the NRH reported being unaware of the needle-stick injury protocol and the number of unreported cases of NSIs was also higher.

Use of personal protective equipment is important in preventing occupational health hazards in health facilities and it should be always available and accessible. However, this study revealed inadequate and inconsistent supply of PPE. Of the PPE, surgical gloves were most available PPE followed by apron and masks. Eyes-shields were the least available PPE in hospitals selected for the study.

The following chapter provides findings from focus group interviews conducted with the hospital cleaners of the National Referral Hospital.

CHAPTER 7

FOCUS GROUP INTERVIEWS WITH HOSPITAL CLEANERS

This chapter presents findings from focus group interviews conducted with hospital cleaners of the National Referral Hospital (NRH). Hospital cleaners are the main people responsible for the collection, transportation and disposal of infectious waste to the designated disposal sites within the facility. Therefore, it was considered important to explore their views and obtain information related to healthcare waste management practices from their perspective, in addition to views from the policy makers and the health professionals.

As shown in the organogram of the National Referral Hospital (NRH) (see Appendix L), hospital cleaners occupy the lowest level in the hierarchical system. For their day-to-day work, the cleaners are accountable to the nurse unit manager of each respective unit. Their main tasks are to maintain the cleanliness of the hospital, to transport healthcare waste (HCW) to disposal sites within the hospital premises, and to disinfect and to wash soiled linen before sending it to the central laundry. As explained in Chapter 4, the NRH, has the largest number of hospital cleaners and was therefore, the most convenient hospital at which to conduct focus group interviews.

7.1. FOCUS GROUP INTERVIEW

The objective of the focus group interviews in this study was to assess hospital cleaners' knowledge, examine existing practices, identify problems encountered in the work place whilst managing infectious waste, and to explore common experiences.

Four focus group interview sessions were conducted between November 2008 and February 2009 with the hospital cleaners in a meeting room at their work place. The number of participants in each focus group ranged from nine in group A, eight in group B to seven each in groups C and D. A set of semi-structured, open-ended questions (see Appendix G) was used as a guide to explore participants' knowledge on handling of infectious waste, current practices and their awareness of associated risks. As explained in Chapter 4, since only a few of the informants had undergone formal schooling, the sessions were conducted mainly in the local language, although English was used occasionally. As the group discussion progressed, questions were modified and prompts used to encourage further discussion. All the sessions were moderated by the researcher and the duration of interviews ranged between 60 and 90 minutes. Oral consent was obtained from each group to tape-record the sessions prior to commencement of the focus group interviews. Notes were also taken during the session. As a token of appreciation for their participation, tea and snacks were served at the end of each session.

Since the focus groups were conducted mainly in the local language the researcher translated the recorded discussions into English for thematic analysis of data. The findings from the analysis of focus group interviews are reported below, beginning with a profile of participants. The different groups are represented by the letters A, B, C and D.

7.2. PARTICIPANTS' PROFILE

Although all the 40 hospital cleaners working at the NRH were invited to participate in the focus group interviews, only 31 (19 female and 12 male) chose to be in the study, a participation rate of 77.5%. Years of service as cleaners in hospital ranged from two to nineteen years. Within the group, only seven had attended a formal school, and year eight was the highest level of schooling. All came from a low socio-economic background.

7.3. KNOWLEDGE AND PRACTICE

Although there was no formal training curriculum for hospital cleaners, the general consensus among informants from all four groups that they had undergone some training in the form of a workshop, more of hands-on lasting from half a day to a full day. However, some of the informants, especially those who had been in the service for a longer period, reported that such training had been available only in the last two to three years. Prior to this, no training was provided. With little bit of prompting, the informants reported that topics covered during the training were:

- types of waste (infectious, sharps, non-infectious such as food and paper waste);
- the use of different colour receptacles (red for infectious, yellow for sharps);
- the use of red plastic bags to line infectious waste receptacles and green plastic bags for non-infectious waste;
- the use of personal protective equipment and its importance whilst handling waste;
- the transportation and disposal of waste, taking the shortest route to disposal site;

- the risks associated with infectious wastes and sharps;
- the preparation of disinfectant (chlorine) solution; and
- the disinfection of soiled linen before sending to the common laundry.

These topics formed the basis of the focus group discussion. The general consensus among participants was that the training was good and helpful, enabling them to become more aware of the associated risks of infectious waste and helping them to be cautious while handling the waste.

When asked to give examples of infectious waste, and what they learnt from the training, participants responded appropriately, for example:

A

Blood, any blood and pus stained items like cotton balls, gauze, sputum, used needles and dressings.

B

Laboratory specimens (stool, urine, blood, vomitus), placentae

Other topics that they learnt during the training as reported by the informants were:

C

To protect ourselves by always wearing gloves and not touching infectious waste with bare hands.

B

To put all the infectious wastes inside red plastic bags lining red bucket and to be taken for autoclave. Non-infectious waste to be placed inside green plastic bags, lining the green bucket and disposed of into municipal waste receptacles.

D

Not to transport waste through the pathway that is used by pedestrians, staff, patients and attendants and to use the shortest route while transporting waste.

Although focus group participants reported that they had received training on healthcare waste management, they also spoke of their inability to practise what they learnt because of lack of facilities, inadequate supplies, lack of support from doctors and nurses as well as patients and their attendants. Further prompting revealed a number of reasons for not following recommended procedures for the various tasks of managing infectious waste. These are outlined in the following sections:

7.3.1. Waste Receptacles

The inability to conform to recommended use of colour-coded waste receptacles and plastic bags for waste was because of an inadequate and irregular supply of these items. Therefore, the cleaners used whatever receptacles or plastic bags were in stock (for example using red plastic bags as a lining for both infectious and non-infectious waste). When questioned how they differentiated between the infectious and non-infectious waste in such situations, especially after removing the plastic bags from the waste receptacles, typical comments of focus group participants were:

A

If green plastic bag is lining red receptacle, it is infectious waste, but if red plastic bag is lining green bucket it is non-infectious. This is our everyday work, so we know.

A

We can differentiate by looking at the waste inside the bags. For example, if there are gloves, cotton balls, dressing gauze with pus or blood, then we know it is infectious, so we take for autoclave, otherwise dispose in city receptacles.

7.3.2. Segregation of Infectious Waste

Discussions related to segregation of infectious waste revealed that manual sorting of infectious waste was practised despite the cleaners being aware of the risks involved. As three participants explained:

D

The staff only tells us to sort the waste manually. Not only that, at times we have to pick wastes and sharps from the floor, lying next to the receptacle.

A

If we take the waste as it is for autoclaving, we get blamed for not properly segregating the waste as this increases the waste load for autoclaving. So, we feel compelled to sort the waste manually despite the fear and knowing the risk of contracting injury or infection. If we do not do, who will do this? After all this is our job only.

B

Sometimes staff threw sharps with other infectious waste. When this waste containing the sharps is shredded, it spoils the machine and we again get blamed for causing the damage to the shredder.

When cleaners were questioned whether they reported to nurse unit managers on such practices as having to manually sort out infectious from non-infectious waste after staff dispose of waste in incorrect receptacles or on to the floor, some typical responses were:

A

What is the use, even if we report to the nurse unit manager, they tell us that they don't know who has thrown in the wrong receptacle or on the floor. Or sometimes they say that they were busy and must have thrown into wrong receptacles accidently or on the floor.

A

Staff only tells us to wear gloves and to pick up from the floor and at the same time cautioning us to be careful not to get hurt. This is our job, so better to do rather than complain about it.

7.3.3. Storage Place for Waste

The general consensus of the groups was that there was no specified storage place for infectious waste. According to participants, the current practice was that waste receptacles from in-patient wards were emptied twice in a day (morning and afternoon) but in the Out-Patient Department (OPD) waste receptacles were emptied only once, either in the afternoon after the clinic closed or the next morning. The cleaners had to collect waste from different areas of the wards. Plastic bags containing the waste were removed from the waste receptacles and, together with cardboard boxes containing sharps, were placed temporarily either along the corridors of the wards or under the staircase before being transported to the disposal site. Focus group participants reported that very often waste collected from different units of the OPD was piled up in the corridor until it was disposed of the next morning.

7.3.4. Preparation of Chemical Disinfection

The hospital cleaners confirmed that they were responsible for the preparation of chlorine solution to disinfect reusable items and to wash soiled linen (linen stained with blood, faeces, urine or any bodily fluid discharges). Most participants reported that sometimes they did not adhere to the instructions strictly while preparing the chlorine solution. The reasons stated were, either because of loss or breakage of the measuring device and no replacement, or because the markings on the device had faded away. Some reported that it took more time to measure quantities, especially when they were busy, so they used an approximation to make the solution, as they felt this process to be faster.

7.3.5. Transportation of Waste

The informants said that they used the same pathway used by patients, visitors and staff, to transport waste (both infectious and non-infectious) either to the autoclaving unit or to the disposal site. Participants complained of lack of a separate pathway to transport the waste. On enquiring how they transported the waste, one of them explained:

C

We try to transport waste when there are less people but this is difficult. We cannot completely avoid them because of having to use the same pathway.

In the focus groups, participants agreed that a common practice was to remove plastic bags filled with waste from the receptacles to dispose of them. When questioned why waste was not transported along with the receptacle, they replied that waste receptacles did not have wheels on them, and when filled with waste was too heavy to be carried to the disposal site. They also said that plastic bags were more easily carried than were the buckets (used as waste receptacles). Another reason for not using the buckets was to save time, as they did not have to make as many return trips between the disposal site and location of waste receptacles.

The participants reported that waste carts were supplied to transport waste but that there were not enough of them. On being asked whether the cart was used specifically to transport waste, some informants said that they used the same cart to carry heavy materials from the medical store to respective units of the OPD and also to carry items back and forth to the central supply department for autoclaving. When questioned about the risks of transmission of infection with such practices, one respondent simply stated:

D

We clean with soap and water after transporting the waste, so it should be ok.

7.3.6. Waste Disposal

Infectious waste disposal

According to the focus group informants, anatomical parts were buried and placentae were disposed of into deep burial pits. Waste in red plastic bags (supposedly containing only infectious waste) was autoclaved before disposing of into municipal waste receptacles. Sharps were disposed of into deep burial pits. When questioned what they did once the deep burial pits were filled, response included:

> *A*
> *We put some fuel in the pit and burn the waste to create some space. Otherwise we have to dispose of into open pit and then burn them once the pit is filled up. To dig a new deep pit is a problem because of lack of land.*

Liquid infectious waste disposal

According to the informants, bodily fluid (blood, pus discharge, vomitus, suction contents) was flushed down toilets. Waste water from the washing of equipment and linen flowed into an open drain outside the hospital building. The consensus of the informants from all four focus groups was that they did not disinfect liquid infectious waste before flushing it down the toilet. They sprinkled some bleaching powder to clean the toilet but not with the intention of disinfecting infectious liquid waste. However, bleaching solution was used to disinfect soiled linen prior to washing it.

Sharps disposal

The discussions revealed that safety boxes, supplied by the Ministry as sharps receptacles, were disposed of into a deep burial pit once the receptacle was three-quarters full, but the plastic receptacles were reused after disinfecting with bleaching solution. Some informants also stated that sharps from the plastic receptacle were emptied into a bucket or cardboard boxes and disposed of into a deep burial pit located within the hospital premises. If the deep pit was full, they would dispose of the items into an open pit.

7.4. OCCUPATIONAL HEALTH AND SAFETY

Occupational Health and Safety (OHS) is an important aspect of healthcare waste management to prevent work related injuries and protect the health of staff by providing a safe work environment. In relation to OHS issues, questions on the availability and usage of personal protective equipment and incidents of needle stick injury were asked during the focus group interviews.

7.4.1. Personal Protective Equipment

As reported by participants, the personal protective equipment (PPE) supplied to them consisted of surgical gloves, masks, gum boots, aprons and utility gloves. The cleaners commented that they preferred to work without using utility gloves. The general view of the groups was that the utility gloves supplied were of poor quality and tore very quickly, even with less frequent use. Utility gloves were not available in appropriate sizes and were therefore uncomfortable to work with and often fell off. Moreover, because of the short length of the gloves, water would get inside them. They also stated that after making repeated complaints to the hospital administration, the supply of utility gloves was stopped and instead they used surgical gloves which they said were more comfortable and fitted their hands better.

When asked about use of PPE whilst handling infectious waste, the majority of participants reported wearing only surgical gloves; however, they wore gum boots and aprons whilst washing soiled linen and during general cleaning of the wards and toilets.

Some informants stated that they had to manually wash ward linen, soiled with blood, faeces and urine before sending them to the common laundry. The soiled linen had to be soaked in bleaching powder for 10 to 15 minutes and washed with detergent and tap water. They said that in the process of washing the linen, sometimes splashes of water would get into their eyes and inside the gloves. It was also reported that the chlorine was used to disinfect soiled linen and this caused some irritation to the eyes. When asked whether they used eye shields or goggles to minimise irritation from chlorine and to prevent splashes of soiled water getting into their eyes or face, responses were:

A

We are not supplied with the goggles. Even if we ask for the goggles, we are told, for what we need the spectacles. So we have stopped asking for it.

B

When we ask, the in-charges either say that spectacles are not available or have limited stock in the store. They tell us that we do not need spectacles whilst washing linen.

During the interviews, it was revealed that goggles were issued to cleaners working in laboratories only and not to those working in other areas of the hospital.

7.4.2. Needle-Stick Injury

Although many participants reported sustaining needle-stick injuries, none said that they had acquired any infection. Further questions were asked to explore what they did following a needle-stick injury. The general consensus of the participants were that they squeezed out some blood as soon as they sustained an injury, washed with soap and water, and obtained one dose of tetanus toxoid injection with a prescription from a doctor.

On questioning about the requirement to perform a blood test following the needle-stick or a sharp injury, none of the participants were aware of the needle-stick protocol which mandates a blood test following an incident of needle-stick injury. In the whole group, only one participant who sustained an injury was advised by the doctor to have a blood test. The rest of the participants said that even though they reported to a doctor after sustaining an injury from sharps, they were never advised for a blood test.

7.5. PROBLEMS

The general view of hospital cleaners is that despite knowing the risks associated with unsafe practices of managing infectious waste, because of their relatively low status, lack of education, and the fear of losing their jobs, they feel compelled to work under such situations as listed in Table 7.1.

Table 7.1 Major problems identified by hospital cleaners in managing infectious waste

- Waste thrown into wrong receptacles and having to be sorted manually despite being aware risks of contracting infections and sustaining injuries
- Frequent picking up of waste from the floor despite receptacles being in the vicinity
- Lack of support from staff as well as patients and their attendants who discard waste in any receptacle available
- Irregular and inadequate supply of waste receptacles and plastic bags
- In the absence of a separate pathway to transport waste, cleaners have to use a common pathway and also be cautious not to injure anybody in the process of transporting waste to the disposal site; and
- Inappropriate and irregular supply of personal protective equipment

7.6. SUMMARY

The views and experiences of hospital cleaners are important for this study as they are responsible for the actual collection, storage, transportation and disposal of infectious wastes within the hospital premises. Although the cleaners had undergone training on healthcare waste management, they were unable to put their training into practice because of inadequate infrastructure and facilities, irregular supplies and inadequate support from health professionals, patients and their attendants. Despite being aware of risks associated with infectious waste and sharps, the hospital cleaners manually extracted infectious waste with limited and inappropriate PPE.

It was revealed that there are problems related to infection control such as using waste carts for other purposes and ineffective disinfection of soiled linen and reusable items because of incorrect measurements of concentration of the disinfectant. There was no proper reporting (and therefore no follow-up) after a needle-stick injury. Findings from this focus group interviews will be integrated with those from other methods and discussed in Chapter 9.

CHAPTER 8

OBSERVATION OF INFECTIOUS WASTE MANAGEMENT PRACTICES

This chapter presents findings from observation of infectious waste management practices at the National Referral Hospital (NRH) in Thimphu, Bhutan. As described in Chapter 4, the observational study was designed to enable the researcher to obtain first hand information about the actual practices of infectious waste management in the hospital. In addition, it allowed comparisons to be made between what was reported in the surveys and in the interviews with the actual practices of infectious waste management within hospital.

Observations were conducted at the NRH in-patient wards and the out-patient department (OPD) between November 2008 and February 2009 for 40 individual days. A check-list (see Appendix I) was used for the observation. Lists of different units observed are provided in Figure 4.4 in Chapter 4. It was not intended to observe practices of infectious waste management on the part of individual staff members. Rather the aim of the observation was to obtain an understanding of hospital infectious waste management practices at the NRH. Therefore, the focus of observation was on types, colour and location of waste receptacles, and the segregation, collection, storage, transportation and disposal of infectious waste and sharps from the site of generation to final disposal area within the hospital premises. The overall safety and risks present in the existing system of infectious waste management were also noted. Besides using a checklist, field notes were recorded. Memelakha, the only municipal landfill for the city of Thimphu, which is located 12 kilometres from the city, was also visited.

As part of the observation, photographs were taken to record examples of specific problems with waste management practices. Since the photographs were taken during the specific period of observations, it is not possible to make a claim that they necessarily recorded everyday practices. Findings from the observation are presented as follows in relation to: *waste receptacles, segregation, location of waste receptacles, labeling of waste, level of waste in the receptacles and storage place for waste, transportation of waste, waste treatment and disposal methods, hospital disposal site and municipal landfill*.

8.1. WASTE RECEPTACLES

In accordance to the guidelines, red plastic buckets for infectious waste and yellow or white puncture proof or safety boxes for sharps are the recommended colour receptacles.

8.1.1. Infectious Waste Receptacles

At the NRH, plastic buckets were used for collecting different categories of healthcare waste. It was observed that plastic buckets with a lid and plastic bag lining were used to collect infectious waste in all the units of the hospital except in the dental unit, where a steel receptacle, double layered and with a foot pedal, without a plastic bag lining was used. Although, red buckets were the most commonly used receptacles for infectious waste, the use of other colours, including yellow, green and blue was also observed. One swing-top yellow receptacle lined with a pink plastic bag was observed to contain infectious waste (see Photographs 8.1, A).

Photographs 8.1 Examples of use of incorrect receptacles for infectious and non-infectious wastes

Pink plastic bag in yellow waste receptacle containing infectious waste

Non-infectious waste in red receptacle

(A) (Photograph taken on December 8, 2008)

(B) (Photograph taken on February 6, 2009)

At the NRH, other than in the dental unit, there was only one sized (large) bucket without wheels or a foot pedal to open the lid as waste receptacles. The buckets used as waste receptacles were observed to be inconvenient as the lid had to be lifted each time waste was deposited and in most instances, receptacles were kept uncovered. Furthermore, since, the waste buckets did not have wheels on them, plastic bags filled with waste were taken out from the receptacles and the hospital cleaners carried them manually to the disposal site, instead of carrying the waste bag within the receptacle to the site.

8.1.2. Plastic Bags

According to the guidelines, the recommended colour of plastic bags to line the infectious waste receptacles is red, while green-coloured plastic bags are to be used for non-infectious waste receptacles. Both red and green plastic bags had the label "JDWNRH" (Jigme Dorji Wangchuk National Referral Hospital). However, it was observed that in some units in the hospital these plastic bags were used interchangeably; that is, red plastic bags were used as lining inside non-infectious waste receptacles while green plastic bags were inside infectious waste receptacles (see Photographs 8.2).

Photographs 8.2 Examples of incorrect use of plastic bag lining the waste receptacle

Infectious waste receptacle

Green plastic bag lining

(A) (Photograph taken on December 8, 2008)

(syringe covers, paper)

Red bucket with pink plastic bag lining

(B) (Photograph taken on February 6, 2009)

Green plastic bag lining

Gloves

(C) (Photograph taken on January 31, 2009)

Although the World Health Organization (1999) recommends the use of biohazard symbols on various hazardous HCW, the infection control (IC) and HCWM guidelines do not specify their use. However, in the entire NRH, only the plastic bags used in the Public Health Laboratory (PHL) displayed the biohazard symbol although without the *JDWNRH* label. Moreover, it was observed that these plastic bags were also used to line receptacles for general non-infectious waste in the laboratory as illustrated in Photograph 8.3.

Photograph 8.3 Example of plastic bag with biohazard symbol used for non-infectious waste

Non-infectious waste

Red plastic bag with biohazard symbol

Green waste receptacle

(Photograph taken on February 9, 2009)

8.1.3. Sharps Receptacle

The recommended receptacle for sharps is a safety box (a thick cardboard box manufactured specifically to collect sharps) or a puncture-proof receptacle. The recommended standard colours for sharps receptacles are either yellow or white. However, besides the use of recommended receptacle and the colour, other receptacles such as small plastic boxes (red colour), empty plastic tablet receptacles and a steel receptacle (with a foot pedal) were observed to be in use. In the general laboratory an ordinary waste receptacle with red plastic bag lining was observed to be in use (see Photograph 8.4). In another unit, hospital cleaners were observed emptying the contents of sharps receptacles into an ordinary bucket and then reusing the receptacles after rinsing with tap water.

Photograph 8.4 Example of collection of sharps in the wrong receptacle

Broken test tubes and vials (Incorrect sharps receptacle)

Ordinary waste bin lined with red plastic bag

(Photograph taken on February 9, 2009)

As reported in Chapter 5, during the interviews some policy makers stated that Nulife Dots (needle destroyer) had been supplied to health facilities for the proper management of sharps (injection needles) and to reduce risks of infection and injury. According to its instructions in the guidelines published by the Ministry of Health, the device uses a low voltage electric current to reduce the needle to ashes and destroys the syringe hub within two seconds without any visible sparks. However, the guidelines recommend the use of masks and eye protection whilst using the equipment due to concerns about aerosols emitted by the device.

In the whole hospital, the use of Nulife Dots was observed in only three units, that is the injecting room and minor operating room in the out-patient department, and in the reproductive health unit. In the remaining units of the hospital, the equipment was not being used at all. However, in all the three units that used the needle destroyer, it was observed that the device, neither burnt the needles to ashes nor destroyed the syringe hub, but instead generated more sharps by cutting the needles into pieces (see Photograph 8.5).

In reality the ash chamber of the device served as a sharps receptacle. In the injection room in OPD, it was observed that the ash receiving chamber (which is not meant to receive sharps) filled up quickly with sharps as the equipment did not reduce the needles to ashes. Each time the chamber filled with sharps, staff emptied the contents from the chamber into a sharps receptacle. Whilst using the device, no staff members were seen using either a mask or an eye protection as recommended in the operating instructions of the Guideline for Infection Control and HCWM in Health Facilities.

Photograph 8. 5 Unburnt sharps in the ash chamber of a Nulife Dots machine in the injecting room in OPD of NRH

(Photograph taken on January 31, 2009)

8.2. SEGREGATION

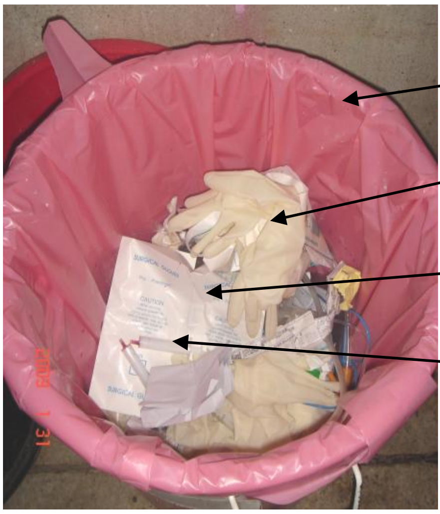
According to the guidelines infectious waste and sharps are to be segregated at the source and collected in appropriate receptacles. However, observation at the National Referral Hospital revealed inconsistent practices of segregation.

8.2.1. Infectious Waste Segregation

Although there were attempts made to segregate infectious waste at source, during the period of observation not a single unit in the hospital practised complete segregation of infectious waste. There was still mixing of infectious and non-infectious waste (see Photograph 8.6 A), rendering all of the waste infectious. Dry non-infectious waste such as paper, plastic covers, juice packets, gloves packet boxes, noodle packets (see Photograph 8.6 C) and sharps were observed in infectious waste receptacles (see Photograph 8.6 B). Hospital cleaners wearing surgical gloves were observed extracting infectious waste from non-infectious waste receptacles and putting it into infectious waste receptacles and likewise transferring non-infectious waste from infectious waste receptacles.

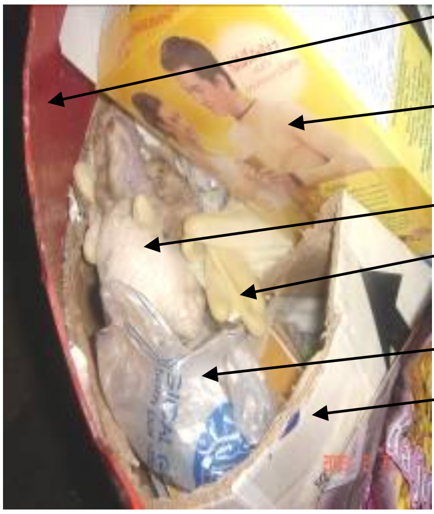
Photographs 8.6 Examples of mixing of infectious and non-infectious waste

(A)



(Photograph on January 31, 2009)

(B)



(Photograph taken on February 6, 2009)

(C)

(Photograph taken on December 8, 2008)

8.2.2. Sharps Segregation

Photographs 8.7 Examples of the mixing of sharps with non-sharps waste

Green plastic bag lining the receptacle

Plastics

Syringes

Cotton balls

Vial

(A)

(Photograph taken on January 31, 2009)

Sharps receptacle

Sharps inside the needle cover

Cotton swab blood stained

Needle cover

(B)

(Photograph taken on January 31, 2009)

Sharps receptacle (improvised)

Medicine vial

Cotton ball

Broken ampoule

Syringes

(C)

(Photograph taken on February 6, 2009)

As reported by the participants in the survey and from what was observed, the practice of segregation of sharps was better than that of infectious waste. However, there was still a mixing of sharps with non-sharps waste. For example, cotton swabs, syringe covers, paper and plastics were observed in sharps receptacles (see Photographs 8.7 B & C) while syringes, ampoules and vials were found in a non-designated sharps receptacle lined with green plastic bag (see Photographs 8.7 A).

8.3. LOCATION OF WASTE RECEPTACLES

There was no specified location for infectious waste within the hospital facility. In several instances, it was observed that waste receptacles were placed either near to nurses' work stations, next to wash basins (see Photographs 8.8 A), by entrance doors (see Photographs 8.8 B) or kept in the corridors (see Photographs 8.8 C) used by patients and their attendants, visitors and health staff. In the Out-Patient Department some of the waste receptacles were located next to the patient waiting area (see Photographs 8.8 D).

Photographs 8.8 Examples of locations of waste receptacles

(A)

(Photograph taken on December 8, 2008)

Photographs of examples of locations of waste receptacles (continued)

(B)

Hand washing area

Waste receptacle (pink plastic bag lining)

Black waste receptacle with green plastic bag lining

Entrance door

(Photograph taken on January 31, 2009)

(C)

Corridor (in-patient ward)

Red buckets lined with green and red plastic placed in the corridor

(Photograph taken on February 6, 2009)

(D)

Patients in Out-Patient Department

Patients' waiting area

Black waste receptacle with green plastic

Red plastic bag without a receptacle on

(Photograph taken on January 31, 2009)

8.4. LABELING OF WASTE

According to the Environmental Code of Practice for Hazardous Waste Management of Bhutan, all waste receptacles containing hazardous waste are to be labeled both in English and Dzongkha, the national language. However, during the observation, it was observed that only some infectious waste and sharps were labeled in English but none in Dzongkha. There was no uniform practice of labeling. All of the observed labels were hand written either on the lid or on the side of the receptacle as illustrated in Photographs 8.9 A and C. In the Emergency and Casualty Unit, the label was written on the wall (Photographs 8.9 B).

Photographs 8.9 Examples of labeling of waste

(A) **(B)** **(C)**

Photographs taken on December 15, 2008, January 31 & February 6, 2009 (left to right)

8.5. LEVEL OF WASTE IN RECEPTACLE

According to the guidelines the content of infectious waste receptacles and sharps receivers are to be disposed of when the receptacles are three-quarters full. However, it was observed that in some in-patient wards, sharps receptacles were either filled to the brim or overflowing with waste (see Photographs 8.10 A & B) while Photograph 8.10 B illustrates sharps in a wrong receptacle. In the Out-Patient Department, infectious waste receptacles were emptied in the evening after the clinic working hours irrespective of them being three-quarters full or empty.

Photographs 8.10 Examples of level of sharps in the receptacle

Sharps overflowing

Sharps filled to the brim

Sharps in wrong receptacle filled to the brim

(A) (B)

(Photographs taken on February 6, 2009)

8.6. WASTE STORAGE PLACES

There were no specific places in the hospital allocated for storage of either infectious waste or sharps prior to disposal. Waste from in-patient wards was stored temporarily under the main staircase or kept in the corridors of respective units (see Photographs 8.11 B) before transporting for treatment or to the disposal site. In the OPD waste receptacles or plastic bags containing waste were kept in the corridors (see Photographs 8.11 A).

Photographs 8.11 Examples of storage place for waste

Corridor

Red (infectious waste) and green (non-infectious waste) plastic bags in the of OPD after clinic hours

(A)

(Photograph taken on December 15, 2008)

Photographs of examples of storage place for waste (continued)

(B)

Black waste receptacle (non-infectious waste)

Infectious waste

Corridor of the in-patient ward

Cardboard box containing sharps

(Photograph taken on December 15, 2008)

8.7. TRANSPORTATION OF WASTE

The NRH buildings are widely spread out and there is only one disposal site within the premises. As illustrated in the photographs, none of the waste receptacles had wheels. Instead of carrying the waste within the receptacle to the disposal site, plastic bags filled with waste were removed from receptacles. Plastic bags were either hand carried or transported on carts with wheels to the disposal site. However, in the OPD, the same cart was observed being used to carry medical supplies from the store (see Photograph 8.12), and dressing packs and drums to the central supply unit for autoclaving (see Photograph 8.13).

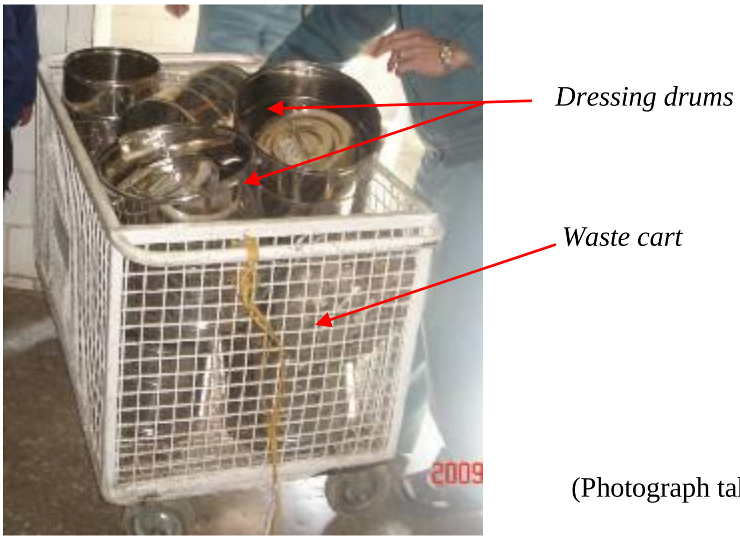
Photograph 8.12 Example of a waste cart used to transport medical supplies

Medical supplies

Waste cart

(Photograph taken on December 9, 2008)

Photograph 8.13 Example of a waste cart being used to carry dressing items for autoclaving



(Photograph taken on January 31, 2009)

There was no separate pathway to transport waste to the treatment or disposal site. The same pathway used by pedestrians, staff, patients and visitors was also used for transporting wastes from the hospital to the disposal site within the premises.

8.8. WASTE TREATMENT

In the guidelines, autoclaving or incineration are the recommended methods of treatment for solid infectious and chemical disinfection for liquid infectious waste. At the time for observations for this study, the NRH had ceased the use of incineration since the hospital had initiated the autoclaving of infectious waste.

8.8.1. Autoclave

As revealed during the focus group interviews with hospital cleaners, infectious waste from laboratories was to be autoclaved by the laboratory technicians, then discarded into waste receptacles and taken to the disposal site by the hospital cleaners. The monitoring of effectiveness of autoclaving was the responsibility of laboratory technicians. Infectious waste from the remaining areas of the hospital was carried by the cleaners to the common autoclaving unit, located outside main hospital buildings. After autoclaving, the waste was unloaded from the machine and disposed of into municipal receptacle, which was then taken to the landfill at Memelakha in a municipal truck. According to the guidelines, a chemical indicator strip is to be used (does not specify whether the chemical strip should be used with every new load of waste) to indicate effective treatment of waste, ensuring safe disposal. However, at the time of the observation, use of the chemical indicator strips was not observed. On enquiry it was found that the chemical indicator strips were not currently used.

8.8.2. Chemical Disinfection

Chlorine (bleaching powder) was used as the chemical disinfectant to disinfect soiled linen and reusable items. Extra bleaching powder was sprinkled over soiled linen which was then soaked in the chlorine solution before washing with detergent and water. In one of the units it was observed that three to four layers of soiled mackintoshes (thick waterproof material used to prevent soiling of bed linen in hospitals) were kept on the floor and bleaching powder sprinkled on the top of them along with some water but not in between the layers. There was inadequate solution to soak between the layers to disinfect effectively.

It was also observed that reusable items were soaked in disinfectant (chlorine) in a bucket but were not fully immersed in the solution nor was the receptacle covered with a lid (see Photographs 8.14 A). For some reusable items, the bucket was too small to accommodate the item and it protruded from the bucket (illustrated in Photograph 8.14 B).

Photographs 8.14 Examples of improper disinfection of reusable items

(A)

Reusable items not fully immersed under the disinfectant

Bucket less than half filled with disinfectant

(Photograph taken on December 15, 2008)

(B)

Tray protruding out from the bucket

Bucket containing less than half filled with disinfectant

(Photograph taken on February 6, 2009)

8.9. WASTE DISPOSAL

8.9.1. Solid Infectious Waste

According to the guidelines, solid infectious wastes are to be disposed of into a municipal waste receptacle after autoclaving, whereas anatomical parts are required to be buried and placentae disposed of directly into a deep burial pit. At the time of observation, it was uncertain whether the pink plastic bags supposedly containing infectious waste had been rendered safe for disposal into the municipal bin (see Photographs 8.15 B). There was only one municipal bin and it was filled to the brim and waste was lying on the ground around the bin. As illustrated in Photographs 8.15 C a dog was rummaging through the waste and scattering it.

Photographs 8.15 Municipal bin within hospital premises

(A)

(Photograph taken on January 15, 2009)

(B)

(Photograph taken on December 19, 2008)

(C)

(Photograph taken on January 15, 2009)

8.9.2. Liquid Infectious Waste

It was observed that the contents of suction apparatuses was emptied directly into toilets without first being disinfected, and liquid infectious waste from washing of soiled linen and articles was released directly into open drains outside the building (see Photographs 8.16 'A & B') to eventually flow into an open area within the hospital premises as illustrated by Photographs 8.16 C. According to the guidelines, liquid infectious waste is to be disinfected with 0.5% chlorine solution for 10 minutes duration before disposal.

Photographs 8.16 Examples of liquid infectious waste flowing into open drain

(A)

Infectious liquid waste from the laundering of blood-soiled linen flowing into open drain outside hospital.

Foot path used by staff, patients and their attendants

(Photograph taken on December 2, 2008)

(B)

Pedestrian pathway

Infectious liquid waste flows down collecting more such waste from in-patient wards through the open drain. The drain can be accessed by stray animals.

(Photograph taken on December 2, 2008)

(C)

The drain carrying infectious liquid waste eventually flows into an open area in close proximity to staff residences

(Photograph taken on January 15, 2009)

8.9.3. Sharps

According to the guidelines, sharps are to be destroyed by using Nulife Dots equipment and the ashes discarded into a deep burial pit. In the absence of the equipment, sharps are to be disposed of into a deep pit. However, during the period of the observation, sharps were not completely destroyed by the Nulife Dots (as shown in Photograph 8.5). As illustrated in Photographs 8.17 'A & B' sharps were found to be disposed of into an open pit with some needles and syringes exposed.

Photographs 8.17 Examples of incorrect disposal of sharps

(A)

Sharps receptacles disposed of into an open pit within the hospital premises

(Photograph taken on February 6, 2009)

(B)

Exposed needles and syringes in the open pit

(Photograph taken on February 6, 2009)

8.10. HOSPITAL WASTE DISPOSAL SITE

The disposal site within the hospital premises was located in close proximity to a main public road, a primary school and residential areas (see Photographs 8.18). Although the site was fenced by a hurricane wire fence, 1.3 meters high and kept locked, people could easily gain access by climbing over the fence (as illustrated in Photograph 8.18, C).

At the time of the observation a portion of the fence (from the main road side over the cement wall) was bent in once section, indicating that climbing had occurred. The hospital cleaners were observed burning the waste inside the deep pit to create some space as it was full. As shown in Photographs 8.18 'A & B'), the open pit was also full of sharps and several red plastic bags. Some sharps were clearly visible (as shown in Photograph 8.17, B). The close proximity of the open pit to the main public road, easy access into the pit (because of low height of the fence and the cement wall) provided easy accessibility for scavengers looking for needles and syringes.

Photographs 8.18 Location of the National Referral Hospital disposal site

(A)

Cement wall separating the main motor road and the hospital disposal site.

Deep pit burial

Open pit

(Photograph taken on December 19, 2008)

(B

Residences overlooking the hospital pit site

Pedestrians

Hurricane fence (1.3 meters high)

(Photograph taken on February 6, 2009)

(C)

Location of the school

Easy access to disposal site from the cement wall near the main motor road

(Photograph taken on February 6, 2009)

8.11. MUNICIPAL LANDFILL

At the time of the visit to the municipal landfill site at Memelakha, the municipal waste truck arrived with a full load of waste brought in from Thimphu urban area. The researcher saw municipal waste handlers manually unloading waste from the truck without using any personal protective equipment. The waste was extracted from the truck using a long pitchfork. The site was more like a waste dump than a landfill. Dogs with puppies, as well as cows were observed roaming amidst the waste. There were a few adults and children from a nearby dwelling collecting scrap (metal, plastic bottles). People were observed collecting scrap from the tip without using any personal protective equipment (see Photographs 8.19 B). Although it was winter season, there were number of flies and a foul odour.

Photographs 8.19 The municipal landfill at Memelakha

(A)

Waste from the tip overflowing

A dwelling next to the tip

(Photograph taken on February 13, 2009)

Cows, dogs and people amidst the waste.

People scavenging waste without personal protective equipment

(B)

(Photograph taken on February 13, 2009)

Photographs of the municipal landfill at Memelakha (continued)

(C)

Hospital waste (the green and red plastic bags with JDWNRH label) in the landfill

(Photograph taken on February 13, 2009)

(D)

Surgical gloves

Dressings

Intravenous bottle and tubings

Syringes

(Photograph taken on February 13, 2009)

Syringes and needles, gloves, used dressings and intravenous sets were observed at the site, as well as “JDWNRH” labeled red and green plastic bags (see Photographs 8.19 ‘C & D’).

8.12. SUMMARY

It cannot be claimed that the findings from the observation reflect everyday practice of infectious waste management. However, during the period of observation, violations of the Waste Prevention and Management Act of Bhutan, Environmental Codes of Practice for Hazardous Waste Management and the Guideline for Infection Control and HCWM in Health Facilities were observed. Breaches were evident in each stage of infectious waste management practice, starting from the segregation of waste at the source to its final disposal. Examples include the incorrect use of colour coded waste receptacles and plastic bags, mixing of infectious and sharps at the source, and access to sharps and infectious waste due to lack of safe and secure storage places. There were risks associated with the occupational health and safety of the people handling the infectious waste as well as to the patients and the public. The risks involved manually extracting infectious waste from non-infectious waste receptacles, using the same pathways as pedestrians to transport infectious waste and sharps, incorrect and ineffective chemical disinfection of reusable items and liquid infectious waste, the release of liquid infectious waste into open drains close to the pedestrian pathways and the use of the waste trolley to transport clean goods. These issues are further discussed in the next chapter.

CHAPTER 9

DISCUSSION: POLICY AND PRACTICE

In this chapter the findings from the research described in Chapters 5-8 are reviewed. Integration of data from document analysis, in-depth interviews with policy makers, a survey of doctors and nurses, focus group interviews with hospital cleaners and observation of waste management practices enabled the assessment of both the adequacy of policies for hospital infectious waste management and the consistency between policy and practice.

This discussion is presented in three main sections: the *national level* focusing on regulatory frameworks and guidelines, codes of practice, infectious waste management committees, and roles and responsibilities; the *translation of policy at institutional level* concerning issues related to waste management plans, infrastructure, supplies, monitoring and evaluation systems, and training programs necessary to facilitate policies into operational tasks; and infectious waste management practices from the production of waste to its disposal. Occupational and public health and safety issues evident in the current practices of infectious waste management are highlighted. Finally, at the *individual level,* issues related to the knowledge and practice of participants, their views on the standard of infectious waste management, leadership, communication and team support are discussed. The limitations and benefits of the study are also described in this chapter.

9.1. THE NATIONAL LEVEL

In Bhutan, any legislative changes or policy decisions made at the central level apply throughout the country. Legislation relating to overall waste management in Bhutan lays the foundation for improving the system of infectious waste management as it empowers the Ministry of Health to implement safe healthcare waste (HCW) management practices in all health facilities. How well legislation and regulations are structured will influence the overall process of effective implementation of the healthcare waste management system. The legislation has to be supported by a policy framework and technical guidelines, including measures to enforce the legislation for an effective and sustainable system.

9.1.1. Regulatory Framework and Guidelines

Analysis of the existing legislation and guidelines related to hospital infectious waste management in Bhutan revealed several gaps and weaknesses. As reported in Chapter 5, the Waste Prevention and Management Bill of Bhutan, enacted in 2009, is the only legislation pertaining to waste and applies to all categories of waste (including HCW) generated in the country. A general definition of the term *medical waste* is provided in the Act but there is no consideration of different categories of medical waste.

According to the Act, the onus for developing rules and regulations related to HCW is on the Ministry of Health. Other than the *Guideline for Infection Control and Healthcare Waste Management in Health Facilities*, published in 2006, the Ministry to date has not developed formal rules and regulations. The Audit Report on Medical Waste Management commented on the need for guidelines to be transformed into rules and regulations, and highlighted the lack of accountability for the effective management of HCW. The Guideline document was developed prior to the enactment of the Waste Prevention and Management Bill of Bhutan. In the guidelines, waste from health facilities is termed *healthcare waste* whereas in the Act it is termed *medical waste,* thus revealing inconsistency in the use of the terminology.

The in-depth interviews with policy makers and the survey of health professionals revealed that the standards of management of infectious waste perceived as less than satisfactory. The absence of any report of major incidents related to poor management of infectious waste gave the opposite impression that current practices were adequate and, therefore, did not need immediate attention for improvement. It can be argued that the absence of reports of major incidents does not indicate that infectious waste and sharps are being managed safely, as there have clearly been unreported incidents of needle-stick injuries (NSIs) which were not followed up to detect possible infections.

Kingdon (1984) identified a range of influences to bring about policy changes; one of them, which he calls, a *defining event*, draws the attention of policy makers to a particular problem. An example of such a “defining event” was the washing up of hospital waste along East coast beaches of United States of America. As Rutala and Mayhall have explained, the event became a highly publicised issue because of aesthetic concerns, pollution and public fear of Human Immunodeficiency Virus (HIV) infection, and ultimately led to reforms related to the management of healthcare waste (Rutala & Mayhall, 1992). In Bhutan, there has not been such a defining event involving infectious HCW to compel the attention of policy makers, despite the apparent poor standard of healthcare waste management (HCWM) practices.

Although the existing guidelines contain some instructions on the process of HCWM practice, there are discrepancies and inconsistencies in waste categorisation and instructions, as well as the use of incorrect examples. As described in Chapter 5, the categorisation of HCW is incorrect and confusing. In one section of the document, HCW is classified into ten types, in another it is categorised into three and yet another as four types of waste. In the classification, all types of HCW are not taken into consideration. It is not clear into how many categories HCW is to be segregated, as there are different instructions under different sections of the document. In addition, the use of different terms, such as *potentially infectious, highly infectious, hazardous or highly hazardous* for various categories of HCW does not make the waste any different from being *infectious or hazardous*, and potentially creates confusion for staff implementing the guidelines. There is a high possibility of staff misinterpreting terms and subsequently the guidelines may not be implemented correctly as intended.

As explained in Chapter 5, the guidelines include a table describing the recommended colour coding of waste receptacles, and treatment and disposal options for HCW. The title and contents of the table do not match. The contents of the table show only four categories of HCW, which include *infectious, sharps, non-infectious* and *food waste*. There is a possibility that staff may interpret this table to mean that the remaining category of HCW (pathological, pharmaceutical, chemical, cytotoxic, radioactive, pressurized containers and heavy metal wastes) do not require special treatment and disposal methods. Moreover, the 'treatment' column of the table, although labeled as treatment options, contains both treatment and disposal methods. It is left to individuals to decide between the treatment and disposal methods. There is a high risk of infectious waste reaching the landfill disposal site without being treated if correct treatment options are not selected by the staff.

All information and instructions in the guidelines should be correct, clear and specific. The use of 'et cetera' makes instructions unclear as it assumes that the reader already knows what is being referred to. As shown in Table 3.6 of Chapter 3, giving "c*atheter"* as an example of sharps is incorrect. Guidelines are used as a reference to implement correct practices. The simpler, clearer, correct and more specific a guideline is, the easier it is to be understood and implemented correctly.

Codes of Practice

As described in Chapter 5, although the Environmental Code of Practice (ECOP) for Solid Waste Management in Urban Areas stipulates the use of colour-coded waste receptacles to collect HCW, the Code does not specify the colour and its application to the type of waste. Likewise, the need to treat infectious waste prior to disposal is not identified in the Code and the recommended treatment methods are not outlined. With such unspecific instructions, there is a likelihood of people putting waste into incorrect receptacles, increasing the risk of mixing waste and resulting in exposure to occupational health hazards whilst handling waste which, as reported in Chapter 8, observable at the National Referral Hosptial (NRH). Similarly, the ECOP for Hazardous Waste does not specify what it is meant by ‘appropriate facilities’ or ‘waste receptacles’.

9.1.2. Infection Control and Healthcare Waste Management Committees

As reported in the findings in Chapter 5, two committees, one the policy making body related to HCW and the other, a technical committee to develop standards, conduct training sessions and monitor practice, were established in the Ministry of Health in 2004. Analysis of committee minutes revealed infrequent meetings of the committee formed to guide and monitor HCWM. For example, since the formation of the two committees in 2004, the last recorded meeting of the technical committee recorded was in December 2008, despite the decision made by members in 2004 to hold quarterly meetings. During the interviews, some committee members acknowledged their inability to execute their roles and responsibilities related to HCWM effectively because of their day-to-day tasks, which took precedence over the management of healthcare waste. Some of the participants in the survey have also commented on the lack of interest and commitment displayed by the committees.

9.1.3. Roles and responsibilities

According to the Waste Prevention and Management Act of Bhutan, the Ministry of Health is responsible for managing HCW generated from health facilities. Interviews with policy makers confirmed that hospital administrators were responsible for the overall management of healthcare waste, but for day-to-day management of the waste, the onus was on nurses and the hospital cleaners. Some of the policy makers were also of the view that as doctors were busy with patient management, they may not have time to be involved in managing HCW. In the absence of written job responsibilities, people who generated waste were not held accountable for poor waste management.

In order to make relevant departments, institutions, programs and people responsible and accountable for the management of infectious waste, and prevent duplication or confusion of tasks, roles and responsibilities must be clearly stipulated in the policy document. However, the roles and responsibilities require clarification. During the in-depth interviews, some of the informants were unclear whether the Department of Medical Service (DMS) or the Department of Public Health was responsible for the overall management of healthcare waste. This is despite the fact that Infection Control and Healthcare Waste Management Program is under the DMS.

The management of infectious waste involves different groups of people, with varying roles and responsibilities. All those working within the system, from those generating waste to those disposing of it, must be equally responsible and accountable for managing the waste.

9.2. TRANSLATION OF POLICY AT THE INSTITUTION LEVEL

In order to translate policy objectives into operational tasks at the institutional level there must be an enabling and supportive environment to facilitate the process of implementation. This requires a proper waste management plan developed for the local context, appropriate infrastructure and facilities, development of expertise through training programs, and monitoring and evaluation systems.

9.2.1. Waste Management Plan

In order to implement an effective comprehensive waste management system, there must be a plan based on appropriate means to implement a safe, environment-friendly waste management system. The process of planning involves formulation of objectives and outcome indicators and specification of infrastructure requirements, human resource development and budget allocations. Feasibility and practicality of different waste treatment and disposal techniques relevant to local needs should also be taken into consideration. Health resources are limited and proper planning could help efficient use of limited resources. As stated in Chapter 3, a HCWM Plan was developed by Danish International Development Agency (DANIDA) in 2004 but it still remains in draft form. Interviews with policy makers revealed the absence of a waste management plan both at the national and at individual institution levels. In the absence of a plan, the implementation of waste management risks being haphazard.

9.2.2. Infrastructure

The absence of a system of incorporating management of healthcare waste into overall hospital building plans emerged during the in-depth interviews with policy makers. As reported by the hospital cleaners during the focus group interviews and confirmed during the observation of waste management practices at the National Referral Hospital (NRH), there is neither a separate pathway to transport waste to the designated disposal site, a secure infectious waste and sharps storage place, nor a sluice room to clean reusable items and a laundry for soiled linen. Even the most recently built hospital complex in Thimphu, completed in 2008 does not have any of these facilities. This is despite the need for these facilities being clearly stipulated in the guidelines developed by the Ministry of Health, the Environment Code of Practice for Hazardous waste, as well as in the Bhutan Environment Outlook. The absence of facilities hampers optimal practice of managing the waste.

9.2.3. Supplies

The purchase of waste receptacles and personal protective equipment (PPE) is done locally by the individual hospitals. Contrary to the views of some policy makers, that the supply of items was adequate, available and accessible, focus group interviews with the hospital cleaners and the survey findings confirmed an inadequate supply of recommended colour waste receptacles and plastic bags, as well as PPE. As noted in Chapter 8, there was a lack of uniformity and inconsistency in the use of waste receptacles and plastic bags at the NRH, demonstrating practices that did not conform to the guidelines. Hospital cleaners complained of an irregular and inadequate supply of PPE, poor quality utility gloves (tearing easily) and inappropriate sizes. Survey participants also had similar complaints regarding the PPE. As reported in Chapter 7, face-shields were supplied only to hospital cleaners working in the laboratory and not to others. This is despite the hospital cleaners being exposed to splashes of contaminated water from manual washing of soiled linen.

The literature shows that hospital cleaners are at a higher risk of contracting infections or sustaining needle-stick injuries because of the nature of their work, which involves frequent handling and contact with infectious waste and sharps (Appleton & Ali, 2000; Rahman & Ali, 2000). The Occupational Safety and Health Administration Fact Sheet of United States (2011) emphasises the importance of the appropriate use of PPE to protect staff from workplace injuries or illnesses resulting from contact or exposure to infectious pathogens or other hazardous substances at workplace. Therefore, it is important that all the necessary PPE is adequate, available and accessible to any staff handling infectious waste irrespective of their socio-economic status or level within hierarchy of the organisation. However, it is equally important that people wear the appropriate PPE each time they handle infectious wastes.

The hospital administration has a moral duty to ensure the safety and safeguard the health of employees by providing a safe work environment and ensuring availability of all the necessary PPE. It is essential that people responsible for the supply of items understand the importance of providing adequate supplies and maintaining the uniformity of waste receptacles and plastic bags as specified in the guidelines. Irregular supply, deviation from the specified standard colour-coded waste receptacles and poor quality of items, will compromise safety. Furthermore, there is risk of mixing infectious waste with non-infectious waste resulting in the wrong category of waste reaching the landfill.

9.2.4. Monitoring and Evaluation System

There is a need to strengthen the system for infectious waste management in Bhutan. It is suggested that inadequate monitoring may have contributed to breaches in the practice of infectious waste management (as reported in observation findings in Chapter 8) and the lack of follow-up actions on reported incidents of needle-stick injuries (NSIs) as revealed by survey findings in Chapter 6. For example, Nulife Dots devices were provided to health facilities with the aim of minimising associated risks of sharps. As reported in Chapter 8, during observations at the NRH, the researcher found the device was either shelved or ineffective. During an interview, one of the hospital officials commented that the effectiveness of Nulife Dots was neither monitored nor evaluated following the distribution of the device. Investment in such a device is not only a waste of resources, but generates more sharps, increasing the frequency of handling of sharps and the risks of sustaining NSIs and contracting infections.

According to a few officials interviewed, poor supervision and monitoring was due to lack of people with the expertise in the area. One of the interviewees also acknowledged the failure of Ministry in delegating the responsibility of supervision and monitoring to people possessing the appropriate knowledge and skills. Swart and Coulson (2003) stress the importance of instituting a regular monitoring and evaluation system to ensure proper execution of plans and feed-back of the evaluation findings into the planning processes to make further changes for improvement.

9.2.5. Healthcare Waste Audit

Waste auditing is a performance improvement strategy designed to maintain standards of waste management practices in health facilities and create a safer environment for patients, visitors, staff and the wider community. There is no such system established within the existing healthcare service delivery system in the Ministry of Health. The only medical waste audit was conducted by the Royal Audit Authority (RAA) of Bhutan in two hospitals from December 2007 to February 2008. The findings, summarised and reported in Table 5.7 of Chapter 5, indicate a need for further development of infectious waste management. Some of the participants in the survey pointed out that such a waste audit should have been initiated by the Ministry of Health rather than by the RAA.

9.2.6. Key Personnel

For proper implementation of waste management practices in health facilities, the guidelines stipulate the need to identify a focal person or a team. This requirement for personnel responsible for coordinating HCWM activities as well as monitoring and evaluation is yet to be met in most hospitals. The requirement for key personnel was also expressed by some of the participants in the survey. According to two policy makers, although key persons have been identified, they were unable to execute their responsibilities because of other tasks that took precedence over the management of waste. Adjustments to position responsibilities may be necessary for these focal persons to be effective. It is important that hospital administrators understand the importance of safe management of infectious waste and give due attention to the appointment of suitable focal personnel as part of the overall delivery of healthcare services. According to WHO (2000) for any regulatory framework to work effectively, there has to be an official body or people designated to monitor its compliance.

9.2.7. Documentation

Interviews with policy makers revealed the lack of a proper system for documenting either the volume or the category of waste generated in health facilities in Bhutan. The need for a proper documentation on the composition and volume of HCW generated in each health facility was recommended by the Royal Audit Authority (2008) in its Report on Medical Waste Management. The observations of infectious waste management practices at the NRH, reported in Chapter 8, revealed that bags supposedly containing infectious waste brought for autoclaving were weighed and documented but no chemical strips were used to indicate the efficacy of autoclaving. Waste category data were not used in planning for effective procedures to manage HCW, as reported in Chapter 8, although some of the policy makers expressed the benefits of documenting the amount of HCW generated in respective health facilities, whilst others stated that physically weighing and documenting would be difficult with the existing shortage of human resources.

9.2.8. Healthcare Waste Management Training Programs

Although the Infection Control (IC) and HCWM program has conducted several training sessions on HCWM, participants in the survey commented that the sessions did not impart sufficient knowledge to improve waste management practices. One of the policy makers also commented that a knowledge and practice gap existed despite many training sessions being provided.

Providing training is one among many other strategies in the overall effective management of HCW. Training may create some awareness of safe waste management of HCW and the associated risks to both human health and the environment. However, to establish a safe waste management system demands behaviour change of waste generators, commitment of all people involved in HCWM and an enabling environment as discussed in the conceptual framework in Chapter 4.

Interviews with the policy makers revealed that training on HCWM was provided for nurses and the hospital cleaners but not for doctors. However, according to the survey results, 26.6% doctors reported that they received in-service training on HCWM. This discrepancy may be either the policy makers were not aware of including doctors in the training sessions or the doctor participants in the survey wrongly reporting having had the training or they had received training at medical school.

Although most policy makers felt the importance of including doctors in training for HCWM, some informants commented on the limited budget whereby groups for the training had to be prioritised to target groups that would have the greatest impact in safely managing the waste. Therefore, training of HCWM was provided first to nurses. The management of HCW involves different groups of people at different levels, and providing training to a selected group of people will not make the system effective if there is no concerted effort and support from all other groups within the organisation or institution.

Pre-service training programs

As revealed from document analysis, the existing curricula for the nursing and allied health students at the Royal Institute of Health Sciences do not contain the whole process of HCWM. Some survey respondents identified the need to include this topic for future students. Some policy makers considered that including HCWM in the curricula would not only equip students with the basic knowledge and skills of managing HCW, but would also inculcate the idea of managing waste as being an integral part of the healthcare delivery system.

9.3. INFECTIOUS WASTE MANAGEMENT PRACTICES

To improve the management of healthcare waste, the Ministry of Health has established infection control and healthcare waste management committees, developed guidelines, introduced colour-coded waste receptacles in health facilities and distributed sharps receptacles and Nulife Dots devices. In addition, the Ministry initiated segregation of infectious waste, installed autoclaving machines to treat infectious waste and conducted training programs on HCWM. However, findings from the survey and the observations reveal areas of waste management practices requiring improvement and minimisation of occupational health risks.

9.3.1. Waste Receptacles and Colour-Coding

For ease of monitoring and supervision, to prevent mixing of infectious waste and sharps with other HCW, appropriate waste receptacles and colour-codes are necessary. However, according to the survey findings, almost one-third of participants said that they did not use the correct waste receptacles to collect infectious waste, while some 7.5% reported not doing so for sharps. The higher percentage of use of sharps receptacles may be because of suitable receptacles being supplied by the Ministry of Health. The use of non-recommended waste receptacles and colour-coding were identified by the hospital cleaners and was also confirmed during observations (see Photographs 8.1 A & B) resulting in high chances of the wrong waste (infectious waste) going to municipal waste bins and the non-infectious waste being sent for autoclaving. Although the reported use of recommended colour-code (red for infectious waste and white or yellow for sharps) receptacles was predominant, 7.2% of respondents reported the use of other than the recommended colour for infectious waste and 8.6% for sharps. The use of non-recommended colour receptacles and plastic bags is in breach of guidelines.

The recommended waste receptacles with wheels and lids operated by a foot-pedal are not in use. Only one unit at the NRH had the requisite waste receptacle while the remainder used large plastic buckets. The use of receptacles without wheels and lids requiring to be lifted to dispose of waste is inconvenient and risks occupational health hazards (discussed later in the chapter).

9.3.2. Re-use of Waste Receptacles

The guidelines recommend the reuse of waste receptacles after cleaning them but the method of cleaning is not specified. During the observation at the NRH, there was no designated place with the necessary materials (brushes, detergent and disinfectants) to clean the waste receptacles. The requirements stipulated in the guidelines must be supported with the necessary and appropriate facilities if they are to be implemented correctly.

9.3.3. Disinfection of Articles

As observed at the NRH, the efficacy of disinfection of reusable items is highly questionable and there is potential for transmission of infections because of insufficient disinfectant to fully immerse the item (see Photograph 8.14 A in Chapter 8) and lack of contact between the item and the disinfectant. Focus group interviews with hospital cleaners revealed that preparation of disinfectant solutions and disinfection of articles were all done by them, but they did not measure fluids when mixing solutions. The literature shows that the correct concentration of, duration and contact with disinfectant as important factors for effective process of disinfection (Rutala, Weber & Healthcare Infection Control Practices Advisory Committee, 2008; World Bank, 2003; Prüss et al. 1999). In the absence of proper monitoring and supervision, the correct concentration of disinfectant and complete immersion of articles, correct chemical disinfection is not ensured in current practice.

9.3.4. Plastic Bags

During the observation, in most instances plastic bags used were not in accordance with the guidelines. As reported by hospital cleaners in the focus group interviews and confirmed by observation, both red and green plastic bags were found to be used to line waste receptacles containing infectious as well as non-infectious waste (illustrated in Photographs 8.2 A, B & C of Chapter 8). The existing practice of inconsistent use of correct plastic bags and removing plastic bags filled with waste from the receptacles for disposal creates a high possibility of the bags getting mixed up and the wrong bag containing infectious waste reaching the municipal landfill without being treated to render it safe.

In an attempt to reduce the volume of plastic waste and its impact on the environment, the Ministry of Economic Affairs of Bhutan issued a public notification to ban the use of plastic bags in 1999. However, according to the notification, the ban applies to commercial uses only and does not apply to hospitals. A study conducted by the Royal Society for Nature Protection (2009) showed plastic waste constituting the third highest composition of municipal waste. A total ban on the use of plastic bags in the country would be unrealistic as hospitals still need to use bags to contain waste.

9.3.5. Segregation of Infectious Waste

As reported in the survey 25.1% and 4.5% of respondents stated that they did not always segregate infectious waste and sharps respectively (see Table 6.20 in Chapter 6). Photographs 8.6 A, B and C, and Photographs 8.7 A, B and C in Chapter 8 indicate mixing of infectious waste and sharps respectively with non-infectious waste. Thus, hospital cleaners having to sort the waste manually as was reported during the focus group interviews. The researcher observed some of the cleaners in the act of manual sorting of infectious waste and sharps during the observation at the NRH. As highlighted in Chapter 2, even if a small amount of infectious waste is mixed with non-infectious waste, the whole waste needs to be considered as infectious waste and will necessitate special treatment to render it non-infectious. This puts extra burden on the limited resources besides increasing potential associated health risks. Such a problem could be prevented or minimised by instituting a proper segregation practice at the source. People who generate infectious waste not only have the responsibility to discard into appropriate receptacles, but also a moral duty not to cause harm to people handling the waste and the public. Poor segregation of infectious waste at the source also minimises the opportunity to reduce the volume of waste and generate income because of inability to recover, reuse or recycle the general HCW.

9.3.6. Labeling of waste

Labeling of hazardous waste both in English and Dzongkha is required according to the Environmental Code of Practice for Hazardous Waste Management in Bhutan. This requirement was neither stated in the guidelines developed by the Ministry of Health nor practised, as was confirmed during observations. This gap, once more demonstrates a need to ensure that when technical guidelines are being developed, relevant policy documents are consulted so that policy decisions are made operational. Observation confirmed the practice of labeling of waste in English language only and not all waste receptacles were labeled. Therefore, there is a lack of standardisation and consistency with regard to labeling of waste. Furthermore, the labels were all handwritten ether on the lid or the side of the receptacle (see Photographs 8.9 A & C). In one instance the label was written on the wall near the receptacle (see Photograph 8.9 B in Chapter 8). Such a practice of labeling is unsafe since it may lead to waste being discarded into incorrect receptacles. Besides the labeling, the World Health Organization (1999) recommends using biohazard symbols on different categories of healthcare waste so that people can understand the nature of waste by the sight of the symbol. At the NRH, except for the sharps receptacles supplied by the Ministry of Health, neither the waste receptacles nor the plastic bags containing infectious waste displayed symbols. Only the public health and general laboratories had labeled plastic bags with the biohazard symbol.

The inconsistent labeling of infectious waste (see Table 6.16 of Chapter 6) and the non-use of biohazard symbols gives no warning to patients and people visiting the hospital or caution them to keep away from the waste. Moreover, people scavenging for resaleable items are placed at risk.

9.3.7. Level of Waste in Receptacles

The guidelines recommend waste receptacles to be emptied or disposed of when they are three-quarters filled. This facilitates closing the lid and prevents exposure to occupational health hazards. However, 33.4% of participants in the survey reported that they did not maintain the correct level of waste in receptacles. During observations both infectious and sharps receptacles were seen either filled to the brim or overflowing (see Photographs 8.10 A & B in Chapter 8). The overflowing of waste is unsightly for people visiting the hospital and gives the impression of waste not being managed properly. Moreover, the overflowing of waste exposes hospital cleaners to occupational health risks during handling and transportation of waste to disposal sites. As explained in Chapter 5, such a practice is not in accordance with the guidelines developed by the Ministry of Health (2006a) and the Environmental Code of Practice for Hazardous Waste developed by the National Environment Commission (2002).

9.3.8. Waste Treatment

Solid infectious waste

During the fourth IC and HCWM Technical Committee meeting in 2005, a recommendation was made for autoclaving as the method of treating infectious waste in all health facilities. However, as revealed during the in-depth interviews, this requirement is yet to be met since autoclaving machines were not supplied to all health facilities due to budgetary constraints. The supply of autoclaving machines occurred in phases starting from bigger hospitals, that is the NRH and regional referral hospitals. This may have contributed to the high percentage (77.2%) of survey participants reporting that infectious waste was not autoclaved before disposal. However, hospitals that have been supplied with an autoclaving machine do not necessarily indicate that they treat all their infectious waste prior to disposal as evident in Table 6.22 of Chapter 6. Some 81.3% of staff from the NRH have reported that they did not autoclave the waste.

For the autoclave machine to operate optimally, all the recommended parameters (temperature, pressure and time) must be maintained to ensure the waste is safe for disposal. The guidelines stipulate the use of chemical strips or indicators as evidence of correct autoclaving to ensure the safety of waste to be disposed of into municipal bins. However, the use of these was not apparent at the time of the observation. In the absence of use of chemical indicators, autoclaving waste does not guarantee the waste has been rendered safe for disposal.

As stated by some of the policy makers, the NRH does not have a standby autoclaving machine or an alternative method to treat infectious waste in the event of breakdown of the existing autoclaving machine. With limited flat land to dig a new deep burial pit, the absence of a standby autoclaving machine is an issue of high concern as there is high risk of infectious waste being disposed of into municipal bins thus exposing the community to great public health risks. According to the report submitted by DANIDA (2004), the NRH alone produces 34.3% of the total infectious waste in the country. Moreover, with the additional new NRH hospital complex, there will be a further increase in the volume of infectious waste. If this situation continues, it is likely that more infectious waste will reach the municipal landfill. Such practice is unethical and in breach of principles underlying the management of hazardous waste, the Act and regulations.

Liquid infectious waste

As informed by some of the policy makers and hospital cleaners, the most prevalent practice of managing liquid infectious waste was flushing it down toilets or directly discarding it into open drains. The survey findings also revealed that 74.1% of participants reported that they did not disinfect liquid infectious waste prior to its disposal. Such practices contravene the National Environment Protection Act of Bhutan (Chapter IV, section 55 and 56, p.21), and the Waste Prevention and Management Act of Bhutan (Chapter II, section 6, p.3) including Medical and Health Council Regulations (Part II, section 5.19.3, p.36).

As reported by some of the policy makers during the in-depth interviews and confirmed by observation, there is no effluent treatment plant at the NRH to treat hospital liquid waste and most flows into drains, which are uncovered (see Photographs 8.16 A, B, C in Chapter 8). As was seen in the literature review, studies on the spread of multi-drug resistant (MDR) bacteria from hospital effluent to municipal sewage (Chitnis, Patil, Ravikant & Chitnis, 2000) and the bacterial population of a hospital treatment plant in India (Chitnis, Chitnis, Vaidya, Ravikant, Patil & Chitnis, 2004), have shown the presence of MDR bacteria and various type of pathogens. Similarly, in France, the study on hospital waste water have also shown the presence of a wide range of pathogens, including drug resistant bacteria, highlighting concerns of difficulty in treating people infected with MDR bacteria. In Bhutan, in order to institute proper treatment and disposal methods for infectious liquid waste, the IC and HCWM technical committee had recommended the conduct of a study on the management of infectious liquid waste at the NRH. However, to date, neither a study nor a plan has been instituted. The lack of follow-up on the recommendations was apparently due to a change of some of the committee members and lack of available expertise.

9.3.9. Location and Storage Place of Waste Receptacles

According to the guidelines, receptacles for different categories of HCW are to be kept at separate locations to prevent people discarding waste into incorrect receptacles. Moreover, infectious and sharps receptacles are to be kept in a secure area with access to authorised personnel only. As reported by hospital cleaners and confirmed by observation, infectious waste and sharps receptacles were not only located in easily accessible areas but also placed beside non-infectious waste receptacles (see Photographs 8.8 A, B, C & D, and 8.11 A & B in Chapter 8). Such practices not only increase the risk of staff disposing of waste into wrong receptacles, but also provide easy access to scavengers looking for used syringes and needles.

9.3.10. Waste Disposal

The nursing staff and doctors are not directly responsible for how the HCW is disposed of at the ‘end stage’. They might practise correct disposal at the ward level and then never see the waste again; however, the hospital administrators in Bhutan expect them to know the correct disposal methods to guide and supervise the hospital cleaners.

The guidelines recommend deep pit burial as the method of disposal of sharps and infectious waste. However, in the survey 64.3% and 58.5% respectively of participants reported that these wastes were not disposed of as recommended at their facility. The survey also shows that highest proportion of staff who reported not knowing how sharps and infectious waste were disposed of at their facility were from the NRH, suggesting that they are less likely to provide correct guidance and supervision to hospital cleaners with regard to managing infectious waste.

Moreover 31.4% and 38.3% of participants reported the burning of infectious waste and sharps respectively. According to the inventory study on hazardous waste in Bhutan about 64 tonnes of hazardous hospital waste (which included infectious waste and sharps) were burnt annually (Yangzom, 2008). In instances when the deep burial pit was filled, the practice of burning of infectious waste and sharps was reported by the hospital cleaners during the focus group interviews.

The common practice of burning of HCW in health facilities, especially plastic waste containing chlorinated materials, polyvinyl chloride (PVC) was highlighted as a concern by Metha (2005) in her report to the Ministry of Health, Bhutan. She also reported on the incinerators not meeting the required standards and the risks of emission of toxic pollutants. The literature shows that burning of materials containing PVC produces toxic pollutants such as dioxin, furan and co-planar polychlorinated biphenyls (PCBs) which have harmful effects on both human health and the environment. Dioxin is classified carcinogenic to humans by the International Agency for Research on Cancer. To date, no study of the type of pollutants emitted from burning healthcare waste in Bhutan has been conducted. Emitting toxic pollutants and causing harm to human health and the environment is in breach of : Chapter II, section 6 of the Waste Prevention and Management Act of Bhutan; Chapter IV, section 56 of the National Environment Protection Act; and Part II, section 5.19.3 of the Medical Health and Council Regulations.

Observations at the NRH revealed that existing practices of disposal of infectious waste into open pits, liquid infectious waste into open drains without proper disinfection, transporting waste through the common pedestrian pathways, and open pit burning of hospital waste, all contravene the Act and Regulations. Moreover stray dogs were observed rummaging through HCW lying on the ground around the overflowing municipal bin within the hospital compound. This is not only unsightly but also reflects poor management of health facility. Under the Waste Prevention and Management Act of Bhutan (NEC, 2009), the disposal of infectious waste that may cause environmental damage, physical injury or harm to individuals or to the community is considered an offence. As required by the Act, every person has the duty to inform the local authority of any waste that is being disposed of in any manner other than the method that is stated in the disposal procedures of the Act (Chapter X, section 41).

9.3.11. Occupational Health and Safety

Occupational Health and Safety (OHS) is a part of the overall management of healthcare waste. OHS standards are required to provide a safe work environment, to ensure safety of staff working within the health facility, and minimise transmission of infections. OHS standards not only indicate an organisation's commitment to the safety of their staff but also lay down the requirements to be followed by staff to maintain OHS in the work place. Mehta (2005) emphasised the need to develop OHS standards as a priority. The Medical Waste Management Audit Report (Royal Audit Authority, 2008) also drew attention to the lack of a system to deal issues related to OHS. Yet, to date, neither the standards nor a system to handle issues have been developed nor instituted.

In the survey, 69.4% of respondents reported manual transportation of waste to disposal sites within hospital premises. At the NRH, according to the survey, 50.3% of participants reported transporting waste on a wheeled cart. During the observation, it was noted that the waste cart was also used to carry supplies from the medical store and items for autoclaving as illustrated in Photographs 8.12 and 8.13 in Chapter 8. This was confirmed with the hospital cleaners during the focus group interviews. Such a practice risks the transmission of infection and is not in keeping with the guidelines. Furthermore, Bhutan has tropical climatic conditions (moisture and warmth). Such climatic conditions favour the process of multiplication of pathogenic microorganisms present in infectious waste and also result in the production of offensive odours.

In the absence of a separate pathway for transporting waste, the existing practice of carrying waste (especially infectious waste) in plastic bags, through a common pathway is unsafe. The incomplete segregation of infectious waste and the inconsistent use of correct colour-coded waste receptacles and plastic bags, expose hospital cleaners to the risk of contracting infections and sustaining back injuries from manual carrying, besides exposing the public to infectious waste in the process of transporting it through a common pathway.

The lack of a separate, secure storage place for infectious waste and sharps was identified by policy makers during in-depth interviews as well as hospital cleaners in focus group interviews and was confirmed by observations. Infectious waste and sharps were placed either in the corridors or next to doorways, accessible to any one passing by (see Photographs 8.11 A & B in Chapter 8). This practice was observed by the researcher. Moreover, the overflow of waste, especially from sharps receptacles (see Photographs 8.10 A & B), poses a risk of people sustaining injuries and contracting infections from sharps lying on the floor.

Hospital cleaners reported that in instances where sharps and broken glass were found along with infectious waste, they were instructed to remove the items manually before sending the waste to the autoclave to prevent damage to the shredder used to reduce the volume of autoclaved waste. This instruction contradicted being told not to manually handle infectious waste and sharps during the training session. Such an instruction disregards what is stipulated in the Waste Prevention and Management Act of Bhutan, National Environment Act and the Medical and Health Council Regulations.

At the municipal landfill, waste pickers were observed scavenging without personal protective equipment (illustrated in Photographs 8.19 of Chapter 8). This is of concern because of the health risks as hospital infectious waste and sharps were observed at the site.

Needle-stick injuries

Of great concern is that four-fifths of participants in the survey reported sustaining NSIs and 4.2% of those (all nurses) reported having acquired an infection. Compared with doctors, a higher proportion of nurses have sustained NSIs and this may have been due to nurses handling more injections than doctors. Bi and Boss's (2008) study on sharps injury and body fluid exposure among healthcare workers in an Australian tertiary hospital also revealed a higher percentage of nurses sustaining needle injuries and body fluid exposure compared with doctors. Nurses formed 70% of total NSIs in Canada (Canadian Centre of Occupational Health and Safety, 2000) and 45.7% of reported sharps injuries in a Singaporean regional hospital (Ling, Wee & Chan, 2000).

According to the needle-stick injury protocol in the guidelines, all incidents of NSIs are to be reported and followed up. Policy makers in the Ministry of Health in Bhutan expressed the view that all health workers were aware of the NSIs protocol. However, in the survey of doctors and nurses, 46% of participants were unaware of the protocol, possibly contributing to the failure to report the incidents. Despite 54.0% participants reporting being aware of the NSI protocol, 35.1% said that they did not report the incidents either due to the absence of a proper system of reporting or their experiences of lack of follow-up on the reported incidents. These findings are similar to those of Elmiyeh, Whitaker, James, Chahal, Galea and Alshafi (2004) and Shah, Mehta, Fancy, Nayak and Donga (2010). Elmiyeh et al. (2004) found that although 80% of the respondents were aware of the need to notify NSIs, only 51% reported these incidents. The study findings of Elmiyeh et al. (2004) add to the evidence that a culture of silence related to NSIs and the following health risks as well as ethical and monetary implications remain in doubt because of under reporting of NSIs (Elmiyeh et al., 2004). Shah et al. (2010) reported that of the 36% participants who had sustained NSIs, only 8.3% reported the incidents. Some of the reasons for not reporting NSIs as reported by Elmiyeh et al. (2004) are also similar to the findings of this research study undertaken in Bhutan.

The general view of policy makers in Bhutan that there were no adverse waste management incidents occurring in the work place may be attributed to the absence of a focal person responsible for all issues related to management of HCW, a lack of proper reporting system on NSI incidents, and poor documentation combined with the absence of a defining event related to poor management of HCW.

Studies have reported recapping of used needles (Salehi & Garner, 2010; Bi & Boss, 2008; Prüss-Ustün, Rapiti, & Hutin, 2003; Talaat, Kandeel, El-Shoubary, Bodenschatz, Khairy, Oun, & Mahoney, 2003) and unsafe collection and disposal of sharps as the most common causes of NSIs among health workers (Bi & Boss, 2008; Prüss-Ustün et al., 2003; WHO, 2003). Contrary to other researchers' reports of syringe needles being the most common cause of NSIs among health workers (Smith, Smyth, Leggat & Wang, 2006; Phipps, Honghong, Min, Burgess, Pellico, Watkins, Guoping & Williams, 2002; Ng, Lim, Chan & Bachok, 2002; Memish, Alumneef & Dillon, 2002 and Puro, DeCarli, Petrosillo & Ippolito, 2001), a study in Japan reported ampoules and vials as the most common cause of sharps injuries (Smith, Mihashi, Adachi, Nakashima & Ishitake, 2006). The study findings of Smith et al. (2006) show that of the 42.9% of all NSIs accounted, 32.3% sharps injuries were caused by ampoules and vials.

During the observation at the NRH, staff were seen recapping sharps and practising unsafe collection and disposal of sharps which has the risk of sustaining NSIs as stated earlier. Studies show that NSIs can be prevented, but effective prevention will require a multi-pronged approach consisting of training, safety engineered sharps devices (Prince, Summers & Knight, 1994), and administrative and work place controls (Adams & Elliott, 2006; Elder & Paterson, 2006; Ng et al., 2002) as well as environmental changes (Makofsky & Cone, 1993).

In Bhutan Nulife Dots (needle destroyer) was introduced in hospitals for the safe management of sharps and to reduce risks of infection. However, when the Ministry of Health introduced the device, comprehensive training for the use of device was not provided to all staff. As such, the devices were observed to be either not utilised, possibly because of lack of staff acceptance, or those in use were found to be ineffective. A study by Adams and Elliott (2006) reaffirm the importance of related training and continuous educational reinforcement in reducing incidents of NSIs.

9.4. INDIVIDUAL LEVEL

Health facilities, irrespective of their size and diversity of medical services must have effective leaders and dedicated people possessing adequate knowledge of HCWM as well as positive attitudes and team support within an enabling environment to ensure a safe and effective system. HCWM involves a wide range of people working within a system; any deviation or slackness in the execution of set roles and responsibilities by individuals or a group could affect in the overall efficacy of waste management system, as described in Chapter 4. Therefore, how individuals play their roles and execute responsibilities will influence in the outcome of the implementation of infectious waste management policy directives.

9.4.1. Knowledge and Practice

Findings from the survey of doctors and nurses suggest that formal education and seniority do not predict correct knowledge or practices. Doctors, despite possessing higher formal education as well as professional qualifications than nurses, one in eight doctors did not identify the correct definition of infectious waste, 37.5% reported that they did not segregate infectious waste, 46.9% were unaware of the needle-stick injury protocol, and 9.9% said that it was not important to report NSIs. These findings call into question the assumption of some policy makers interviewed for this study that doctors had an appropriate understanding of infectious waste management.

Irrespective of qualifications held, everyone involved in the management of infectious waste requires to undergo training on HCWM. For example, a hospital administrator commented to a hospital cleaner “What you need the goggles for?” Although there might be other reasons for not supplying the goggles, the lack of support for the cleaners’ request for supply of goggles indicates a lack of awareness of occupational health and safety issues associated with washing of soiled linen and chemical disinfection of liquids and equipment. The safety of staff should not be overlooked but rather given a top priority. Thus, equipping all staff with correct knowledge is one of the steps in instituting proper management of HCWM system. A study of total approach to implementation of handling and management of hospital waste in India, conducted by Prasad and Jayaram (1999) revealed a lack of knowledge in staff contributed to poor management of healthcare waste. Salehi and Garner (2010) have also reported inadequate basic knowledge of universal precautions among hospital staff. Davis, Thomson, Oxman and Haynes (1995) emphasise the need for regular and many sessions of continuing education programs to bring about behavioural changes and to reinforce safe infectious waste management practices.

Siani, Nagarajan and Sarma’s (2005) study of knowledge, attitude and practices relating to biomedical waste management amongst staff of a tertiary level hospital in India revealed that despite doctors possessing higher education and good knowledge on managing HCW, they scored the least with regard to attitudes and practice, whilst the sanitary staff, despite possessing the least knowledge, had positive attitudes and better practices. The study by Siani et al. (2005) highlighted the importance of positive attitudes and commitment rather than just the qualifications or education for good practices of waste management. Likewise, according to the findings of the survey in Bhutan, doctors were least likely to practice correct waste segregation. As reported in the findings of Chapter 6, nurses in Group A, despite being the least qualified (in terms of both school and professional education), reported better waste management practices than the other two groups.

9.4.2. Attitude

Putting the onus of HCWM only upon nurses and hospital cleaners without involving doctors is not in line with the principle of duty of care. The principle means that everyone producing waste has an ethical duty to dispose of waste safely. Management of waste should be shared among all people involved in the production of waste. As a study of hospital waste management in India showed, lack of awareness and sensitivity towards waste management among hospital administrators contributed towards poor healthcare waste management (Shah & Ganguli, 2000). According to WHO (1995) the survey of hospital waste management in South-East Asia Region also revealed that on many occasions management of HCW was left upon less educated lower category of staff, who performed tasks without adequate supervision or guidance.

The findings from the present study in Bhutan suggest that the management of HCW is yet to be considered as an integral aspect of delivery of healthcare services by both the policy makers and health professionals. Some health professionals' views that waste management is the sole responsibility of hospital cleaners will not only hinder efforts for effective implementation of management of waste, but will also require strategies to change behaviours and attitudes.

In the survey almost 50% of participants reported work experience of 10 or more years; some of them may hold senior positions within the medical and nursing professions. Therefore, to bring about changes in work culture and behaviour, especially among staff who have been in the system for a longer period, may not be easy; however, to gain their support and to facilitate change they should be included in training sessions on HWCM and given responsibility for the management of waste.

9.4.3. Perceptions on Standard of Infectious Waste Management

The policy makers acknowledged the standard of infectious waste management to be poor and in need of improvement. There remains the danger, as stated earlier, that the absence of any single reported untoward incident related to the poor management of infectious waste and sharps may foster the belief that waste is being managed safely although this latter view is not supported by the research data. Findings from observations revealed many areas of concern, including occupational health risks in the existing practice of infectious waste management, and participants in the survey reported incidents of NSIs and having acquired infections from the injury.

9.4.4. Leadership and Commitment

In order to bring about effective changes in the management of infectious waste and to sustain the system, commitment and leadership is required at every level of waste management within the organisation. As the findings from this study show, waste management committees have been formed and focal personnel identified to manage HCW; yet, some committee members reported being unable to execute their roles and responsibilities as mandated. The focal personnel have experienced similar problems. In the absence of a written job responsibility, no one is held accountable for the management of HCW. Irrespective of what resources are provided, without the commitment and leadership roles displayed by individuals or the group (from top-down), the system may not be as effective and efficient as expected. Some examples from this study that highlight a need for leadership and commitment include, the absence of standard documentation and proper follow-up action on reported incidents of needle-stick injuries, failure to evaluate Nulife Dots efficiency and effectiveness after its distribution to hospitals, and the lack of monitoring and supervision to ensure correct implementation of guidelines.

9.4.5. Communication and Team Support

Communication and team support in the existing system of waste management is poor. As reported by a senior official during the interviews, there is neither information nor reports submitted to the Ministry of Health on issues related to poor management of healthcare waste to enable them to make policy decisions or interventions. Moreover, the number of staff who sustained NSIs has neither been communicated to the Ministry nor appropriate actions been taken.

In hospitals, the management of healthcare waste is primarily the responsibility of nurses and hospital cleaners. During the focus group interviews with the hospital cleaners, they complained about the “no one bothers attitude” of health professionals (throwing waste into wrong waste receptacles or sometimes outside receptacles). Such actions do not exhibit team spirit or team support.

Irrespective of how the functions and responsibilities of waste management are defined, it is important that all stakeholders (from policy makers to hospital cleaners) are involved in the process of developing waste management strategies, and familiarise themselves with each others’ roles and responsibilities to prevent duplication and misunderstanding of the tasks.

9.5. THE STATUS OF INFECTIOUS WASTE MANAGEMENT

As previously described, the NRH, is the apex hospital of Bhutan and the designated teaching hospital for nursing and allied health students of Royal Institute of Health Sciences. The hospital has the maximum number of qualified and experienced staff working there compared with other hospitals. In the future medical students will also be posted to the NRH for their clinical placements. The hospital, because of its size and many specialty services, is also the biggest generator of infectious waste and sharps in the country. In view of these factors, one would have assumed that the NRH had the best practices of managing the waste. However the research data does not support this view.

Based on what was reported by the participants in the study, the district and regional hospitals have better practices of infectious waste management compared with NRH. Survey participants from NRH gave the lowest rating to the effectiveness and safety of the hospital waste management system. Some of the factors that are unique to NRH which may have contributed to poor waste management could be the large size of the hospital, catering for speciality treatment facilities, being the apex hospital, many diverse groups of people working at the facility and insufficient coordination among staff. Moreover, the facility has the maximum number of health professionals with more than 10 years of work experience, and they may be used to managing HCW not in accordance to the guidelines.

9.6. LIMITATIONS OF THE STUDY

This study involved different groups of people at different levels in the management of infectious waste, which necessitated use of range of data collection methods to obtain the information. The survey was conducted in eleven hospitals based on the selection criteria and all the doctors and nurses of these hospitals were invited to participate in the study. Most items in the survey were completed with an overall response rate of 91.8%. However, observations of infectious waste management practices were conducted on some days at the NRH as well as focus group interviews with their cleaners. Therefore, the breaches noted during the days of observation cannot be concluded as an everyday practice. Moreover, the unsafe practices and occupational health risks identified at the NRH cannot be considered to be the same in other hospitals since observations and focus group inteviews were not conducted at hospitals other than the NRH. Therefore, this may have limited the information on the actual practices of infectious waste management in the country.

9.7. SUMMARY

There is inconsistency between what is stipulated in the legislation and guidelines and the actual practice of infectious hospital waste management in Bhutan. In order to facilitate translation of policy directives into operational practices an enabling environment needs to be adequately developed for optimal output. An enabling and reinforcing environment may include: rules and regulation to enforce proper management of infectious waste, regular supervision and monitoring, and financial support. Such an environment would also include appropriate training or continuing education for people responsible and accountable for generating and handling infectious waste (including policy makers, hospital administrators, doctors, nurses and hospital cleaners) and adequate supplies of such items as waste receptacles and personal protective equipment.

It appears that the overall standard of infectious waste management practice is poor and yet it has not received adequate attention in the absence of a defining event related to poor management of infectious waste. Rather than a whole of system approach, the efforts appear fragmented. Despite the initiatives of the Ministry of Health to strengthen HCWM, there are still many areas at policy level as well as in practice that need further improvement.

Although legislation on waste is in place, it is generic and does not specify clearly safe waste management practices. Currently, there is neither a national policy pertaining to healthcare waste nor occupational health and safety standards. In addition, waste management plans both at national and institutional levels need to be developed. Guidelines related to healthcare waste have been developed, but some of the instructions are vague, inconsistent, confusing and incorrectly written. The management of waste is not incorporated in the initial design of hospital plans, therefore, facilities to support waste handling are inadequate. Not all people involved in the management of HCW are included in training sessions on HWCM. Monitoring and supervision at all levels is inadequate, and there are many areas of practice that are in breach of the Waste Prevention and Management Act of Bhutan, the Guideline for Infection Control and Healthcare Waste Management in Health Facilities, Environmental Code of Practice for Hazardous Waste, Bhutan Medical Health and Council Regulations and National Environmental Protection Act of Bhutan. Occupational health risks evident in existing practice require measures to reduce them.

The concluding chapter sets the direction as to how reforms could be instituted to improve both policy and practice related to infectious waste management in Bhutan.

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CHAPTER 10

CONCLUSIONS: STRENGTHENING HOSPITAL INFECTIOUS WASTE MANAGEMENT IN BHUTAN

The primary aim of this study was to examine the existing policy and practices related to hospital infectious waste management in Bhutan, in order to identify gaps both in policy and between policy and practice, and propose policy and practice reforms. The study was also designed to explore perceptions of policy makers, and the knowledge and attitudes of doctors, nurses and hospital cleaners related to hospital infectious waste. In this final chapter, conclusions drawn from the study are presented and ways of improving the system of managing hospital infectious waste and sharps considered.

A conceptual framework and a mixed method research design were employed to guide the study. The conceptual framework enabled the researcher to identify discrepancies within the multifaceted system of healthcare waste management (HCWM) from legislation and policies to operational tasks and to individuals responsible for implementing the policies. The mixed method design was chosen in order to achieve an in-depth understanding of the existing infectious waste management system in Bhutan. The use of observation provided insights into the actual practices of infectious waste management and allowed comparisons to be made between such practices and what was reported by the participants in the survey, in-depth interviews and focus groups.

Conclusions are drawn from the analysis of data produced by the various research methods used in this study. Firstly, gaps in policies on the management of hospital infectious waste at national level, as well as in the translation of policies into practices at institutional levels. These gaps are reflected in the knowledge and attitudes of health professionals. There was evidence of violation of legislation and breaches of guidelines during the observation period and occupational health risks evident in existing practices. However, despite the evident risks there is, to date, no evidence of major adverse events. Secondly, measures to improve policy and practice both at the national and institutional level including awareness and training programs are considered as well as strategies to prevent and minimise occupational health risks.

Despite the limitations to the study identified in Chapter 9, this research has identified a number of areas requiring improvement to promote the safer management of hospital infectious waste and sharps. In this chapter the gaps and risks in policy and practice are presented followed by specific suggestions to deal with them to improve the management of hospital infectious waste in Bhutan. Finally, future research areas are identified and benefits of the study outlined.

10.1. GAPS AND RISKS

10.1.1. Gaps in Policy at the National Level

Efforts to develop policy related to managing healthcare waste (HCW) in Bhutan to date have been fragmented. The Waste Prevention and Management Act of Bhutan does not include definitions of different categories of HCW. Although Chapter VII, Section 29(a) of the Act specifies the need to develop rules and regulations pertaining to the safe management of waste, and Section 29(c) indicates the need to prepare and adopt waste management plans, these provisions are yet to be developed.

The Ministry of Health has made efforts to provide instructions to manage HCW through publishing the Guideline for Infection Control (IC) and Healthcare Waste Management in Health Facilities; however, there are number of areas in the document that could be improved. As detailed in Chapter 5, the Guideline contains a wide range of topics, including areas not related to the actual practice of managing HCW. Some instructions in the Guideline appear too broad for application to practice, or unclear, incomplete, inconsistent or inaccurate.

Lack of proper reporting, monitoring and evaluation mechanisms make it difficult for policy makers to obtain a complete understanding of problems and risks apparent in the existing system of HCWM practices. Although waste management committees have been formed, some of the members reported during the in-depth interviews that they were unable to execute their roles and responsibilities effectively because other tasks took precedence over the management of HCW.

10.1.2. Gaps between Policy and Practice

The research revealed that the practice of managing hospital infectious waste did not fully conform to the Environmental Code of Practice for Hazardous Waste and the Guideline for Infection Control and Healthcare Waste Management in Health Facilities.

Translation of policy decisions into effective operational guidelines for the tasks of managing hospital infectious waste and sharps has therefore not been optimal.

A major finding of the research was the lack of mechanisms to reinforce legislation and guidelines, including clearly defined roles, responsibilities and accountabilities for various personnel involved in the management of hospital infectious waste. From the observation of infectious waste management practices at the National Referral Hospital (NRH) breaches of guidelines were evident from segregation, collection, labeling, storage, treatment to the transportation and disposal of waste. The effective management of waste is hampered by inadequate facilities as well as shortfalls in human resources (both in numbers and expertise). The lack of proper reporting, monitoring and evaluation mechanisms, noted earlier as hampering policy making, also limits opportunities to develop evidence-based best practice guidelines.

10.1.3. Occupational and Public Health Risks

Occupational and public health risks were evident in this study and posed a significant issue. The existing practice of hospital infectious waste management carries a potential risk of injury or transmission of infections to staff, patients, visitors to hospitals and the general public due to unsafe handling and disposal of infectious waste and sharps. The occupational and public health risks identified are:

Injury from sharps is possible because of manual segregation of mixed waste, excessive handling of sharps, overflow of sharps from waste receptacles, and easy access to used sharps in the absence of secure and separate locations for such receptacles.

Transmission of infections may result from incorrect disinfection of reusable articles, manual segregation of infectious waste and sharps, overflow of waste from receptacles, and infectious liquid waste flowing into open drains close to pedestrian footpaths and staff residential areas. The inadequate and inappropriate supply of personal protective equipment further increases the risk of transmitting infection whilst waste is being handled. Lack of separate, secure storage places and location of waste receptacles including pathway to transport HCW (both infectious as well as non-infectious waste) puts the public, as well as staff, at risk of acquiring infections and sustaining injury. Using waste trolleys to carry other materials without proper disinfection poses a potential risk of transmitting infections. In the absence of standard practice to monitor efficacy of autoclaving, it is not possible to ensure that the waste coming out of the autoclave is safe for disposal into municipal bins. As such there is a high possibility of infectious waste reaching the landfill resulting in potential health risks to members of the public including waste pickers who scavenge at the site without any personal protective equipment.

Physical injury - hospital cleaners are at risk not only of acquiring infections and injuries from sharps but also sustaining back injuries from manual transportation of heavy plastic bags containing infectious waste from the source to the disposal site.

Poor compliance of needle-stick injury protocol – not all participants were aware of the needle-stick injury (NSI) protocol. As such, there is inconsistency in the implementation of the protocol. Moreover, staff who sustained needle-stick injuries may not receive appropriate interventions to prevent complications or further transmission of infection.

Environment and human health - the open pit waste disposal at the National Referral Hospital (NRH) is close to residential areas, road and a school. As such there is potential for exposed material to be spread from the site to nearby areas by strong winds; moreover, the short height fence around the disposal pit site and close proximity to a main road (illustrated in Photograph 8.18 B & C) provides easy access for injectable drug users looking for sharps. In addition, the existing practice of burning HCW in the open pit presents a potential risk to the environment and human health from emission of toxic substances or volatile chemicals and leaking to ground water. Furthermore, the site is unsightly and burning generates unpleasant odours.

10.1.4. Knowledge and Attitude of Doctors, Nurses and Hospital Cleaners

Knowledge is one of the key factors in the effective management of HCW. The survey revealed that 46.0% and 28.7% of participants reported having undertaken training on HCWM either during pre-service or in-service periods respectively. The logistic regression on identification of correct definition of infectious waste and factors including in-service training on HCWM and survey participants with higher professional qualifications showed an association. However, one in eight doctors and one in four nurses who participated in the study did not identify the correct definition of infectious waste, indicating the possibility of them discarding waste into incorrect receptacles with the risk of adverse consequences. Survey participants with more years of service were less likely to identify the correct definition of infectious waste and segregate it from non-infectious waste. However, compared with doctors, nurses are more likely to segregate the waste as well as take responsibility for managing the waste.

At the time of the study, HCWM was not incorporated in the curriculum for nursing and allied health students at the Royal Institute of Health Sciences. Therefore, graduates may not understand the importance of the correct management of HCW and fail to recognise its importance in the overall health care delivery system.

Although hospital cleaners were able to differentiate between infectious and non-infectious waste, they raised concerns about their inability to implement correct practices because of deficient facilities. According to the hospital cleaners, doctors, nurses, and patients and their attendants did not use correct waste receptacles; as such they had to manually segregate infectious waste and sharps from other categories of HCW prior to autoclaving. They also maintained that because of their low social status, as well as being on the lowest rung in the hierarchical system of management, they felt compelled to work under unsafe environmental conditions and situations.

Irrespective of what level people are within the organisation, it is important that everyone involved in the management of HCW (policy makers, administrators, unit managers, all health professionals, supply people and hospital cleaners) be included in the training programs to create awareness of the importance of safe management of infectious waste, and also to gain their support and commitment in the implementation of effective management of HCW.

In order to improve and strengthen the management of hospital infectious waste (including sharps) in Bhutan a number of measures should be considered.

MEASURES TO IMPROVE POLICY AND PRACTICE

10.2. NATIONAL LEVEL

10.2.1. Strengthen Legislation and Regulations

Legislation could be strengthened by clearly defining the terms used to identify different categories of HCW, and establishing regulations for the proper segregation, collection, treatment, storage, handling and transportation of waste and its disposal. The regulation should explicitly outline financial penalties for unsafe waste management practices (both to individuals and organizations). Respective agencies or organizations should also be held responsible and accountable in the safe management of waste that they generate. Inclusion in the legislation of the legal obligations of the Ministry of Health and HCW producers would give the Ministry the mandate to develop rules and regulations for the conduct of HCWM taking into account public health risks and potential environmental pollution.

10.2.2. Develop a Comprehensive National Policy Framework on Healthcare Waste Management

A comprehensive national policy framework on HCWM developed and implemented by the Ministry of Health would promote safer management of HCW in all health facilities in Bhutan. The process of formulating a national policy could consider the principles underlying the management of hazardous HCW including negative driving forces as well as possible influences on the poor management of waste.

It is suggested that a national policy framework outline the aims and objectives and strategies to accomplish them, and incorporate other relevant national legislation on the management of general waste, air emissions, occupational health and safety, and environmental standards. Safe waste management practices and risks of incorrect practices, including cost implications, as well as various ways to minimise production of waste at the source could be specified. In addition, the framework could outline training requirements, use of sharps safety devices, administrative and work place control measures to preventive needle-stick injuries and responsibilities of people handling waste both within and outside the health facilities.

Translation of policy decisions into logical and achievable operational tasks may be supported by technical guidelines or practice standards. Technical guidelines clearly outlining the correct use of waste receptacles (colour and type), segregation of infectious waste and sharps, plastic bags, labeling of category of waste along with biohazard symbols, storage, transportation, treatment and safe disposal options would provide direction and standards for safe HCWM practices.

10.2.3. Incorporate HCWM Infrastructure along with Hospital Building Plans

It is essential that hospital building planners understand the importance of safe management of HCW in the hospital design. Secure storage places, separate pathways to transport infectious waste, sluice rooms and laundry facilities for soiled linen and equipment, safe sewerage systems and infectious waste disposal sites must be incorporated into future hospital infrastructure plans. Lack of these facilities could hinder effective waste management practices. There is a need to investigate the possibilities of modifying existing health facilities; this may include building secure storage places for infectious waste and or, sluice rooms for infectious soiled linen, and constructing closed sewerage drainage systems.

10.2.4. Develop a National Purchasing Policy

A national purchasing policy developed by the Ministry of Health has the potential to identify products used in health facilities that will generate less waste thereby reducing the adverse impact on both human health and the environment. Although this study did not examine the type of HCW being burnt and the impact on the environment, the study revealed that burning was reported as a prevalent method of managing waste. Burning of plastic HCW containing polyvinyl chloride products have been identified as human carcinogens by the International Agency for Research for Cancer. Therefore, purchase of polyvinyl chloride-free products needs to be clearly stipulated in the purchasing policy document by the Ministry of Health.

Central supply of waste receptacles and plastic bags

A central supply system for the purchase and distribution of waste receptacles and plastic bags operated through the Division of Vaccine and Equipment Supply Unit in the Ministry of Health has the potential to not only maintain uniformity and standard of waste receptacles but also facilitate monitoring and supervision. The supply of standard waste receptacles and plastic bags labelled both in English and *Dzongkha* languages and marked with biohazard symbols, as recommended by the World Health Organization could be used to promote correct segregation of waste at the source and use of correct waste receptacles. To prevent hand contact with receptacles and for convenience of use, waste receptacles (especially large ones) should be supplied with wheels and have a lid operated by a foot-pedal.

The Royal Government of Bhutan has banned the use of plastic bags in the commercial purposes. In the event the ban is also applied to hospitals, the Ministry of Health may have to consider using biodegradable plastic bags to manage waste in the future.

10.2.5. Develop Occupational Health and Safety Standards

Occupational health and safety standards specific to HCW developed by the Ministry of Health would provide a safe work environment, minimise risk, prevent work-site injuries and protect the health of staff,

Personal protective equipment (PPE)

The use of appropriate PPE should be part of a hospital policy. Therefore, training for all staff handling infectious waste is necessary to make them aware on different types of PPE and the importance of wearing them correctly, and a regular and adequate supply of appropriate PPE, accessible to staff at all times whilst handling the waste is required. The correct use of PPE could be monitored by the focal person for infectious waste management at each hospital site.

At the municipal landfill site, both municipal waste handlers as well as scrap dealers were observed scavenging without personal protective equipment. Such practices have potential risk of acquiring infections and injuries since red plastic bags supposedly containing hospital infectious waste and sharps were observed at the site. The Ministry of Health has the moral obligation to inform the concerned authorities in the municipal office and the National Environment Commission (NEC), highlighting on the associated risks of handling waste without PPE. The wearing of appropriate PPE should be required as an important aspect of occupational health safety standards. The NEC being the national authority on proper management of waste could monitor that appropriate PPE are available, accessible and worn at workplace by the waste handlers, including scrap dealers.

Sharps safety device

As observed, Nulife Dots devices were found to produce more sharps by cutting the needles into pieces rather than reducing them to ashes. There is a need to conduct proper analysis of the efficacy, effectiveness and user acceptance of this device.

Transportation of waste

To minimise the risk of back injury from carrying of large plastic bags filled with waste, as well as the transmission of infections and injury from the close proximity of infectious waste and sharps, plastic bags should not be removed from the receptacle for transportation but rather, wheeled along with the receptacle to designated disposal sites.

Needle-stick injury reporting

The focal person for infection control and HCWM in each health facility is in a position to offer counselling and support to individuals who sustain needle-stick injuries (NSIs). Such individuals require follow-up until their blood test results show negative for infectious blood-borne diseases (in particular for Hepatitis B and C Virus or Human Immunodeficiency Virus). In order to maintain consistency of documentation and reporting of such incidents and for the ease of analysis of data, a standard NSI reporting format developed by the Infection Control and HCWM Program in the Ministry of Health could be distributed to all health facilities in the country. As individual staff members are responsible for reporting a needle-stick injury, they should be informed of the reporting procedures through office memoranda or meetings to create awareness of the importance of reporting incidents of individuals sustaining injuries from sharps.

10.2.6. Institute a Regular Monitoring and Evaluation System

A monitoring and evaluation system as a part of the overall healthcare delivery system is essential to ensure effective implementation of health programs, including safe management of HCW.

A waste audit tool or check-list should be developed by the IC and HCWM Program in collaboration with the focal person at each health facility. The waste audit should be conducted annually or as per the policy of the Ministry and the findings used to develop strategies to prevent transmission of infections, minimise risks and to further improve the safe infectious waste management practices. The waste audit tool should include the items listed in Table 10.1.

Table 10.1 Essential components of a waste audit tool

- Type of waste receptacles (with wheels, lid operated by a foot-pedal, for sharps puncture proof)
- Colour code of waste receptacles and plastic bags
- Collection of waste in appropriate and correct receptacles
- Segregation of waste at the source
- Labeling in written language (both in English and *Dzongkha*) as well as use of biohazard symbols
- Appropriate biohazard symbols on waste receptacles and plastic bags
- Level of waste in the receptacle
- Waste storage area (secure with access to authorised personnel)
- Location of waste receptacles (infectious waste and sharps located separately from other categories of waste)
- Waste treatment effectiveness :
  - autoclaving – efficacy monitored;
  - chemical disinfection - correct strength, proper contact and duration)
- Occupational health risks identifiable
- Transportation of waste (separate pathways, specific waste trolley)
- Safe disposal of waste in designated sites
- Documentation and reporting systems (categories of health staff, incidents of sharps injury and follow-up actions, type of infections developed following the injury)
- Actions taken on reported incidents of needle-stick injuries

10.2.7. Revision of the Guideline for Infection Control and Healthcare Waste Management in Health Facilities

The guidelines need to be revised to provide accurate, appropriate and specific instructions for safe waste management practices consistent with the relevant policies. To maintain consistency with the Act, the term *healthcare waste* should be changed to *medical waste* in the guidelines and all other terms used consistently and defined clearly to avoid ambiguity. It is important that the instructions in the guidelines should be related to the practice of correct waste management processes for waste minimisation, waste receptacles, colour codes, waste segregation, storage, labeling, level of waste in receptacles, collection time and transportation, and the recommended treatment and disposal options. To reduce the volume of waste generated as well as the associated management costs and the risks, the guidelines must promote the hierarchy of integrated waste management especially the concepts of reduce and re-use. Although recycling is one of the concepts of integrated waste management, this process may not be applicable to infectious waste because of the presence of infectious microorganisms and the risk of transmitting infections.

10.2.8. Develop Roles and Responsibilities of Departments and Focal Personnel

To prevent miscommunication and duplication of tasks, the Ministry of Health could clearly delineate the roles and responsibilities of departments and the Infection Control and HCWM Program in the Ministry, including the IC and HCWM committees. The roles and responsibilities of the respective departments and program as well as the committees must be made known through office memos by the concerned in the Ministry, departments and hospitals. The roles and responsibilities of focal personnel or teams responsible in managing waste in health facilities need to be outlined clearly by each hospital administration. In addition, focal personnel or teams identified should be held accountable to their supervisors for any lapses related to HCWM.

Infection Control and HCWM Committees

The members of committees must be committed to improving the HCWM system. They must meet the attendance requirements and reporting of actions. If the committee members are unable to execute their roles and responsibilities as mandated, the chairperson could ask them to resign and be replaced by someone possessing the appropriate knowledge and the expertise.

10.3. STRENGTHENING INFECTIOUS WASTE MANAGEMENT PRACTICE

As demonstrated by the four hospitals in Metro Manila (Health Care Without Harm Asia, 2007) instituting best practice HCWM does not require sophisticated plans or expensive technologies. Small initiatives have resulted in effective outcomes. Likewise, the initiatives taken by the four hospitals could be started as a pilot project in one of the hospitals in Bhutan before implementation in other hospitals in the country.

In order to strengthen and promote safe infectious waste management practices in Bhutan, the system must be supported with adequate and appropriate facilities and resources to facilitate effective translation of policy decisions to operational tasks. The focus should be on the implementation of safe management of hospital infectious waste practices rather than on the disposal options or techniques.

The following measures would strengthen safe infectious waste management practices in Bhutan.

10.3.1. Change in Behaviour and Work Culture

To institute effective segregation of waste at the source will require change in behaviour and culture on the part of staff. They should be responsible for the waste that they generate. Changes can be brought in through regular, appropriate continuing education programs for all staff and induction programs on waste management for all new staff. Staff must understand the management of waste as being a collective responsibility and not that of the hospital cleaners only. In addition the IC and HCWM focal person of respective hospitals should perform regular supervision and monitoring to bring about desired changes. The focal person should provide feedback on the status of HCWM practices to all those involved in managing the waste through monthly staff meetings or memos.

10.3.2. Adequate Human Resources and Supervision

The Ministry of Health needs to develop adequate and appropriate human resources, both in numbers and expertise. Appoint IC and HCWM inspectorates or focal persons to monitor and supervise implementation of safe HCWM practices in health facilities. With the availability of adequate human resources, accreditation of waste management in hospitals could be conducted to examine the process of the waste management system of the facility in a systematic manner. The findings should be informed to staff and hospital management in order to promote and strengthen safe infectious waste management practices at the facility.

10.3.3. Regular and Adequate Supplies and Equipment

To minimise occupational health risks, hospital administrators should at all times maintain an adequate stock of appropriate waste receptacles and plastic bags, as well as PPE. It is anticipated that the regular supply of these items will facilitate proper segregation of infectious waste and reduce the risk of mixing of waste or the wrong waste reaching the landfill without being rendered safe for disposal. The hospital management must also ensure adequate supply of waste trolleys to transport HCW. These trolleys must be used only for transporting waste and not for any other purposes.

Waste receptacles

The tropical climate of Bhutan is favourable to the multiplication of pathogenic microorganisms. Under such climatic conditions offensive odours are produced and there is a need for more frequent collection and disposal of waste, thereby increasing the frequency of handling and contact with infectious waste and sharps.

As observed, buckets were used as waste receptacles. The Ministry of Health should consider replacing pails with closed-wheeled receptacles to facilitate easy and safe transportation of waste to the designated storage place or disposal sites. Further, the use of closed-wheeled receptacles will reduce occupational health risks (transmission of infections and injury to back from manually carrying the receptacle filled with waste) to hospital cleaners. After disposing of the waste at the designated site, the receptacle can be cleansed, taken back to wards for re-use. Re-use of waste receptacles will resolve the problem of having to relabel in English and Dzongkha as well as the use of biohazard symbols on the receptacle.

10.3.4. Waste Treatment Options

Policy on the choice of waste treatment options should not be considered only on the volume of waste. As the literature shows, there is no single treatment technology that is best to treat HCW; therefore, decisions on the choice of technology should take into consideration local needs and situations, legislation, feasibility, existing standards of emission, cost effectiveness and efficiency and sustainability in the future. The choice of technology must be safe in terms of both public and environmental health.

Encapsulation and solar treatment technology could be options to treat infectious waste in smaller district hospitals and basic health units in Bhutan, where the volume of sharps and infectious waste is less than that of the NRH and regional referral hospitals. However, the use of such technology may need to start as a pilot project in a smaller district hospital before being made widely available. Environmental issues are global concerns and international organisations, in particular WHO, Health Care Without Harm and United Nations Environment Program advocate safer alternative waste treatment options to burning or incineration. Therefore, the Government of Bhutan could seek support from these international organisations to promote alternative safer waste treatment options in the country.

Back-up services

Hospitals that use autoclave to treat infectious waste should have a back-up service as an interim measure to provide continued services in the event of break down of the machine or during its maintenance. Bigger hospitals, especially the national and regional referral hospitals, should have a second autoclaving machine as a standby to treat infectious waste during such periods; whereas, smaller hospitals could dispose of waste in deep burial pits as outlined in the guidelines.

Strengthen proper treatment of infectious liquid waste

People handling liquid infectious waste must ensure effective disinfection by using the correct concentration and maintaining contact duration of disinfection time prior to disposal into the municipal sewerage system. Chemicals used to disinfect liquid infectious waste must be made non-hazardous as per the guidelines so as not to disturb the normal flora of the sewage.

Transboundary of hazardous waste

Bhutan, as a signatory to the Basel Convention for Transboundary Movements of Hazardous Wastes, has the option to transport hazardous waste from health facilities to countries within the South East Asia Region of the World Health Organization or other parts of the world. However, a cost benefit analysis needs to be conducted to find out whether it would be cheaper to transport the waste outside or to build treatment plants within the country. Hazardous wastes are also generated by non-health institutions. The National Environment Commission being the overall authority with regard to the management of waste, should liaise with relevant agencies or organisations to obtain resources to set up a common waste treatment plant that could be optimally utilised if the Government of Bhutan decides to build a treatment plant within the country.

Waste disposal

The existing practice of disposal of infectious waste and sharps into open pits has a great potential of transmission of infection and causing injury. The practice is in breach of the guidelines and the Waste Prevention and Management Act of Bhutan. Therefore, such a practice should be stopped. The focal person for managing HCW must ensure that sharps and infectious waste are disposed of into deep burial pits in hospitals that do have autoclaving facilities. Hospitals that have autoclaving facilities to treat infectious waste must monitor the efficacy of autoclaving before disposing of the waste into municipal bins.

10.3.5. Strengthen Documentation and Reporting System

There is a need to develop and strengthen the overall documentation and reporting system. To obtain an estimate on the volume of different category of HCW, all health facilities should weigh and document HCW generated from their facility and annually submit a report to the Ministry. Further, the information can be used as a base-line to assess trends in HCW generation and the effectiveness of waste management strategies, as well as help in identifying suitable waste treatment and disposal options. The data can also be used to liaise with other agencies and ministries to build a common infrastructure for effective and efficient utilisation of resources to institute waste treatment methods to safely manage waste in the country.

There is evidence of potential risks posed by contaminated needle-stick injuries. Therefore, every incident needs to be documented properly and the status of transmission of infection confirmed by a blood test as outlined in the guidelines. It is suggested that annually all health facilities submit a report on the number of incidents of NSIs to the Ministry of Health including the category of staff who sustained the injury as well as the mode of injury and the outcome (number of staff who developed infections, type and actions taken). This information could be presented during the bi-annual health conference of Ministry of Health to alert health professionals to the number of incidents and the potential risks. The information could be used to assess number of incidents related to NSIs and identify measures to prevent NSIs and minimise associated health risks and the treatment cost of people who have acquired infections from the injury.

10.4. AWARENESS AND TRAINING PROGRAMS

There have been instances where hospital cleaners were told to remove broken glass and sharps mixed with infectious waste. Such an instruction is in breach of the Waste Prevention and Management Act of Bhutan, National Environment Act, Medical and Health Council Regulations and the guidelines. The problem of mixing of sharps with infectious waste should be tackled at the source by emphasising proper segregation of infectious waste through continued-education, making people who produce waste responsible for discarding items into appropriate receptacles, and advocating safe waste management practices. The management of HCW is team work and no staff members should be put at the risk of acquiring infections or sustaining injuries. Therefore, it is important to create awareness of risks associated with unsafe management of HCW to gain commitment as well as to bring about behavioural changes in people involved in handling and managing waste. These changes could be promoted through relevant training sessions and awareness on safe HCWM practices.

10.4.1. Awareness through Media

There is a need to create public awareness on the potential risks associated with infectious HCW and the meaning of different colour-coding and biohazard symbols on waste receptacles. The awareness could be created through the mass media (local newspaper, radio, television), public debates, health education activities in the community, and by involving the public in cleaning campaigns organised jointly by the Ministry of Health, National Environment Commission (NEC), Royal Society Protection for Nature (RSPN) and City Corporation. Field visits to the municipal landfill could be organised by the City Corporation, NEC and RSPN to make the stakeholders, health professionals and the community people to visually see the volume of waste generated and the implications on human health and the environment. The system of participatory democracy has started only recently in Bhutan and may take time for public to voice their concerns in this newly established system of governance. Awareness among public on the potential risks of hospital infectious waste from unsafe practices could put pressure on the Ministry of Health and demand a safer waste management system like the public did in United States of America following washing up of HCW on beaches.

10.4.2. Communication and Team Support

In order to prevent communication gaps and promote team support, there is a need to establish an open and free communication system. The system can be set up through regular meetings (to discuss issues, concerns, changes), briefings and written memos among relevant people involved in managing the waste. In addition, the channel of communication among different levels of people needs to be clearly outlined by the Infection Control and HCWM Program Officer in the Ministry and focal person of the respective hospitals. This information should be provided to other departments or unit heads in the Ministry as well as hospitals to establish an effective communication system in the work place.

10.4.3. Inclusion of HCWM in the Pre-service Training Curricula at RIHS

There is a need to incorporate a HCWM component in the pre-service training curricula of future medical, nursing and allied health students at the Royal Institute of Health Sciences. Creating awareness of the importance of safe management of waste and imparting the required knowledge will introduce HCWM as a part of the overall healthcare delivery system, rather than as a separate entity. This will provide students a basic understanding of the whole process of HCWM and may institute good practice of managing the waste once they start clinical placements in hospitals.

Since the National Referral Hospital is the designated teaching hospital for RIHS students, it should provide an enabling environment for them to develop the best clinical practices with high standards including safe healthcare waste management practices.

10.4.4. Develop Appropriate Training Programs

The focus of the training programs should be to provide the necessary knowledge and skills to enable staff to perform the task effectively. However, the Infection Control and HCWM Program Officer ought to remember to develop appropriate training programs taking into account the discrepancy model used by Moore (1998) and the training needs identified by Swart and Coulson (2003). The content of the training should relate to the target group and in minimising the discrepancy between what staff “know” and “do not know” within an enabling and supportive environment as identified by Adelson, Hepburn and Vanloy (1997) in Chapter 4 of this study. The overall aim of the training program should be to bring about lasting changes in practice through appropriate knowledge and skills. Training should encompass the topics listed in Table 10.2.

Table 10. 2 Content of healthcare waste management training package

- Legislative and regulation requirements
- Definitions and risks associate with infectious healthcare waste
- Occupational health risks and how to minimise those risks
- Roles and responsibilities in the management of waste
- Importance of appropriate and correct use of personal protective equipment whilst handling infectious waste
- Use of colour coded waste receptacles, segregation, level of waste in the receptacle, location and transportation
- The recommended waste treatment (solid as well as liquid infectious waste) options, including safe disposal of waste
- Appropriate documentation and reporting
- Correct use of needle-stick injury protocol, including “What, Where and To Whom to Report” and actions that need to be taken after sustaining an injury

10.5. FUTURE RESEARCH AREAS

The following are areas for future research on issues related to HCW in Bhutan:

10.5.1. Infectious Waste Management System in Hospitals in Bhutan

An observational study of how hospitals in Bhutan manage their infectious waste and sharps would provide the opportunity for researchers to make comparisons and identify differences in practice among hospitals and areas that need strengthening. In addition it would identify hospitals with the best practices that can be used as a model for other hospitals. The findings would also provide the basis to develop further interventions or strategies to improve infectious waste management system in the country.

10.5.2. Sharps Injury among Health Staff in Bhutan

A study in this area could provide pertinent information such as: number of incidents of sharps injuries, category of staff who sustained the injuries, how the injury was sustained (whether in the process of administering treatment, whilst recapping or disposing of in the receptacle) and type of any infection. Such information will be helpful in making evidence-based policy decisions related to NSIs and furthermore in developing appropriate strategies to institute measures to reduce needle-stick injury related incidents. Besides, the strategies could also help in minimising transmission of blood-borne diseases in the future. Incidents of sharps injuries could also be used as an indicator to evaluate the effectiveness of sharp injury reduction strategies put in place.

10.5.3. Burning of Healthcare Waste in Bhutan

The study revealed burning to be the second most prevalent reported waste disposal method in Bhutan. As reported in the focus group interviews by the hospital cleaners, syringes and needles were disposed of in an open pit and burnt. In Bhutan to date no study has been conducted to examine whether the burning of HCW emits toxic pollutants or to explore any adverse effects on public health, especially for people residing close to the pits. Research into this practice will provide evidence for future policy decisions and interventions.

10.5.4. Training Programs on Healthcare Waste Management

This study revealed that despite the conduct of training programs on HCWM, there was still inadequate knowledge on the part of both doctors and nurses who participated in the study. Swart and Coulson (2003) state that gaps in practice may not necessarily be related solely to inadequate knowledge; however, it is important to assess why past training had limited effects upon acquiring the appropriate knowledge to enable safe infectious waste management practices. The findings would aid in developing relevant training materials, content, as well as ways of conducting the sessions.

10.5.5. Problems with Nulife Dots in Bhutan

The device for destroying needles and syringe hub, Nulife Dots, was supplied to hospitals to manage sharps and minimise injuries from them. After supplying the device the Ministry of Health did not conduct an evaluation to assess whether the device performed as expected. As revealed in this study, significant problems were observed with the use of Nulife Dots. Therefore, there is a need to examine whether this observed ineffectiveness is associated with the quality of the device or with the way staff operated the device. Since problems with Nulife Dots were observed only at the NRH, it would be important to investigate whether staff in other hospitals in Bhutan experienced similar problems with the device. The findings would help in making decisions on the continued use of the device or the purchase of alternative equipment.

10.6. BENEFITS OF THE STUDY

The findings from this study could be used to create awareness among stakeholders and relevant groups of people to highlight gaps and weaknesses in the existing policies and practices related to infectious waste management; advocate rational process of policy formulation (evidence based policy making) to develop strategies to promote and strengthen safe practice; seek technical support and mobilise funds from interested donor agencies to improve the waste management system in the country and support further research in the future.

Instituting safe infectious waste management practices will not only provide a safer working environment but will also reduce associated public health problems as well as environmental risks. The effort to minimise the negative impact on the environment by safely managing infectious waste and sharps will be in line with Bhutan's nature conservation policy and also contribute in the global effort to protect and conserve the environment and in reducing disease burden attributed by occupational exposures to percutaneous injuries.

10.7. CONCLUSION

Healthcare waste management in Bhutan is an integral part of the overall healthcare delivery system, linked to the overall standards of hospital hygiene and safety. The Constitution of Bhutan states that every individual has the right not only to a safe and healthy environment, but also has equal duty to protect and promote the environment as well as public health. In Bhutan, despite the commitment of the Government as reflected in the Constitution, waste management at the institutional level is weak and needs to be strengthened. Effective management of waste will require a concerted effort at all levels with support and cooperation from other relevant agencies, ministries and organisations in within an enabling environment. Furthermore, to bring about successful, sustained changes will also require committed implementers including the Director of Department of Medical Services and the IC and HCWM Program Officer in the Ministry of Health, medical director, nursing superintendent, district medical officers and hospital staff within a practical legislative framework recognising environment protection as an important public health concern for the present and the future. Devising potential strategies for safe management of hospital infectious waste will require multipronged approaches which include educational programs, minimisation of hazards, engineering, administrative and work place controls, and personal protective equipment.

As suggested by Kingdon (1984) very often a "focussing event" draws the attention of policy makers to bring about changes; however, this has not been the case in Bhutan. Despite the gaps and the presence of occupational and public health risks in the prevailing HCWM practices, there has not been, to date, a single incident of an outbreak of a disease or a report of someone contracting infection linked to HCW brought to the attention of Ministry of Health or to the media. However, this does not necessarily indicate that no such event has occurred and that hospital infectious waste is being managed in a safe and sound manner. As revealed in the survey, there were instances where staff sustained needle-stick injuries and infection following the injury. The introduction of the Waste Prevention and Management Act of Bhutan in place may bring about improvements in the management of HCW by making the Ministry of Health more accountable and responsible in ensuring safe management of HCW.

As evident in this study, there are gaps and weaknesses in the existing policies related to hospital infectious waste management, as well as occupational health risks to people handling the waste, public health risks and potential for environment pollution obvious in the current practices. The findings from this study provide an opportunity for the Government and Ministry of Health in Bhutan to be proactive in developing policies and systems for the management of infectious hospital waste. Improvement will require system and behavioural changes with leaders from the top of the management showing direction and support, communicating their commitment, displaying effective leadership skills and making safety a fundamental goal of the Ministry of Health. Besides the commitment of managers at various levels within the organisation, it is unlikely for policies to be translated into operational tasks for effective management of hospital infectious waste.

In order to address the problems associated with unsafe HCWM practices, the understanding of policy makers and managers of the organisational context in which the problems arise is crucial. The reinforcement of relevant training on use of safety devices, elimination of risks and use of personal protective equipment will contribute to minimising or preventing the risks. However, problems related to understaffing and inadequate administrative support need to be equally addressed to build a quality and safer health care delivery system in Bhutan.

The Royal Government of Bhutan's investment in providing free healthcare services to the people and the political commitment to preserve the pristine environment and the global concern for environmental issues must not be compromised by unsafe healthcare waste management practices and detract from Bhutan's efforts to strive for "Gross National Happiness".

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APPENDICES

APPENDIX A:

APPROVAL LETTER FROM THE MINISTRY OF HEALTH BHUTAN

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ROYAL GOVERNMENT OF BHUTAN
MINISTRY OF HEALTH
THIMPHU BHUTAN
P.O BOX : 726

MoH/Sec/Gen/08/263

April 2, 2008

To Whom It May Concern:

This is to certify that, the Ministry of Health, Royal Government of Bhutan has endorsed Ms. Neyzang Wangmo's request to undertake research and data collection on infectious waste management practices in Bhutan as part of her PhD programme at the University of La Trobe, Melbourne, Australia.

(Dr. Gado Tshering)
SECRETARY
Ministry of Health
Royal Government of Bhutan

Secretary
Ministry of Health
Thimphu : Bhutan

PABX: + 975-2-322602, 322351, 328091, 328092, 328093 Minister: 323973 Fax: 323113 Secretary 326627
Fax: 324649 HRD: Tel/Fax- 323953 Extension 142

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APPENDIX B:

ETHICS APPROVAL FROM LA TROBE UNIVERSITY, MELBOURNE

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LA TROBE UNIVERSITY

RESEARCH AND GRADUATE STUDIES OFFICE

MEMORANDUM

To:	**Dr. Simon Barraclough, School of Public Health, FHS** **Ms Neyzang Wangmo, School of Public Health, FHS**
From:	**Secretary, La Trobe University Human Ethics Committee**
Subject:	**Review of Human Ethics Committee Application No. 08-110**
Title:	**Infectious Waste Management in Bhutan: An Analysis of Policy and Practice**
Date:	**8 September 2008**

Thank you for submitting revisions to your application for ethics approval to the La Trobe University Human Ethics Committee (UHEC) for the project referred to above. Your response was forwarded to a subcommittee of the UHEC, who has assessed the project as complying with the National Health and Medical Research Council's *National Statement on Ethical Conduct in Human Research* and with University *Human Research Ethics Guidelines*.

Your project has been granted ethics approval and you may commence the study.

The project has been approved to 30 June 2011.

Please note that your application has been reviewed by a sub-committee of the UHEC in the interest of facilitating a decision on your application before the next committee meeting. The decision to approve your project will need to be ratified by the full UHEC and consequently approval for your project may be withdrawn or conditions of approval altered. However, your project may commence prior to ratification of the approval decision. You will be notified if the approval status of your project is altered.

The following standard conditions apply to your project:

- **Complaints.** If any complaints are received or ethical issues arise during the course of the project, researchers should advise the UHEC Secretary on telephone (03) 9479 1443;

- **Limit of Approval.** Approval is limited strictly to the research proposal as submitted in your application while taking into account the conditions and approval dates advised by the UHEC;

- **Variation to Project.** As a consequence of the previous condition, any subsequent variations or modifications you may wish to make to your project must be notified formally to the UHEC. This can be done using the appropriate form (*Application for Approval of Modification to Research Project)* which is available on the internet at http://*www.latrobe.edu.au/www/rgso/ethics/ethics.htm*. If the UHEC considers that the proposed changes are significant, you may be required to submit a new application form for approval of the revised project;

- **Progress Reports.** You are required to submit a *Progress Report* form annually, on or just prior to 12 February (if your project continues for more than 12 months). The form is available on the internet (see above address). When completed, the form should be returned to the UHEC Secretary. Failure to submit a progress report will mean approval for this project will lapse. An audit may be conducted by the UHEC at any time.

A **Final Report** will be due by **31 December 2011.**

If you have any queries on the matters mentioned above or require any further clarification please contact me through the Research and Graduate Studies Department on telephone (03) 9479 1443, facsimile (03) 9479 1464 or e-mail address humanethics@latrobe.edu.au

On behalf of the UHEC, best wishes with your research!

Barbara Doherty
Administrative Officer (Research Ethics)
University Human Ethics Committee
postal details:
Research and Graduate Studies Office
La Trobe University Bundoora, Victoria 3086
P: (03) 9479 - 1443
F: (03) 9479 - 1464
http://www.latrobe.edu.au/rgso/ethics

(APPENDIX C)

LA TROBE UNIVERSITY

School of Public Health
Faculty of Health Sciences

PARTICIPANT INFORMATION STATEMENT

(In-depth interview)

Title of the project

Infectious Waste Management in Bhutan: An Analysis of Policy and Practice

Supervisors

Dr. Simon Barraclough and Dr. Priscilla Robinson
School of Public Health, La Trobe University
s.barraclough@latrobe.edu.au and Priscilla.robinson@latrobe.edu.au (respectively)

Dr.Beverley Wood
School of Nursing & Midwifery, La Trobe University
b.wood@latrobe.edu.au

Researcher

Ms. Neyzang Wangmo, undertaking her Doctor of Philosophy research in the School of Public Health at La Trobe University
nwangmo@students.latrobe.edu.au

Background of the study

In comparison to total healthcare waste, infectious waste poses a higher risk of transmission of infection and injury (needle prick). This study seeks to examine infectious waste management in selected hospitals in Bhutan from the perspective of policy makers, health professionals and waste handlers in order to improve the system.

Aim of the study

To explore infectious waste management policy and practice in selected hospitals in Bhutan and to identify how they can be strengthened.

La Trobe University
Victoria 3086, Australia
Tel: +61 3 9479 1751
Email: nwangmo@students.latrobe.edu.au
Web:www.latrobe.edu.au/publichealth

Your role as a participant

If you agree to participate in this study, you will be interviewed for approximately one hour using a semi-structured questionnaire. The interview will be tape-recorded and transcribed. You will have the right to discontinue the interview at any time. You may also ask that the information from the interview not be used, provided you ask this within four weeks of completion of the interview. You will not be personally identified as the source of information or opinions obtained during the interview. Your participation is **voluntary** and there are **no penalties** or **adverse consequences** for not participating in or withdrawing from the interview. Interview transcripts will be made available on individual request.

Confidentiality

All data will be processed using a computer protected by a password. Only the researcher and the supervisors working on this project will have access to your information.

Results of the study

The results from the study will appear in a PhD thesis and in a report to the Secretary, Ministry of Health, Royal Government of Bhutan. It is intended that the findings will be published in journal articles or book chapters. A copy of the report will also be kept at the Royal Institute of Health Sciences (RIHS) Library in Thimphu and will be available to participants on request from the library.

In the course of the study if any serious health risks are identified the authorities will be informed while maintaining the anonymity of the informant.

Complaints or queries

Any questions regarding this project may be directed to the supervisors at La Trobe University or to Neyzang Wangmo, (phone: +613 9479 1751, email: nwangmo@students.latrobe.edu.au). If you have any further queries and or complaints, you may contact the Secretary, Human Ethics Committee, Research and Graduate Studies Office, La Trobe University, Victoria 3082, (phone: +613 9479 1443, email: **humanethics@latrobe.edu.au**.

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(**APPENDIX D)**

School of Public Health
Faculty of Health Sciences

PARTICIPANT INFORMATION STATEMENT

(Focus group interview)

Title of the project

Infectious Waste Management in Bhutan: An Analysis of Policy and Practice

Supervisors

Dr. Simon Barraclough and Dr. Priscilla Robinson
School of Public Health, La Trobe University
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Dr. Beverley Wood
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Researcher

Ms. Neyzang Wangmo, undertaking her Doctor of Philosophy research, in the School of Public Health at La Trobe University
nwangmo@students.latrobe.edu.au

Background of the study

In comparison to total healthcare waste, infectious waste poses a higher risk of transmission of infection and injury (needle prick). This study seeks to examine infectious waste management in selected hospitals in Bhutan from the perspective of policy makers, health professionals and waste handlers in order to improve the system.

Aim of the study

To explore infectious waste management policy and practice in selected hospitals in Bhutan and to identify how they can be strengthened.

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Web:www.latrobe.edu.au/publichealth

Your role as a participant

If you agree to participate in this study, you will be interviewed for approximately two hours using a semi-structured questionnaire. The interview will be tape-recorded and transcribed. You will have the right to discontinue the interview at any time. You may also ask that the information from the interview not be used, provided you ask within four weeks of completion of the interview. You will not be personally identified as the source of information or opinions obtained during the interview. Your participation is **voluntary** and there are **no penalties** or **adverse consequences** for not participating in or withdrawing from the interview. Interview transcripts will be made available on individual request.

Confidentiality

All data will be processed using a computer protected by a password. Only the researcher and the supervisors working on this project will have access to your information.

Results of the study

The results from the study will appear in a PhD thesis and in a report to the Secretary, Ministry of Health, Royal Government of Bhutan. It is intended that the findings will be published in journal articles or book chapters. A copy of the report will also be kept at the Royal Institute of Health Sciences (RIHS) Library in Thimphu and will be available to the participants on request from the library.

In the course of the study, if any serious health risks are identified the relevant authorities will be informed while maintaining the anonymity of the informant.

Complaints or queries

Any questions regarding this project may be directed to the supervisors at La Trobe University or to Neyzang Wangmo, (phone: +613 9479 1751, email: nwangmo@students.latrobe.edu.au). If you have any further queries and or complaints, you may contact the Secretary, Human Ethics Committee, Research and Graduate Studies Office, La Trobe University, Victoria 3082, (phone: +613 9479 1443, email: **humanethics@latrobe.edu.au**.

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School of Public Health
Faculty of Health Sciences

(APPENDIX E)

PARTICIPANT INFORMATION STATEMENT

(Survey questionnaire)

Title of the project

Infectious Waste Management in Bhutan: An Analysis of Policy and Practice

Supervisors

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Dr. Beverley Wood
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b.wood@latrobe.edu.au

Researcher

Ms. Neyzang Wangmo, undertaking her Doctor of Philosophy research, in the School of Public Health at La Trobe University
nwangmo@students.latrobe.edu.au

Background of the study

In comparison to the total healthcare waste, infectious waste poses a higher risk of transmission of infection and injury (needle prick). This study seeks to examine infectious waste management in selected hospitals in Bhutan from the perspective of policy makers, health professionals and waste handlers in order to improve the system.

Aim of the study

To explore infectious waste management policy and practice in selected hospitals in Bhutan and to identify how they can be strengthened.

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Your role as a participant

If you agree to participate in this study, it will take about 20 minutes to complete the attached questionnaire. I would appreciate it if you could respond to all the questions and give your comments. All contributions made by you will be valuable and help in the development of policy and strengthening of infectious waste management. Please ***do not write your name*** on the document. Your participation in the study is **voluntary** and there are **no penalties** or adverse consequences for not participating. You are requested to return the completed questionnaires to the researcher in the stamped self-addressed envelope provided to you within **two weeks** of receiving the questionnaire.

Confidentiality

All data will be processed using a computer protected by a password. Only the researcher and the supervisors working on this project will have access to your information. The questionnaires are anonymous.

Results of the study

The results from the study will appear in a PhD thesis and in a report to the Secretary, Ministry of Health, Royal Government of Bhutan. It is intended that the findings will be published in journal articles or book chapters. A copy of the report will also be kept at the Royal Institute of Health Sciences (RIHS) Library in Thimphu and will be available to the participants on request from the library.

In the course of the study, if any serious health risks are identified the relevant authorities will be informed while maintaining the anonymity of the informant.

Complaints or queries

Any questions regarding this project may be directed to the supervisors at La Trobe University or to Neyzang Wangmo, (phone: +613 9479 1751, email: nwangmo@students.latrobe.edu.au). If you have any further queries and or complaints, you may contact the Secretary, Human Ethics Committee, Research and Graduate Studies Office, La Trobe University, Victoria 3082, (phone: +613 9479 1443, email: humanethics@latrobe.edu.au.

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(APPENDIX F)

In-depth interview question guide
(Policy makers)

1 What is your personal view on the standard of infectious waste management practices in the country?

2 What is your view on the knowledge and skill of people involved in the management of infectious waste?

3 How important is the management of infectious waste in the delivery of quality health care services?

4 What are some of the major problems faced in managing infectious waste and sharps in Bhutan?

5 What monitoring tools are in place (both at the national level and institutional level) for the management of infectious waste?

6 What occupational safety measures are in place to protect staff in work place whilst handling infectious waste?

7 Who do you think should be responsible in managing the hospital infectious waste?

8 How important is the training of infectious waste management? Which category of staff?

(APPENDIX G)

Focus group interview question guide
(Hospital cleaners, National Referral Hospital)

1. Have you attended training on the management of healthcare waste?
2. What difference has the training made in managing infectious waste and sharps?
3. What sort of risks are there when handling infectious waste?
4. Why do infectious waste and sharps need to be handled more carefully compared with other healthcare wastes?
5. How do you differentiate between infectious and non-infectious waste?
6. How are infectious waste and sharps, collected and transported to disposal site in the facility?
7. Do you always wear personal protective equipment (PPE) whilst handling infectious waste?
8. Is the supply of PPE adequate, regular and accessible at all times?
9. Do you think wearing PPE will prevent transmission of infection?
10. If you get pricked or injured by a sharps whilst handling, what would you do?
11. Have you ever contracted infection as a result of needle prick from your work?
12. What problems do you face with regard to infectious management in your work?

(APPENDIX H) **Office use only**

☐☐☐☐

INFECTIOUS WASTE MANAGEMENT IN HOSPITALS IN BHUTAN

(Survey Questionnaire)

This survey explores the management of infectious waste and sharps by health professionals in your hospital. Your responses will assist in the further development of policy and programs. Please answer every question. All responses to the questionnaires are **ANONYMOUS** and **CONFIDENTIAL**. You are requested to return the completed questionnaires to the researcher within **two weeks** of receiving in the self addressed envelope provided to you. Please **DO NOT** write your name on the form**.**

SECTION A

Please tick the appropriate box

1. What is your current work?

☐ Assistant Nurse
☐ Auxiliary nurse-midwife
☐ A chief nurse
☐ Staff nurse
☐ Doctor / Specialist
☐ Nursing Superintendent / Deputy / Assistant Nursing Superintendent

2. What is the highest level of school education you have completed?

☐ Class 8 or below
☐ Class 9 - 11
☐ Class 12 or above

3. What is the highest level of professional qualification you have obtained?

☐ Certificate
☐ Diploma
☐ Bachelor's degree
☐ Postgraduate certificate
☐ Postgraduate diploma
☐ Master's degree
☐ Other (Please specify) -----------------------------------

----

4. For how many years have you been in the health service?

☐ Less than one year ☐ 1- 5 years ☐ 6 – 10 years ☐ 11 years or more

5. What type of hospital are you working in?

☐ National Referral hospital
☐ Regional Referral hospital
☐ District Hospital

SECTION B

6. Was the topic of *Healthcare Waste Management* covered in your pre-service training (Nursing or Medical School)?

☐ Yes ☐ No ☐ I don't remember

7. Have you had any other training on healthcare waste management since you were employed?

☐ Yes ☐ No ☐ Unsure

8. How do you define **"Infectious waste" ? (***Please tick only one of the boxes).*

☐ Any waste generated from a health facility
☐ Any waste containing biological matter derived from a patient (e.g. tissue, blood, urine)
☐ Any waste containing toxic substances or disinfectants
☐ I don't know

Office use only

☐☐☐☐

SECTION C

Please provide the response that best fits your experience in the workplace.

9. Do you segregate (separated) infectious waste from other category of healthcare waste?

☐ Always ☐ Sometimes ☐ Rarely ☐ Never ☐ I don't know

10. Is solid infectious waste autoclaved before disposal?

☐ Always ☐ Sometimes ☐ Rarely ☐ Never ☐ I don't know

11. Do you treat (made non-infectious) liquid infectious waste before disposal?

☐ Always ☐ Sometimes ☐ Rarely ☐ Never ☐ I don't know

12. What type of waste receptacle is used for collecting infectious waste at your facility? (*Tick all that apply*)

☐ Bucket with lid and foot pedal
☐ Plastic bag
☐ Cardboard box
☐ A rubbish bin
☐ I don't know

13. What coloured receptacle does your facility use for collecting infectious waste?

☐ Green ☐ Blue ☐ Yellow ☐ Red ☐ Other (*please specify*)………………………

14. Are receptacles with infectious waste in your facility labelled "INFECTIOUS"?

☐ Always ☐ Sometimes ☐ Rarely ☐ Never ☐ I don't know

15. To what level is the receptacle for waste usually filled?

☐ Until waste overflows from the receptacle
☐ To the brim of the receptacle
☐ Until the receptacle is 3/4 full
☐ I don't know

16. How is infectious waste disposed of at your facility? (*Tick all that apply)*

☐ Deep pit burial
☐ Open pit
☐ Municipal (City corporation) waste bin
☐ Burnt
☐ I don't know

17. In your facility, how is infectious waste transported from wards /units to the disposal site? (*Tick only one of the boxes)*

☐ Hand carried
☐ On a specific waste trolley
☐ I don't know
☐ Other means (*please specify*) ……………………………………………………………..
……………………………………………………………………………………………………

18. Are sharps kept separately from other categories of healthcare waste?

☐ Always ☐ Sometimes ☐ Rarely ☐ Never ☐ I don't know

Official use only

☐☐☐☐

19. How are sharps disposed of in your facility? (*Tick any that apply)*

- ☐ Deep pit burial
- ☐ Open pit
- ☐ Municipal (City corporation) waste bin
- ☐ Burnt
- ☐ I don't know

20. What type of receptacle is used for collecting sharps? (*Tick any that apply)*

- ☐ Bottles
- ☐ Plastic bags
- ☐ Safety box
- ☐ Cardboard box
- ☐ I don't know

21. What colour coded waste receptacle does your facility use to collect sharps?

☐ Red ☐ Yellow ☐ Blue ☐ Green ☐ Other (*please specify*…………

……………………………………………….

22. Are the sharps receptacles labelled as "SHARPS"?

☐ Always ☐ Sometimes ☐ Rarely ☐ Never ☐ I don't know

23. To what level is the sharps receptacle filled?

- ☐ Until sharps overflow from the receptacle
- ☐ To the brim of the receptacle
- ☐ Until the receptacle is 3/4 full
- ☐ I don't know

SECTION D

Is the following protective gear available in your work place? (*Please tick the appropriate box in relation to each item):*

	Always	Sometimes	Rarely	Never
24. Surgical gloves	☐	☐	☐	☐
25. Mask	☐	☐	☐	☐
26. Protective eye wear or face shield	☐	☐	☐	☐
27. Gowns	☐	☐	☐	☐
28. Plastic aprons	☐	☐	☐	☐
29. Over shoes (gumboots)	☐	☐	☐	☐

If available, which items of protective gear do you wear while handling infectious waste? (*Please tick the appropriate box in relation to each item):*

	Always	Sometimes	Rarely	Never
30. Surgical gloves	☐	☐	☐	☐
31. Mask	☐	☐	☐	☐
32. Protective eye wear or face shield	☐	☐	☐	☐
33. Gowns	☐	☐	☐	☐
34. Plastic aprons	☐	☐	☐	☐
35. Over shoes (gumboots)	☐	☐	☐	☐

Official use only

☐☐☐☐

36. Have you ever had a needle prick injury during the course of your work?

☐ Never ☐ Once ☐ A few times (2-5) ☐ Many times (more than 5) ☐ I don't Remember

37. Have you ever contracted an infection as a result of a needle (syringe) prick or sharp injury?

☐ Yes ☐ No ☐ I don't remember

38. If yes, what type of infection did you get?

☐ An acute infection ☐ Chronic infection ☐ I don't remember

39. Do you report incidents involving needle prick or blood splash that occur in your work place?

☐ Always ☐ Sometimes ☐ Never

40. If incidents are not reported, why is this so? (*You may tick more than one response)*

This is because:

☐ Fear of consequences
☐ Did not know it had to be reported
☐ Not important to report
☐ Busy, not enough time
☐ Not sure how to report
☐ Other reason (please specify)

....

....

41. Do you know the requirements of sharps injury protocol contained in the Infection Control and Healthcare Waste Management Guidelines of the Ministry of Health, Bhutan?

☐ Yes ☐ No

SECTION E

42. How would you rate the current system of infectious waste management practice in your hospital?

☐ Very good ☐ Good ☐ Poor ☐ Very poor ☐ Unable to Rate

43. How safe do you consider the current practice of infectious waste management in your hospital?

☐ Always safe ☐ Sometimes safe ☐ Rarely safe ☐ Unsafe ☐ Unable to rate

What is your responsibility in the waste management in your facility? (*please tick the appropriate box in relation to each item):*

	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Sure
44. Waste reduction or minimization	☐	☐	☐	☐	☐
45. Correct disposal	☐	☐	☐	☐	☐
46. Implementation of the IC & HCWM Guidelines	☐	☐	☐	☐	☐
47. Correct handling at the source	☐	☐	☐	☐	☐
48. Monitoring & supervision of staff	☐	☐	☐	☐	☐
49. Staff orientation	☐	☐	☐	☐	☐

If you have any comment(s) or suggestions to improve management of infectious waste in hospitals in Bhutan, please outline them.

(THANK YOU FOR YOUR TIME)

(APPENDIX I)

Checklist for the observation of infectious waste management practices at the National Referral Hospital

<u>Unit</u> : …………………….. **Date : ………………..**

Time: …………………..

1. Segregation of waste:

a). *Infectious waste* : Yes (completely) Yes (to some extent) No

b). *Sharps:* Yes (completely) Yes (to some extent) No

2. Waste receptacle:

a). *Colour coded:* Yes (specify colour) No

b). *Leak proof :* Yes No (specify type of container used)

c). *Lid present*: Yes No

d). *Wheels present:* Yes No

e). *Level of waste in the receptacle* : ¾ full Filled till the brim Over flowing

e). *Location :* Convenient & safe Convenient but unsafe Inconvenient & unsafe

4. Storage of:

a). Infectious waste – Safe, Secure, Locked, accessible to authorised personnel only

Unsafe, unsecured, no lock & key, easily accessible

b). Sharps – Safe, Secure, Locked & accessible to authorised personnel only

Unsafe, unsecured, no lock & key, accessible

5. a) Mode of transportation:

Hand carried Patient trolley or wheel chair Specific carrier for waste only

b) Pathway for transport of infectious waste

Separate pathway No separate pathway

6 Treatment & disposal:

a). Infectious waste

b). Sharps

c). Liquid waste

7. a) Disposal site: Secured and safe Not secured and unsafe

b) Location of the disposal site (describe):

(APPENDIX J)

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LETTER

To
The Hospital Superintendent/ District Medical Officer
----------------------------*(Name of the hospital)*
National / Regional Referral / District hospitals

Sub: Invitation to doctors and nurses to participate in a study on infectious waste management

Sir / Madam,

I am currently undertaking PhD research at La Trobe University, Melbourne on hospital infectious waste management policy and practice in selected hospitals. The objective of the study is to assess the current system of infectious waste management with regard to collection, transportation, storage and disposal; identify gaps between policy and practice that impede optimal performance of infectious waste management in hospitals; explore the knowledge and attitudes of people involved in infectious waste management and identify strengths and weaknesses with current practices of infectious waste management. The findings from the study will help in further development of policy and infectious waste management practices in Bhutan besides reducing associated risks (health and environment pollution) and providing a safer working environment for people both within and outside the health facility. I would also like to inform you that in the event that the findings reveal any serious health risks, the relevant authorities will be informed while maintaining the anonymity of the informant or informants.

I would like to emphasize that participation in the study by staff members is entirely **voluntary** and there are **no penalties** or **adverse consequences** for not participating in the study.

I have obtained approval from the Ministry of Health to conduct the study in hospitals in Bhutan. A copy of the letter is attached for your reference. I intend using survey questionnaires to collect information from doctors and nurses from your hospital. I would therefore, ask you to:

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- distribute the enclosed questionnaires with information for participants and the stamped self-addressed envelopes to all the doctors and nurses working in your hospital;
- keep extra copies of the questionnaire in case someone loses the original;
- send a general reminder letter to the participants (copy of letter attached) two weeks after the distribution of the questionnaire to the participants and;
- provide me with statistics on the total number of doctors and nurses working in your hospital so that I can assess return rates.

The participants are requested to return the completed questionnaires to the researcher in the stamped self-addressed envelope provided to them within **two weeks** of receiving the questionnaire.

Thanking you for your assistance

Yours sincerely,

Neyzang Wangmo
(PhD Candidate)
La Trobe University
Melbourne, Australia

***Attachments**:*

1. Approval letter from the Ministry of Health, Bhutan
2. Information Statement for the Participants
3. Questionnaires
4. Follow-up letter

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(APPENDIX K)

Follow-up letter

Dear Colleagues,

This letter is to remind you about the questionnaire on infectious waste management that was distributed to you about two weeks ago. If you have already completed and posted the questionnaire to the researcher please ignore this letter. But if you have not returned the questionnaire, you are requested to do so. In case you have lost the questionnaire, please get another copy from your hospital administrator.

Thanking you for your cooperation and participation

Yours sincerely,

Neyzang Wangmo
(PhD Candidate)
La Trobe University
Melbourne, Australia

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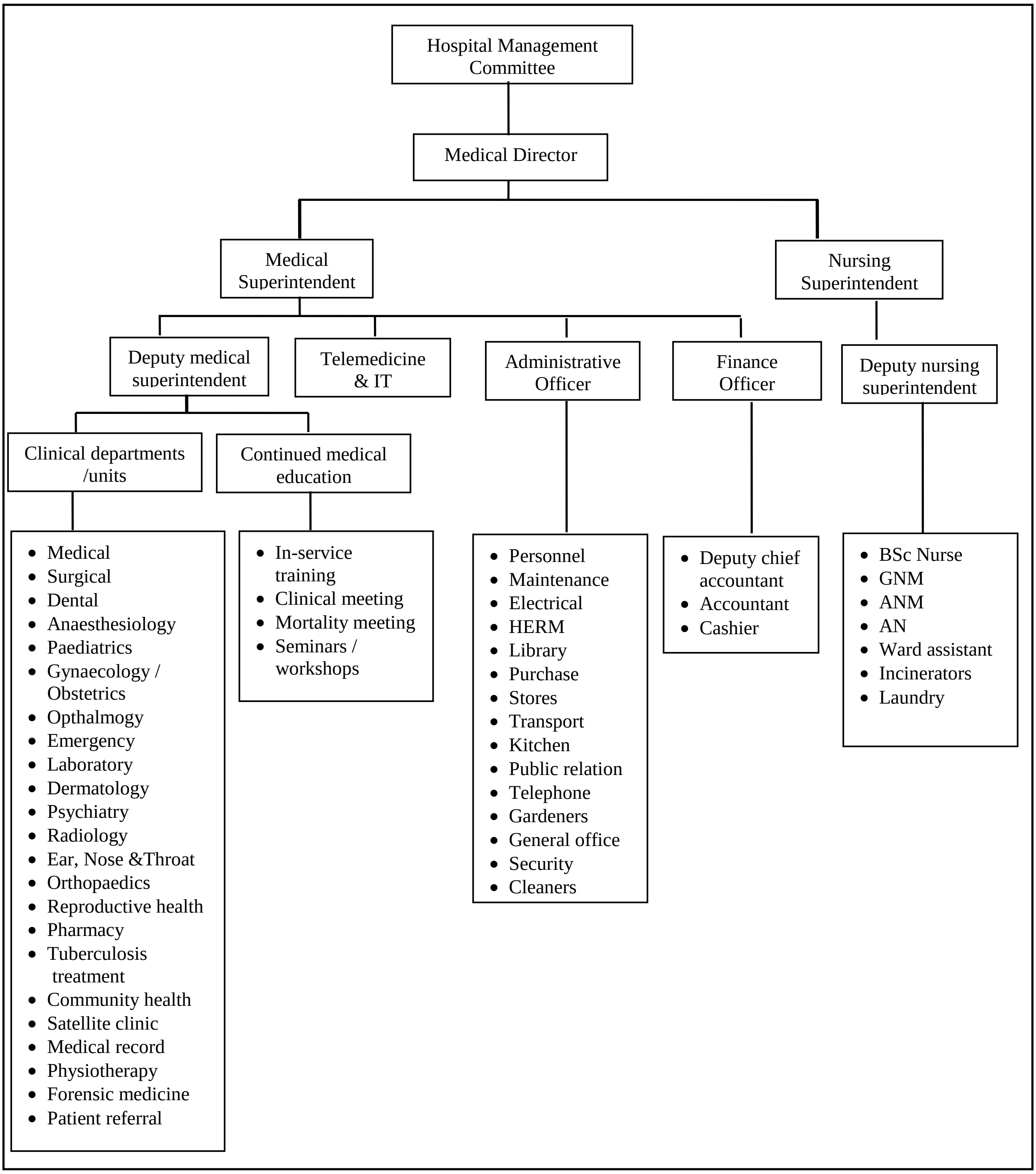
(APPENDIX L)

Organogram of the National Referral Hospital



(GNM – *general nurse midwife*; ANM- *auxiliary nurse midwife*; AN- *assistant nurse*)

(Source : Jigme Dorji Wangchuk National Referral Hospital, 2010)

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