Report on health-care waste management status in countries of the South-East Asia Region

April 2017

World Health Organization
Regional Office for South-East Asia

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Report on health-care waste management (HCWM) status in Countries of the South-East Asia Region (SEA Region), April 2017.

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Foreword

This report – Report on health-care waste management (HCWM) status in Countries of the South-East Asia Region (SEA Region) – presents an assessment of health-care waste management policies and practices in 10 Member States of the WHO South-East Asia Region. Primary data from health-care facilities, secondary data obtained through the ministries of health, and status reports presented by focal points of the ministries of health from 10 Member States that attended a regional workshop on health-care waste management in 2016 were used in preparing this report.

Six of the 10 Member States that shared data have a dedicated policy on health-care waste management. Two Member States have draft policies in place and another two have guidelines. The average health-care waste generated daily in the Region is approximately 0.693 kg/bed. All countries have reported using segregation and colour-coding norms; however, segregation practices range from 30% to 100%. Collection and transportation of waste remains a serious concern. Most hospitals find it tedious and unaffordable to transport their waste through private transporters and hence dump it with municipal waste.

Rules and guidelines in most countries mandate a proper waste storage room with good ventilation. Most health-care facilities surveyed, however, have yet to develop such rooms. Many countries report using open burning and incinerating in single-chamber incinerators as the major means of treating waste. The WHO report on small-scale burners and incinerators has shown these to be very polluting. Concerted efforts are needed to shift from such polluting ways to cleaner or non-burn technologies for treating medical waste.

Bhutan and India have made hepatitis B vaccination mandatory for health-care staff. Indonesia, Maldives, Myanmar, Nepal and Sri Lanka have vaccination programmes in place but all health-care staff are not covered. It is important that all countries include relevant vaccination for all categories of health-care workers and hospital staff to prevent infectious diseases which can be transmitted through improper handling and management of health-care wastes.

Most countries have a policy in place for disposing pharmaceutical waste but no country has a policy on handling and managing hazardous and cytotoxic drugs. Incineration, secured landfilling, encapsulation and disposal at cement kilns are the most common ways of disposing pharmaceutical waste. Indonesia has an extended producer responsibility for pharmaceuticals. Most Member States have initiated steps to curtail the use of mercury in the health-care sector. Most Member States also do not have policies or guidelines for the safe management of wastewater from health-care facilities. Since hospital wastewater contains toxic chemicals, heavy metals, antibiotic residues and antibiotic-resistant bacteria, it is very important to ensure its proper treatment before disposal into the environment.

Although compliance on health-care waste management remains a big challenge in many Member States, there are some good practices which have been documented in this report. WHO will continue to work with the ministries of health to raise awareness, develop capacity, and institutionalize management of health-care wastes to protect patients, health workers, hospital staff and the community.

Dr Poonam Khetrapal Singh
Regional Director

Abbreviations

AIDS	Acquired Immuno-Deficiency Syndrome
AIIMS	All-India Institute of Medical Sciences
ADS	auto-disabled syringes
BAT	best available technologies
BBS	Bhutan Broadcasting Service
BEE	Bureau of Energy Efficiency
BEP	best environmental practices
BHUs	basic health units
BMPs	best management practices
BMW	biomedical waste
BMWM	biomedical waste management
CAG	Comptroller and Auditor General of India
CBWTF	Common biomedical waste treatment facility
CEA	Central Environmental Authority
CEPHED	Centre for Public Health and Environment Development
CEU	Central Epidemiology Unit
CHCs	community health centres
CIDA	Canadian International Developmental Agency
CME	continuing medical education
CPCB	Central Pollution Control Board
CTF	common treatment facility
DDA	Department of Drug Administration
DGFP	Director General of Family Planning
DGHS	Directorate General of Health Services
DHs	district hospitals
DoE	Department of Environment
DoHS	Department of Health Services
DoPH	Department of Public Health
ECR	Environment Conservation Rules
EIA	environment impact assessment

EMOC	emergency medical obstetric care
EMT	emergency medical team
EPA	Environment Protection Act
EPL	Environmental Protection License
EPR	extended producer responsibility
ETP	effluent treatment plant
e-waste	electronic waste
GDP	gross domestic product
GEF	Global Environment Facility
HAI	health-care acquired infection
HAMT	hospital administration and management transformation
HBV	hepatitis B virus
HCE	health-care establishment
HCF	health-care facility
HCV	hepatitis C virus
HCW	health-care waste
HCWM	health-care waste management
HECAF	Health Care Foundation
HFR	health-care facility research
HICC	Hospital Infection Control Committee
HIV	human immunodeficiency virus
HNGV	National Hospital Guido Valadares
HP	health posts
HPNSDP	Health, Population and Nutrition Sector Development Program
HW	hazardous waste
HWL	Hazardous Waste License
IAEA	International Atomic Energy Agency
IC and MWM	Infection Control and Medical Waste Management
ICDDRB	International Centre for Diarrheal Disease and Research
IEC	information, education and communication
IEE	initial environmental examination
IGMH	Indira Gandhi Memorial Hospital
IPC	infection prevention and control
IPHS	Indian Public Health Standard
IW	Infectious Waste
JDWNRH	Jigme Dorji Wangchuk National Referral Hospital
JICA	Japanese International Corporation Agency

KAP	knowledge, attitude, practice
KGMU	King George's Medical University
KGUMS	Khesar Gyalpo University of Medical Sciences
kld	Kilo litres per day
KMC	Kathmandu Medical College
KPIs	key performance indicators
LAO	local administrative organization
LHMC	Lady Hardinge Medical College
MCDC	Mandalay City Development Committee
MCH	medical college hospital
MERS-CoV	Middle Eastern respiratory syndrome coronavirus
MNRE	Ministry of Natural Resources and Environment
MoEE	Ministry of Environment and Energy
MoEF&CC	Ministry of Environment Forest & Climate Change
MoH	Ministry of Health
MoHFP	Ministry of Health and Family Planning
MoHFW	Ministry of Health and Family Welfare
MoHS	Ministry of Health Sciences
MoPE	Ministry of Population and Environment
MoPH	Ministry of Public Health
MSDS	Material Safety Data Sheet
MWM	medical waste management
NABH	National Accreditation Board for Hospitals and Health-care Providers
NACO	National AIDS Control Organization
NCASC	National Centre for AIDS and STD Control
NCCWM	National Steering Committee for Clinical Waste Management
NEA	National Environment Act
NEC	National Environment Commission
NGO	nongovernmental organization
NHCWM	National Healthcare Waste Management Policy
NHRC	Nepal Health Research Council
NIPS	National Initiative on Patient Safety
NRHM	National Rural Health Mission
NSIs	needle-stick injuries
OEH	Occupational and Environmental Health
OTs	operation theatres
PAH	polycyclic aromatic hydrocarbons

PCB	polychlorinated biphenyl
PCC	Pollution Control Committee
PCI	prevention and control of infections
PEP	post-exposure prophylaxis
PHA	Public Health Act
PHCs	primary health centres
POPs	persistent organic pollutants
PPE	personal protective equipment
PRISM	Project in Agriculture, Rural Industry, Science and Medicine
PTS	private transport sector
QCI	Quality Council of India
RHC	rural health centres
SDHs	subdistrict hospitals
SEARegion	South-East Asia Region
SGP	small grants programme
SISCA	Integrated Development of Community Health Services
SOPs	standard operating procedures
SPCB	State Pollution Control Board
STP	sewage treatment plant
SWL	Scheduled Waste License
TB	tuberculosis
TEQ	toxicity equivalence factor
TOT	training of trainers
TSDF	hazardous waste treatment, storage and disposal facility
TUTH	Tribhuvan University Teaching Hospital
UHC	universal health coverage
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations International Children's Emergency Fund
UNIDO	United Nations Industrial Development Organization
VBH	Valachenai base hospital
VDC	village development committee
WHO	World Health Organization
YCDC	Yangon City Development Committee

1

Introduction

As defined by WHO (2014), the term health-care waste includes all the waste generated within health-care facilities, research centres and laboratories related to medical procedures. It also includes waste produced in the course of health care undertaken in the home.

The hazardous nature of health-care waste is due to one or more of the following characteristics: presence of infectious agents, genotoxic or cytotoxic chemical composition, presence of toxic or hazardous chemicals or biologically aggressive pharmaceuticals, presence of radioactivity and presence of used sharps (WHO 2014).

Owing to the multi centric generation, biomedical waste affects many people, which include medical doctors, nurses, health-care auxiliaries and hospital maintenance personnel, patients in health-care facilities or receiving home care, visitors to health-care facilities, workers in support services, such as cleaners, people who work in laundries, porters transporting waste to a treatment or disposal facility, workers in waste-management facilities (such as landfills or treatment plants), as well as informal recyclers(scavengers) and last but not least, our environment (WHO 2014).

Improper disposal practices of hospital waste affects the people who come in direct contact with it. Waste piles also attract a variety of disease vectors, including mosquitoes and flies (S. Gupta and R. Boojh2006). It can cause environmental pollution, unpleasant odors, and growth of insects, rodents and worms; it may lead to transmission of diseases such as typhoid, cholera, HIV, tuberculosis (TB), hepatitis B and C through injuries from sharps contaminated with human blood (F. Abdulla, H. A. Qdais and A.Rabi2008). Moreover, antibiotics poured down the drain can kill beneficial microbes and bacteria in septic systems, and dumping of health-care waste in uncontrolled areas can have a direct environmental effect by contaminating soils and underground water (S. V.Manyele and T. J. Lyasenga 2010).

In addition to health risks derived from direct contact, health-care waste can adversely impact human health by polluting the air through emissions of highly toxic gases during incineration.

The risks associated with health-care waste are infection from a deep needle-stick injury involving fresh blood from an infected patient (HIV, hepatitis C and B) and exposure to blood splashes (1 to 4 out of every 10000 workers handling biomedical waste could develop HIV due to blood splashes) (WHO Regional Workshop, 2016).

In 2000, sharps injuries to health-care workers were estimated globally to have caused about 66000 hepatitis B virus (HBV), 16000 hepatitis C virus (HCV) and 200–5000 HIV infections among health-care workers (Prüss-Ustun et al. 2005). For health-care workers, the percentage of these infections that are due to percutaneous occupational exposure to HBV, HCV and HIV are 37%, 39% and 4%, respectively. It is estimated that more than 2million health-care workers are exposed to percutaneous injuries with infected sharps every year (Prüss-Üstün et al. 2005).

2

Need for health-care waste management

Biomedical waste management started with the need to protect local communities from spread of infections and later became an issue of global significance. Segregation of waste in a hospital affects infection control, patient safety, occupational health (in the hospital), and overall community health and the environment. It also helps to cut down emissions of greenhouse gases, persistent organic pollutants (POPs), mercury and other hazardous waste (HW).

In the new environmental paradigm, biomedical waste management affects many bigger environment issues including the release of POPs, which are released during medical waste incineration.

The health-care sector has become a major stakeholder to address health and environment issues. Biomedical waste management affects many critical issues that have received international attention and priority. Injection safety and patient safety secretariats (under WHO) are working with various national governments. Both of these put much focus on good biomedical waste management practices. On the environment front, management of BMW is directly related to the success of international environmental treaties such as the Stockholm Convention on Persistent Organic Pollutants, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal and the Minamata Treaty on Mercury.

The recent experiences from Ebola and MERS-CoV disease outbreaks highlight the need for very strong infection prevention and control (IPC) measures in health-care facilities, as transmission of the viruses has occurred in health□care facilities in several countries. Health-care waste management together with safe water, proper sanitation and hygiene are key measures for prevention and control of infection in health-care facilities.

A United Nations (UN) human rights expert noted that medical waste was becoming an increasing problem. The Special Rapporteur noted that much more remained to be done to ensure the effective enjoyment of the inherent right to life, as set out in article 6 of the International Covenant on Civil and Political Rights, and the right to the highest attainable standard of health, as defined in an article of the International Covenant on the Economic, Social and Cultural Rights in the context of the management and disposal of medical waste.

3

World Health Organization Policy

WHO has elaborated a number of policy, management and advocacy tools to minimize the risks that the improper management of health-care waste poses to health-care workers, patients, waste handlers, the community at large and the environment. It has also facilitated the establishment and sustained maintenance of a sound system of health-care waste management. These include a policy paper on safe health-care waste management (2004) and core principles for achieving safe and sustainable management of health-care waste (2007). WHO has also developed a handbook on the safe management of health-care waste, a policy document to facilitate the elaboration of a national plan of action on health-care waste management, as well as specific guidelines for the safe management of particular categories of medical waste, such as solid health-care waste and mercury-containing equipment (WHO 2005).

WHO has also established tolerable intake limits for dioxins and furans, but not for emissions. The latter must be set within the national context. A number of countries have defined emission limits. They range from 0.1 ng TEQ/m3 (toxicity equivalence factor) in Europe and India, to 0.1 ng to 5 ng TEQ/m3 in Japan, according to incinerator capacity.

4

Rationale of the report

The present study has been carried out by WHO in collaboration with Toxics Link to identify gaps existing in the countries and to help make regional plans to increase compliance of medical waste management (MWM) in the Region.

As a part of this study, a regional meeting was conducted in 2016. The meeting identified the current medical waste management system, progress from the last meeting, models in each country and action plans to be drafted for each country.

The report envisaged to get data from across the South-East Asia Region with the help of health ministries of each country and prepare reports for 10 countries comprising: Bangladesh, Bhutan, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste. The objectives of this report are to review progress of implementation of the policy and regulatory frameworks, including allocation of financial and human resources. The report also plans to identify gaps in the current situation and recommend strategic action for improvement.

Questionnaires were made to collect national data and information from health-care facilities respectively. Data were collected through the Ministry of Health and WHO country offices. Primary data collected from a few facilities, secondary literature review, the form filled by the MoH and information shared during the HCWM workshop in November 2016 were all compiled to form each country report respectively. The reports are presented below.

5

Regional overview

Status of health-care waste management policy

Six countries out of the ten that shared their data had a dedicated policy for health-care waste management. Bhutan,and Nepal have issued guidelines for the management of health-care waste. Bhutan has a draft policy that has to be approved. Timor-Leste has still to devise a national policy for health-care waste management(HCWM). Despite the fact that no policy is in place, HCWM training was conducted in the country by WHO in March 2013. In a few hospitals, basic segregation has also started. Sri Lanka seems to be doing fairly good on the ground but their policy document needs to be finalized (the draft was issued in 2001). India amended its Bio-medical Waste management Rules in 2016, but the rules may undergo further amendments soon. Maldives has formulated a policy and made a very progressive action plan for taking the issue forward. Overall, many nations would need to incorporate injection safety in the waste management policy.

Waste management committee

Most of the countries have a requirement to form a waste management committee at the health-care facility (HCF), state and national levels. This committee is responsible for supervising the work related to health-care waste management. Indonesia has a requirement of having a unit looking into environmental health which also includes healthcare waste management. Even though Timor-Leste does not have a policy yet, some of the health-care establishments (HCEs) had a nodal person for waste management. Some countries such as Bhutan and Maldives have the requirement of forming a committee in their guidelines/policy, but they are hardly being implemented. India, Myanmar and Sri Lanka have a waste management committee in 90% of their facilities.

Quantum of health-care waste generation

Health-care waste generated per bed per day in the SEA Region varies from 0.2 to 0.8 kg/bed/day. Average medical waste production in the Region stands at approximately 0.693kg/bed/day (data from 8 countries).

The total quantity of health-care waste in the SEA Region (eight countries only, excluding Democratic People's Republic of Korea, Myanmar and Timor-Leste) is approximately 415030.88 tonnes/annum.

Segregation

All the countries have reported having segregation and colour-coding norms. The segregation in countries ranges from 30% to 100%. Government data from Indonesia and Myanmar report the highest rate of segregation at 97% and 100% respectively. But secondary literature review reflects bad

segregation and poor compliance in both countries. Nepal and Sri Lanka also claim 70% segregation. About 30% of the facilities in Bhutan and India are following segregation. In Bangladesh, waste is collected without segregation and dumped along with municipal waste. Health-care facilities in Timor-Leste are trying to segregate waste but bins are not available in most places.

In Thailand, infectious waste is segregated only in two categories –sharp and non-sharp. This practice would create a problem of mixing up pathological and other recyclable waste. This mix would make it difficult to treat and dispose of the waste. Sub-categorization of waste according to type of material is necessary.

Collection and transportation

Collection and transportation of waste remains a serious concern in most of the countries. In Indonesia, Nepal and Thailand, municipal authorities are authorized to pick up general waste from hospitals. But hospitals have to fend themselves for the transport of health-care waste. This leads to substantial mixing of health-care waste into general waste. The hospitals find it tedious and unaffordable to transport their waste through private contractors and find it easier to dump the waste in municipal dumps. Strict deterrence for such practice and an alternative feasible method for collection of waste should be worked out. In Bhutan, the municipal authority transports the waste. At the district level, the frequency of collection is twice or thrice a week. Thus, most of the treatment and disposal is done onsite through chemical disinfection and burial pits.

In Bangladesh, waste is collected without segregation and dumped along with municipal waste in city corporation bins. In India, most of the health-care facilities are tied to a centralized facility but still open dumping by HCEs, and dumping (on roadside while transportation) by the centralized treatment facilities has also been reported. In Maldives, there are no treatment facilities for health-care waste; thus it is mostly burnt onsite in small incinerators/burners (general waste is transported by municipal authorities).

Storage

Most of the countries have requirements (in their guidelines/rules) of a proper storage room with good ventilation. The requirements include: washable surface, lockable room (to avoid pilferage and entry of any pests/vectors), etc. But, most of the health-care facilities have yet to develop such rooms in their facilities. Open dumping is common in many countries.

Timor-Leste is still developing a policy, but most of the health-care facilities report having a temporary storage for health-care waste.

In Thailand, in case the containers are collecting waste that is more than 7 days old, the temperature of infectious waste storage site must be 10°C or lower. In Indonesia, all waste (except infectious and pathogenic waste) can be stored for 90 days. This is recommended only if the waste is properly pretreated and stored according to the guidelines/policy.

Treatment of health-care waste (burn technologies and processes)

Many countries have reported using open burning and single-chambered incinerators as the major way of waste treatment. (Though India required double-chambered incinerators and Indonesia has some rotary kiln Incinerators.)

The World Health Organization (WHO) report on small-scale burners and incinerators (2004) has shown that these incinerators are very polluting. Thus a concerted effort would be required to stop these practices and promote cleaner or non-burn technologies.

Other processes and technologies

Most of the countries are relying on WHO standards for various technologies.

Nepal has started using biological systems to dispose pathological waste. Since it is a process and not a technology, some standardization and strict monitoring and evaluation should be carried out to establish this system as a treatment option in the country. In India, similar attempts of using biological systems have been made in many states but these have not been approved (under the Indian Rules).

Most countries do not have offsite treatment facilities; hence incineration has to be done onsite within hospital premises. This makes it very cumbersome and expensive. Most of these systems operate without proper emission standards, which leads to release of toxins. Lack of transporters of health-care waste is also leading to much waste being dumped along with municipal waste. Thus countries that do not have centralized transport and treatment facilities for medical waste should develop such systems to help health-care facilities comply with legal requirements. Some countries (with issue of terrain/ remote areas/where health-care facilities are sited far away from each other) where centralized treatment facilities are not possible, should encourage onsite treatment through clean non-burn technologies.

Hepatitis B vaccination

Bhutan and India have made hepatitis B vaccination compulsory for health-care staff. Indonesia, Maldives, Myanmar, Nepal and Sri Lanka have vaccination programmes but the entire health-care staff is not covered under it. It is important that all the countries include relevant vaccination requirements (hepatitis B and any other disease specific to the Region) for all categories of health-care workers and hospital staff.

Sharps waste management

In Myanmar and Nepal, the use is restricted to the immunization sector. In Indonesia most of the healthcare facilities use auto disabled syringes as it is mandated by the government. Sharps are mostly collected in sharps boxes or in any locally available puncture proof containers. The mode of disposal ranges from sharps pits at health-care facilities to incineration, autoclaving, encapsulation and landfilling. Recycling of metallic sharps waste was explored once in India, but was not found to be feasible. A ground-level study on feasibility of metal recycling can be explored again.

Most of the countries mention having post-exposure prophylaxis (PEP) guidelines/orders. Generally these guidelines have been issued by Acquired Immuno-Deficiency Syndrome (AIDS) Control bodies in the country. But to reach all the categories of health-care providers, it is suggested that these PEP guidelines find reference in the main policy document of health-care waste management. Bhutan has recently added details of PEP in its policy in 2015.

WHO had also developed a study on evaluating the risks and benefits of using needle-removing devices (2004). This study can be commissioned in some countries to streamline the sharps waste management further.

Personal protective equipment (PPE)

Provision of PPE is a requirement in most of the countries. But the fact remains that due to cost and inconvenience issues, most of the health-care staff is not able to use them. Gloves and masks remain the most-used PPE. Recurrent trainings would help convince staff and management on the need to invest in PPE. Data on needle-stick injuries (NSIs) and the big health, environmental and economic cost associated with it should be shared with health managers.

Pharmaceutical and cytotoxic waste management disposal

Incineration, secured landfilling, encapsulation and sanitary landfill, and disposal at cement kilns are the major ways of disposing drugs. Indonesia has an extended producer responsibility (EPR) for pharmaceuticals. A factsheet on the progress and experience of EPR programme in Indonesia would be helpful for the other countries on lessons learnt.

India has added an EPR clause for pharmaceutical/cytotoxic drugs in the Biomedical waste (BMW) Rules 2016. The rules mention a take back system by manufacturers for high temperature incineration, but still there is no effective take back system in place. There is resistance from pharmaceutical companies and health-care institutions to this clause.

Management of hazardous drugs

Most of the countries have a policy for pharmaceutical waste, but none of the countries has a policy for handling and managing hazardous and cytotoxic drugs. Since most of the health-care settings are dealing with hazardous and cytotoxic drugs, it becomes imperative for the countries to talk about minimizing occupational exposure during handling and use of such drugs (i.e. before they become waste). In India, a national committee has been set up for making guidelines on management of cytotoxic drugs. Other countries in the Region should take up this issue.

Mercury waste management

Most of the countries in the region have initiated some work to curtail the use of mercury in the healthcare sector. Nepal has a blanket ban on procurement of mercury containing instruments from healthcare sector. India and Thailand have state and country phase out orders for mercury containing instruments respectively. Indonesia has devised a national implementation plan for mercury in accordance with Minamata convention and the policy is in the draft stage. Maldives, Srilanka and Bhutan are slowly moving towards mercury alternative in healthcare sector by having awareness programs for their staff about hazards of mercury and spill management. NGOs are playing a vital role in Nepal and Bangladesh in phaseout of mercury. Apart from the above mentioned countries Timor_Leste and Myanmar do not have mercury related work going on in their countries.

Wastewater treatment

Wastewater treatment still remains a grey area in many countries. Although countries claim to have a National Rule/ Act on water management, there is nothing specific about management of liquid waste in health-care settings. Health-care facilities in Nepal are supposed to install sewage treatment plants (STPs). Some of State Pollution Control Boards (SPCBs) in India also expect hospitals above 50 beds

to have treatment plants; however, there is yet no clarity on plants that need to be installed. It might not be feasible for smaller health-care facilities (HCFs) to run STPs. Thus this can be reconsidered.

It is important for hospitals to invest in efforts to treat grey water. It would be difficult for hospitals with severe space crunch to install STPs and treat their black water as well. According to the WHO handbook, discharging wastewater generated from a health-care facility into the municipal sewage system after adequate pretreatment is a preferred method if the municipal sewage-treatment plant fulfils the local regulatory requirements. The waste-management system of the health-care facility should maintain high standards, ensuring only low quantities of toxic chemicals, pharmaceuticals, radionuclides, cytotoxic drugs and antibiotics in the discharged sewage[1].

It is important that countries take up studies on liquid effluents generated in health-care settings and the treatment required for the same. Health-care facilities should be convinced and motivated to treat the effluents coming from specialized areas such as operation theatres (OTs), labs, blood banks, oncology units, etc. Hospitals should also be given incentives to reduce their water consumption through various means such as rain water harvesting, improved flushing, etc.

Bhutan is planning to prepare such a document, and this should be a good starting point for the Region.

Infection control

Except for Bangladesh, Thailand and Timor-Leste, all the countries in the Region have an infection control policy/guidelines.

Capacity-building

Nearly all the countries except for Myanmar and Timor-Leste have regular training programmes. (Timor-Leste had a few training programmes with WHO recently.)

Maldives at present lacks a training module for capacity-building, although the policy requires regular training. Conducting training programmes is a prerequisite to establishing good health-care waste management. It is important that health-care facilities and health and environment departments conduct regular trainings and maintain a record of the same (which is auditable). Standardized training materials should be made available in the country. These two steps would help monitor and evaluate training (quality and quantity) of health-care staff. More than technology, it is important for each country to invest in people. People perform segregation, which is the backbone of the entire waste management system.

Budget

Out of the 8 countries that have shared details about this section, 4 countries reported that waste management does not have a separate budget head; and the other 4 reported having one. Three of these countries stated that these funds were not sufficient.

1 WHO, Safe management of wastes from health-care activities / edited by Y. Chartier et al. – 2nd ed

Indonesia, Maldives and Nepal are receiving funds from the Ministry of Health (MoH) for the management of health-care facilities (this also includes managing of waste). These countries say that the provided funds are not sufficient for HCWM.

The Ministry of Finance in Bhutan funds all health-care facilities, which includes health-care waste management. There is a separate budget allocated for health-care waste management in most public health-care facilities in India and Sri Lanka. Health-care facilities in Myanmar and Timor-Leste do not receive any funds for the same.

In general, health-care facilities felt that having a separate budget head and adequate funding for it helps to sustain a waste management programme in the facility.

Infrastructure

Indonesia and Sri Lanka report that about 60% of the health-care facilities have infrastructure for health-care waste management. In Nepal, infrastructure exists, but it is not maintained properly. Since Bangladesh, Bhutan, Maldives and Myanmar do not have sufficient infrastructure they state that infrastructure needs to be developed.

Annual reports

Seven countries have a requirement for record-keeping and annual reporting to the government. Bangladesh and Myanmar do not have a requirement for reporting. Timor-Leste can incorporate this requirement in their upcoming policy.

Accident reporting

Most countries in the Region have some form of accident reporting (except for Bangladesh, Maldives, Thailand and Timor-Leste). The legal requirement has not translated into practice. Reporting is not taken seriously, and none of the agencies have neither compiled nor used these data anywhere. Recently, Indian rules spelt out what an accident refers to and elaborated on definition of a minor and major accident. It would be good if the countries work out mechanism to increase reporting and compile these reports. These results and their analysis would be very handy to change existing policies and devise newer ways of reducing accidents. Health-care facilities would take reporting seriously if the country devises means of using the data to improve situations rather than book the hospitals for negligence.

Monitoring

Most countries in the Region are monitoring health-care waste management practices (except for Myanmar, Thailand and Timor-Leste). Frequency of monitoring varies from once every 3 months to annually. But most countries report that monitoring is not adequate. Understaffing and lack of funds are the major bottlenecks. There also seems to be an approachability issue. Generally urban centres are monitored more often than rural set-ups.

Compliance

In most countries in the Region, compliance remains a big challenge. Countries like India and Indonesia have had the legislation for many years. But India is still grappling with compliance. Although there

are many good models on the ground and government data show good compliance, the fact remains that the country needs to make a major effort in monitoring to improve compliance levels.

Indonesia lacks adequate waste treatment facilities. Although segregation is happening, the country needs to improve upon its collection and treatment facilities. Bangladesh has just started working on health-care waste management practices. The country is making efforts to improve segregation, collection and transportation facilities.

Maldives, Myanmar and Timor-Leste are in the process of streamlining their policies and would also need to enhance their capacities to manage their waste. Capacity-building of stakeholders and providing infrastructure would be the major focal points for the country.

Bhutan cites 30% segregation in health-care facilities. Most of the treatment is onsite through chemical disinfection (disposables) and disposal through deep burial pits (pathological waste). There is 30% segregation in contrast to the 100% awareness that the country claims. This proves that there are certain problems on the ground level. A high-level monitoring committee should be constituted to help resolve local issues by visiting some facilities.

In Nepal, Indonesia and Thailand, municipal authorities are responsible for picking up general waste but there is no infrastructure for transport of health-care waste. It is difficult and expensive for health-care facilities to transport their waste through private contractors. To save on cost, most of the health-care waste gets mixed up with general waste. This is leading to low compliance in these countries. The government agencies can look into solving this issue by providing a transport system and making it economically less taxing for hospitals.

Deterrence/awards

Most countries in the Region have some form of deterrence/award for not managing/managing their health-care waste (except for Bangladesh, Myanmar and Timor-Leste). Most of the places have a fine. In India, in addition to a fine, there is also a provision of imprisonment of the occupier.

Sri Lanka has constituted an award for best performance and green hospitals. In India the Bureau of Energy Efficiency (BEE) has constituted an award for energy efficiency in hospitals.

Awards and recognition from government can be a good incentive for hospitals to comply with the rules. Including waste management in accreditation programmes or making it a prerequisite for government loans or on being on a panel of insurance and government programmes can also make a difference in implementation. Countries can seriously consider rewarding environmental champions in the health-care sector and constitute awards in different categories such as waste, energy, water, etc.

Awareness

Bhutan, Indonesia, Maldives, Nepal and Sri Lanka claim 100% awareness among health-care staff in the country. Despite the 100% awareness that Indonesia and Sri Lanka claim, they report only 70% and 30% compliance respectively. . India has no data on this but several knowledge, attitude and practice (KAP) studies (done by research institutes and teaching colleges) put data at about 22% of facilities with good awareness levels. Bangladesh, Thailand and Timor-Leste have not shared any data on this.

Epidemic preparedness

Epidemic preparedness is an upcoming field, and many countries have started looking at it. Guidelines are available in Bhutan, Indonesia, Maldives, Myanmar, Nepal and Sri Lanka. In Bhutan, 15% of health-care facilities have the infrastructure to manage outbreaks. In Indonesia, infrastructure needs to be developed for such situations. Myanmar and Nepal have to develop guidelines and infrastructure for the same. Maldives feels that training is needed to build capacity among staff. Bangladesh, India and Timor-Leste have not shared any information on the issue.

6

Bangladesh

Introduction

Bangladesh is the world's eighth most populous country. The country is divided into eight administrative divisions,[2]namely Dhaka, Chittagong, Rajshahi, Khulna, Barisal, Sylhet, Rangpur and Mymensingh. It has 64 districts (zila) and 489 sub-districts (upazila). Each rural area in the upazila is divided into union parishads.

Current status of health sector and waste management in Bangladesh[3]

The country has around 610 government hospitals, 4596 private hospitals and clinics, and 9741 diagnostic centres.[4] The Directorate General of Health Services (DGHS) is the focal department for health-care facilities and is responsible for providing guidance on health-care waste management to these facilities. The Directorate also liaises with the Department of the Environment (DoE), the City Corporation or municipality and private partners.

S.No	Category	No. of hospitals	No. of beds
1	Government hospitals under DGHS	610	48934
2	Secondary and tertiary care hospitals (under DGHS)	128	
3	Upazila and union level hospitals	482	
4	Registered private clinics and hospitals	4596	78426
5	Registered private diagnostic centres	9741	
6	Medical colleges	Government – 36; private – 68	
7	Post-graduate medical colleges	Government– 23; private – 10	

Several policies and rules are in place related to hospitals and management of waste, such as:

- Medical Waste (Management and Processing) Rules 2008
- National Guideline for Medical Waste Management (Revised-2016)

2 http://bangladesh.gov.bd/[References should be verified by IMD Unit.]
3 Report on Regional workshop on health-care waste management, Nepal, November 2016
4 Health Bulletin 2016, Management Information System, Directorate General of Health Services, Dhaka, Bangladesh

- National Environmental Policy 1992
- The Environment Conservation Act 1995 (amended in 2002)
- Environment Conservation Rules (ECR) 1997 amended 2003
- Environment Court Act, 2000
- The Private Hospitals and Laboratories (Regulation) Ordinance 1982
- Private Hospital, Clinics and Diagnostic Centres Administration Rules 2016

Secondary assessment

Medical waste management

Establishment of hospital waste management in public and private hospitals is one of the key measures to be achieved under the Health, Population and Nutrition Sector Development Programme (HPNSDP) by the Ministry of Health and Family Welfare (MoHFW).[5] Under this programme, an environmental assessment and action plan was made for the medical waste management in Bangladesh. The efforts of managing medical waste started in 2005. Standard in-house medical waste management was introduced in 6 medical college hospitals (MCHs), 7 specialized hospitals and 8 district hospitals (DHs) by MoHFW in 2013.[6]

Quantum of medical waste generation

The country generates medical waste in the range of 0.28kg/bed/day – 1.9kg/bed/day.[7],[8,9,10]

A WHO report[11] gives the bifurcated data as: the medical college hospitals (MCHs) produce an average of HCW of 1.54 kg/bed/day and 0.70 kg/patient/day; all the specialized hospitals jointly produce a total of 1.62 kg/bed/day and 0.80 kg/patient/day of HCW; and the district hospitals together produce 1.645 kg/bed/day and 0.58 kg/patient/day. Kitchen wastes and other non-hazardous solid wastes were found to be the highest component in all the surveyed HCEs and the quantity covers more than half of the generated wastes, followed by liquid waste (20.6%), infectious wastes (16.97%), recyclable wastes (8.56%) and sharps items (2.6%).

According to a survey conducted in Chittagong Medical College Hospital, which is the second largest hospital in Bangladesh, a total of 2490 kg/day of health-care waste is generated, out of which 37% is infectious. Medical waste was collected from each ward and then segregated. Although they are

5 http://www.mohfw.gov.bd/index.php?option=com_content&view=article&id=166&Itemid=150&lang=en
6 Health Bulletin 2013, Management Information System, Directorate General of Health Services, Dhaka, Bangladesh
7 Survey on Quantitative and qualitative assessment of medical waste generation and management in Dhaka North City Corporation and Dhaka South City Corporation (2013), PRISM, Dhaka, Bangladesh
8 http://www.mohfw.gov.bd/index.php?option=com_content&view=article&id=166&Itemid=150&lang=en
9 https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-8-36 (journal on Occupational medicine and toxicology)
10 Existing Situation of Health-care Waste Management in Bangladesh: Selected Government Hospitals, World Health Organization, Country Office for Bangladesh, 2013
11 Existing Situation of Health-care Waste Management in Bangladesh: Selected Government Hospitals, World Health Organization, Country Office for Bangladesh, 2013

one of the largest hospitals in the country, they do not have a structured waste management system; waste is dumped openly and resold.[12]

In a survey conducted in Dhaka, it was found that most of the waste is being dumped in the City Corporation Bins, which is primarily meant for disposing municipal wastes. Mostly used sharps, saline bags, blood bags and tubes are salvaged by the sweepers and cleaners for reuse/resale.[13]

In a study by the Department of Environment (DOE),[14] yearly generation of medical waste is about12271 metric tonnes and the corresponding estimate for 2013 is 19578 metric tonnes.

Policy framework

The country has a national policy called the 'Medical Waste (Management &Processing) Rules 2008', which came into force on 5 November 2008.

Waste management committee

The MoHFW started addressing MWM as one of the priority programmes by including it among the identified six critical areas under the health, nutrition and population sector programme. The recent development of formation of the national HCWM committee and also committees for the city corporation, district and upazila to handle the out-house management of HCW will be regarded as a major breakthrough for determining the roles and responsibilities in relation to the MWM.[15]MWM committees at various levels are designated responsibility for implementation and monitoring. An action plan has been made to implement MWM in the country for segregating and treating wastes respectively.[16]

Waste segregation

According to the Medical Waste Management and Training Manual issued by the Directorate General of Health Services, hospitals have to segregate their medical waste into: general/non-hazardous waste (black); infectious, pathological and anatomical (yellow); sharps (red); radioactive waste (silver); recyclable waste (green); and liquid waste (blue).

Collection and transportation

At present, HCFs in Bangladesh lack storage facility. Generally, wastes are collected without any segregation and dumped along with municipal wastes in city corporation bins. Some of the private establishments segregate their wastes in-house and dump it in closed pits at hospital premises or in an open pit for burning. However, in most cases, the final disposal is in city corporation bins.[17]

12 http://journals.sagepub.com/doi/abs/10.1177/0734242X07087661 (journal on health-care waste management)
13 https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-8-36 (journal on Occupational medicine and toxicology)
14 Hazardous Waste Management in Bangladesh: A Country Inventory (2010), Department of the Environment, Ministry of Environment and Forests, Dhaka, Bangladesh
15 Report on Implementation of MWM under HPNSDP – July 2016
16 http://hsmdghs-bd.org/Medical%20Waste%20Management.htm
17 https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-8-36 (journal on Occupational medicine and toxicology)

Sharps management

Few of the private hospitals in Dhaka separate their sharps waste and send it to the International Centre for Diarrheal Disease and Research (ICDDRB) for incineration at a rate of 70 Taka/kg.

Other aspects of medical waste management

The generators hardly maintain any proper record of either the different streams of medical waste or the accidents. Health-care establishments lack any in-house management/treatment of waste. The liquid waste is generally disposed of in sewer drains without any treatment. There is no treatment for cytotoxic and radioactive drugs.

Recent developments in medical waste treatment

Until 2004, there was no facility for treating medical waste in Bangladesh. The Project in Agriculture, Rural Industry, Science and Medicine (PRISM) established a medical waste treatment plant at Matuail, in the outskirts of Dhaka in 2004. The programme started with 17 HCFs initially and now it is coordinating with 727 HCFs.[18]In July 2013, another programme started with 25 HCFs in Savar Pouroshova. PRISM received financial support from the Canadian International Developmental Agency (CIDA) for the development of a low-cost medical waste management facility, and Dhaka City Corporation allocated one acre of land for the MWM. Until2008, PRISM had done capacity-building in about185 health-care establishments. The Ministry of Health and Family Planning (MoHFP) has been conducting capacity-building of health-care professionals since 2005, and had covered 328 HCFs until 2010.

Until June 2015, 14 MCHs, 15 district hospitals (DHs) and 8 specialist hospitals introduced standard in-house medical waste management. All the public and private HCFs of Dhaka, Comilla and private health-care facilities of Chittagong city are now under the MWM scheme of non-governmental organizations (NGOs) such as PRISM and INNOVATION. An NGO named SHOPNO was contracted to take care of the MWM of all the HCFs of Bagura, Rangpur and Dinajpur. For the rest of the country, no out-house medical waste management operations was found.[19]

As per the action plan prepared by HPNSDP, by 2015–2016, medical waste management should be implemented in health-care establishments. But, it was not efficiently implemented due to lack of funds,[20] effective training, etc.

Challenges faced by the country

- Health-care facilities generating medical waste are not sufficiently held accountable for proper handling and management of waste;
- The large population and vast network of health-care facilities puts huge pressure on waste management infrastructure;
- Land for final disposal of general waste is scarce;
- Awareness and training of service providers (staff/handlers) is lacking;

18 http://pbf.org.bd/

19 Bangladesh Health Sector Support Program (HSSP), Environmental Management Framework, (March, 2017), Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh

20 Report on Implementation of MWM under HPNSDP – July 2016

- Human resources and logistics are lacking;
- Monitoring of HCWM is lacking;
- Health-care waste management is not given due importance.

Conclusion

An estimated 0.28–1.9kg/bed/day medical waste is produced in the country. The country has rules to manage its medical waste that requires hospitals to segregate it in a number of categories. NGO initiatives have led to training and establishment of waste management practices in some hospitals. Yet most of the hospitals are still dumping their waste in the municipal bins or openly burning it. The country lacks infrastructure to manage the waste and has poor implementation of the rules.

Recommendations

- Implementation of Medical waste management rules 2008 in health-care facilities should be strictly enforced.
- Regular monitoring by the district level monitoring authorities such as the Director General of Health Services (DGHS) and Director General of Family Planning (DGFP) should be taken up.
- Intensive and regular capacity-building programmes should be conducted both at the national level and at each health-care establishment.
- Dumping of medical waste in municipal dumps should be made punishable. Municipal workers need to be trained to understand and report this menace.
- The country is beginning with medical waste management and according to a PRISM 2013 report, only 10% (104 out of 1012) HCFs have a proper management system. A few of these – 104 HCFs can be tailored as model hospitals, which can further serve as training centres.
- Strengthening institutional capacity and compliance towards segregation of waste in all facilities by using the established colour-coding system and record-keeping of medical waste generated.
- Awareness programmes should be held to sensitize health-care professionals and the public about the risks associated with health-care waste.
- Handling of health-care waste should be included in the curriculum for medical, nursing graduates, etc.
- Accident reporting and record maintenance should be made part of the policy.

7

Bhutan

Introduction

Bhutan, officially the Kingdom of Bhutan, is a landlocked country in Asia and the smallest state located entirely within the Himalaya mountain range. The country has a total population of 775000,[21] and it spends 3.6%[22] of its gross domestic product (GDP) on health.

The Royal Government of Bhutan provides free health-care services to all people through a network of about 31 hospitals, 14 grade I basic health units (BHUs), 178 grade II BHUs and 550 outreach clinics.[23]The increase in these facilities has led to a steady rise in the quantity of health-care waste generated in the country.

The country has enacted several acts and rules related to waste management, such as the Medicine Act of the Kingdom of Bhutan 2003; Waste Prevention and Management Act of Bhutan 2009; and Waste Prevention and Management Regulation 2012. Infection control and medical waste management (IC and MWM) committees are established at all levels of a health-care facility. A system for annual waste reporting is in place. The Infection Control and Medical Waste Management programme was established in 1994. The 1st edition of the Infection Control and Health-care Waste Management guidelines was developed in 1994, and the 4th revision was made in 2014. Health-care associated surveillance started in 2012, but the main challenge faced is effective recording and reporting of health-care acquired infection (HAI).[24]

Inventorization of biomedical waste generation and management

General information

Types of health-care facilities

Public sector hospitals are categorized as national, regional and district hospitals. The country also has BHUs-I and II as well as outreach clinics. BHU-II is 5 bedded and it provides 70% preventive/immunization services and 30 % curative services. There is no private health-care set up in the country.

21 WHO, 2015 http://www.who.int/countries/btn/en/
22 WHO, 2015 http://www.who.int/countries/btn/en/
23 Report on Regional workshop on health-care waste management, Nepal, November 2016
24 Report on Regional workshop on health-care waste management, Nepal, November 2016

Total number of health-care facilities in the country Government (all ministries) bedded and non-bedded	753
National	1 hospital
State/sub national level	2 regional referral hospitals
District	25 hospitals
Military/police	NA
Basic health units- I	22
Basic health units-II	185
Outreach clinics	518

Bed strength Government (all ministries)	
National level	350 bedded
State/sub national level	150 bedded
District level	20-40-60 bedded
BHU-I	25
BHU-II	185

National data on medical waste

Data on medical waste generated in the country is collated annually. The Programme Officer for Infection Control is the nodal person for this purpose. Total quantity of medical waste generated in the country is about 358 tonnes/year (as per the MoH).

As per the draft guidelines, the figure stands at 100 tonnes/year.

According to an assessment carried out by an NGO in 2014, 1.15 kg of hospital waste was produced per patient per day, and average per bed per day medical waste generation of the country was about 0.2 kg

Policy framework

Bhutan has a "Waste prevention and management" Guidelines, drafted in 2012. According to these guidelines, waste is categorized into: medical, municipal, industrial and electronic waste (e-waste). Medical waste is categorized into general, pathological, infectious, sharps, pharmaceutical, chemical, radioactive waste and pressurized containers. The policy document has specified the roles and responsibilities of various authorities, viz. Ministry of Health, health-care facilities, Drug Regulatory Authority, Bhutan Narcotic Control Agency, and private pharmacies and pharmaceutical firms.

The latest policy on infection control and medical waste management (Draft, National Infection Prevention and Medical waste Policy and Strategic Plan, 2015) will be replaced by a strategic framework on Infection Control and Medical Waste Management, 2016. The policy will be endorsed after approval by the cabinet, and it may take some time.

The country has accession to the Basel Convention on the control of transboundary movement of hazardous waste, but has not signed the Stockholm or the Minamata Convention.

National rules/ policies on medical waste

The Waste Prevention and Management Guideline, 2012, and the draft National Infection Prevention and Medical Waste Policy and Strategic Plan, 2015, are the two major policies dealing with the issues of health-care waste.

The National Environment Commission (NEC) was responsible for framing these guidelines.

Agency responsible for implementation

Health clinics, BHUs, hospitals, department of livestock, the Bhutan Narcotic Control Agency and Drug Regulatory Authority are responsible for implementing the medical waste management regulation; and the Ministry of Health and NEC are responsible for monitoring these implementing agencies.

Annual reports

All hospitals, BHUs and outreach clinics are required to send their annual compliance and monitoring status reports to the District Medical Officer. The Officer sends it to the national medical waste monitoring committee of the MoH, which is in turn responsible for reporting to the NEC Secretariat. The Secretariat finally reports to the NEC, the Cabinet and the Parliament.

Waste management committee

National policy requires the formation of a committee at the health-care facility level, which is responsible for cleanliness of the facilities. The focal person for infection control also looks after waste management. But only 5% of the health-care facilities have reported having this committee.

Segregation

The national policy requires segregation of waste into – general waste (degradable and non-degradable), sharps, infectious waste, pathological, chemical, pharmaceutical waste, radioactive waste and pressurized containers. According to the draft Guidelines, 2015, the waste is required to be segregated according to the following colour codes:

- Biodegradable general waste: Blue
- Non-biodegradable general waste: Green
- Solid infectious waste: Red
- Sharps waste: Yellow/White
- Chemicals and pharmaceutical: Brown
- Cytotoxic: Purple

Although the national law requires segregation of medical waste, only 30% of the facilities are implementing it.

Collection and transportation

Intramural waste collection and transportation is done by hospital staff. It is collected in red and green biodegradable plastic bags twice a day (every morning and evening) by the ward boys/girls (cleaners). Very few hospitals use trolleys to transport the waste, and these are mostly uncovered. The hospitals do not have separate lifts for waste transportation. Extramural transport is done by municipal authorities. At the national level, waste is collected daily and at the district level, it is being collected once every2–3 days. The authority uses trucks to transport waste to the site of disposal. The municipal authority is also responsible for any accident during transportation. It is also required to maintain a hazardous waste tracking sheet.

Storage

The facilities cannot store their waste beyond 48 hours and the storage area should be designated within the facility in a separate room. The waste storage area is required to have compartments according to various waste categories. The details are mentioned in Annex 1.

Treatment and disposal

Medical waste is required to be treated only onsite by using autoclave and chemical disinfection. The majority of health facilities use chlorine for disinfection of infectious waste as very few facilities have autoclaves. After the onsite treatment, hospitals follow deep burial and landfill methods for their end disposal. Pathological waste, such as placenta, body parts, etc., is directly sent for incineration or deep burial.

The treatment technologies are not being tested on a fixed interval. The emergency medical team (EMT) division in health and NEC are responsible for ensuring technology standards/validation and inclusion of new technologies. Annex 2 lists the treatment and disposal methods according to each waste category.

Radioactive waste

Radioactive waste should be stored and transported safely as per the guidelines prescribed by the International Atomic Energy Agency (IAEA) or any other competent agency notified by the NEC.

Occupational safety

Personal protective equipment is generally used for all procedures of health-care waste management, as they are covered under the Guidelines for Infection Control and Medical Waste Management in health-care facilities. All health-care staff of the nine facilities surveyed are using protective equipment. Since the vaccination of staff against hepatitis B is mandatory, all health-care staff (100%) of the nine surveyed facilities is vaccinated.

Sharps waste management

According to the waste management regulation, sharps should be segregated at the source into colour-coded containers with bio-hazard labelling. It should be autoclaved and shredded before transporting it to the waste storage site and then discarded as general waste.

In practice, the facilities collect sharps waste in a safety box, and then dispose of it in a deep burial pit. Although the existing regulation does not have standards for deep burial, the draft Guidelines, 2015, have included these.

Bhutan does not have a provision of using needle cutters/destroyers. However, all the facilities use injection safety devices, such as auto-disabled syringes/retractable syringes.

Post-exposure prophylaxis

The draft Guidelines for Infection Prevention and Control, 2015, deal with the requirement of PEP as well as its procedure.

Pharmaceutical waste

The Waste Prevention and Management Regulation, 2012, require source segregation of pharmaceutical waste into various categories depending on the origin of source and hazardousness of the wastes. Waste that is being categorized as hazardous should be stabilized before disposal. Pharmaceuticals categorized as controlled drugs or under the Narcotic Drugs and Psychotropic Substances Act are required to be destroyed beyond reclamation, and their destruction should be witnessed by authorized personnel from the concerned agencies.

This waste can finally be disposed in landfills or by incineration depending on the chemical contents and toxicity. Since there are no incinerators in the country, the facilities are disposing this waste in a landfill.

However, the draft Guidelines for Medical Waste Management in health-care facilities, 2015, have detailed segregation, storage and transportation methodology for pharmaceutical waste. It requires the hazardous waste category pharmaceuticals to be discarded in purple plastic bags. Non-hazardous waste should be further segregated into liquid and solid /semi-solid dosage forms. This waste should be discarded into well-labelled green plastic bags. The used ampoules or vials that contain non-hazardous pharmaceutical wastes should be crushed on a hard, impermeable surface and disposed as “sharps”. Overall pharmaceutical waste being generated in a facility should be returned to the pharmacy for disposal. The private pharmacies are required to store it separately prior to disposal and should also bear the disposal cost.

Genomic/cytotoxic waste

The draft Guidelines 2015 include this category and require this waste to be disposed of in a landfill or by deep burial after collecting it in a leak-proof container and treating it either by chemical disinfection or by incineration (when installed in the country). These Guidelines also entail the procedure on how to handle a cytotoxic drug spill.

Chemicals

The 2015 Guideline has some mention on the use of chemicals (especially with regard to disinfectants) in hospitals.

All health-care facilities use 0.5% solution of bleaching powder for disinfection and cleaning. Use of glutaraldehyde has been advised for equipment. Presently, liquid waste generated by use of

these chemicals is disposed directly in a drain or toilet. The draft Guidelines instruct adoption of appropriate technologies to handle and dispose of liquid chemical wastes from health-care facilities. The Guidelines instruct the NEC to publish detailed information on the subject.

Mercury management

Bhutan is following WHO recommendations and is gradually phasing out mercury-based devices. The country is also running awareness programmes on mercury-based equipment for health-care providers. Currently, they are following the strategy of storing this type of equipment in a safe place and have not discarded them yet.

Wastewater treatment

There are no data available on the average use of water in a hospital. Facilities having connectivity to municipal sewage plants discharge their wastewater in it. The country has a policy that requires treatment of wastewater generated in health-care facilities. The MoH has been given the task to develop standard designs for construction of a liquid waste management plant in hospitals. It has to ensure that all hospitals and BHUs Grade-Is have a liquid waste treatment plant of internationally accepted standards.

Capacity-building of people handling waste management

In-country training workshops and continuing medical education (CME) courses are conducted under the National Infection Control Programme once every two years. Infection control and medical waste management training is also provided by the infection control focal person of health facilities to the new recruits. The country finds these training programmes adequate. The proceedings of these training programmes are required to be reported.

The Bhutan Medical and Health Council is responsible for awarding CME credit for the training.

The Ministry of Health is responsible for supplying training material to the facilities. The country through its broadcasting services (BBS- Bhutan Broadcasting Service) creates awareness on the environmental issues.

The subject is also covered in the curriculum of the faculty of Nursing and Public Health.

Monitoring (within hospital/national)

The frequency of monitoring is once a year at the state/province level as well as at the national level. Although the monitoring is being conducted efficiently, time constraint is identified as the major bottleneck in the monitoring process.

Records

Health-care facilities are required to maintain records of the amount of waste generated in that particular year, disposal methods adopted and challenges in implementing the guideline or comments made by the monitoring committee, and report that information to the NEC every year. These reports are not made available to the public.

Accident reporting

Although Regulation 2012 requires reporting of any accident occurring during transportation/handling of medical waste (in the prescribed form to be sent to the prescribed authority), only 5% of needle-stick injury cases were reported last year.

HCFs are also required to report the actions taken on these accidents and their outcomes. The facilities have a needle-stick injury reporting system in place. There is no provision of collating these data at the national level.

Funding

The Ministry of Finance allocates funds for the management of health-care facilities, but there is no separate budget head for waste management. Necessary procurement is met from the institutional budget, but these funds are insufficient.

There is a monitoring body that checks efficient budget utilization by all health-care facilities.

Purchase of waste management items/equipment is decentralized to the districts, and thus, there is difficulty in securing funds, which subsequently hampers in maintaining the standards as per the Guidelines.

Compliance

According to the government, there are no gaps in their health-care waste management policy. There is no difference between the federal and state government policies of health-care waste. In the form, the government claims 100% compliance. But this cannot be justified keeping in mind the 30% segregation noticed in the facilities in the primary survey and the fact that 10% of HCFs were following good practices.

Infrastructure

Only 5% of health-care facilities have the required infrastructure for management of health-care waste.

Deterrence

The NEC and municipality (Thromdey) have a provision of imposing fines (cash payment) if health-care facilities do not manage their health-care waste as required by law.

Awareness

According to estimates, 99% of the health-care facilities are aware about the risks associated with mismanagement of health-care waste yet only 10% were following best waste management practices.

Epidemic preparedness

There are guidelines/documents available on highly infectious diseases, surveillance mechanism, response mechanism, isolation units and epidemic preparedness. These guidelines are reviewed every four years. Only 15% of the facilities – i.e. national referral/regional referral hospitals and general hospitals – have the capacity to manage the outbreaks. The Ministry of the Health is the monitoring agency.

The country does not have enough infrastructure available for the management of health-care waste in case of any disease outbreak. There is no provision of training the staff to handle an epidemic situation in respect to health-care waste management.

Infection control committee

The national regulation requires formation of an infection control committee in health-care facilities. All health-care facilities follow the standard guidelines issued by the Ministry of Health.

Staff are required to wear protective equipment (such as gloves, masks, goggles, caps, gumboots, aprons etc., depending on the nature of exposure) while handling health-care waste.

The country is a signatory to the Patient Safety Pledge of the World Health Assembly (the Patient Safety Guideline is under the Nursing Programme).

International treaties

The country has an accession to the Basel Convention on the control of transboundary movement of hazardous waste and has not signed the Stockholm or the Minamata Convention. Waste laws of the country are in conformation with these conventions. To date, no projects (inventory, compliance improvement/any other) have been undertaken with the help of Global Environment Facility (GEF) funds.

Primary assessment

A primary assessment was conducted in nine health-care facilities in the country (Refer annex 3 for the list of the hospitals). All health-care facilities segregate their medical waste majorly into: infectious (red), general (green), sharps (yellow) and food waste (blue). Some facilities also have categories for pharmaceutical, pathological, radioactive or chemical waste. Of the surveyed facilities, 78% have a waste management policy and 67% of these have a waste committee as required by the Waste Prevention and Management Regulation, 2012. 67% of the facilities have a storage area. Segregated waste is collected by the hospital ward (male/female) and is transported in trolleys (to the storage area) by only 33% of the facilities.

All the facilities provide PPE to their staff, which includes gumboots, gloves, masks, aprons and goggles. Since there are no offsite treatment facilities in the country, eight out of the nine surveyed facilities autoclave or chemically disinfect (by using 0.5% bleaching solution) their waste. Dewathang Hospital does not treat the waste before sending it for deep burial. 78% of the facilities send their waste directly to a deep burial pit as well as to a municipality for landfill disposal. Punakha District Hospital is burning its waste. All these facilities except for the Central Regional Referral Hospital maintain records of their daily waste generation. Although the Eastern Regional Referral Hospital has a provision of maintaining such records, they are not doing it currently.

Apart from Dewathang Hospital, all the facilities have a provision of accident report. Although three of these facilities report only needle-stick injuries or any percutaneous injury, the remaining five also report other injuries such as splash of chemicals, and exposure to blood and body fluids, etc.

55% of facilities discard their sharps waste in a yellow bin and send it to a deep burial pit. The Central and Eastern Regional Referral Hospitals pre-treat their sharps waste and then discard it with the general waste. Paro District Hospital and Jigme Dorji Wangchuk National Referral Hospital (JDWNRH) incinerate their sharps waste. They autoclave the syringes and discard it with the municipal waste.

The survey showed a lack of availability of needle cutters. 55% of the facilities do not have any needle cutters available, and the remaining 45% of them have very few.

The majority of the facilities submit an annual report by the 15th of November; and the majority has a provision of conducting training programmes annually; some also conduct programmes at the time of induction of a new employee. The sessions majorly include infection control and medical waste management. Three facilities mentioned that the state also conducts a capacity-building programme annually.

Although 33% of the facilities mentioned that the infrastructure provided to them for waste management was not enough, the state supports the facilities financially and technically in conducting training and purchasing equipment.

44% of the surveyed facilities mentioned that monitoring is conducted once a year in their facilities. The National Infection Control Programme of the MoH, is the nodal monitoring and enforcing body. Eight out of these nine facilities also have an infection control focal person; this person is in charge of in-house monitoring.

Eight out of these nine facilities mentioned that they receive government funds for training, equipment, storage area, etc. None of the facilities have explored possibilities of receiving funds from any other national or international organization.

78% of these facilities have an isolation ward, and only JDWNRH has a ward only for tuberculosis (TB) patients. On average, 42.5% of the staff is trained for handling health-care waste in case of an epidemic.

None of the facilities have any provision for giving any rewards/deterrence in case of excellent or noncompliance of waste management regulation respectively.

78% of the surveyed facilities do not have any effluent/sewage treatment plants. One of these facilities has an effluent treatment plant (ETP) installed, but it is not in working condition, and one facility has installed an ETP in its new hospital with a capacity of 20kld.

Case Study

Phuentsholing General Hospital: a pilot hospital for model health-care waste management[25]

Phuentsholing Hospital is a 50-bedded hospital with a running capacity of 65 inpatient beds. It is run by 144 staff including all categories of personnel. It serves as a referral centre for other nearby health facilities and districts. In addition to curative services, the hospital also provides diagnostic and preventive services.

The hospital administration and management transformation (HAMT) committee is identified as the infection control and waste management committee. The focal point for HCWM is the nursing head. All units in charge are members of the infection control and medical waste management Committee.

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Training has been conducted on infection control, waste management and patient safety for all categories of staff.

Waste storage and a treatment house and a deep burial pit have been constructed. A waste autoclave has been procured and is under installation. Mercury-based equipment is being replaced with digital and mercury-free devices. Waste bin stands and waste transportation trolleys have been fabricated onsite.

Risks wastes are segregated at the source and treated in an autoclave and then sent to a municipal landfill. Pathological waste and sharps are disposed in deep burial pits. Chemical waste is flushed down the drain after dilution. Burning is strictly prohibited by the National Environment Commission due to environmental concerns. General waste is sold to recyclers. The hospital plans to make it into a model hospital for HCWM in the future.

Secondary assessment According to a study conducted in the 350-bedded Jigme Dorji Wangchuk National Referral Hospital (JDWNRH) in 2012, the guidelines that the hospital was following did not emphasize on the management and disposal options for non-infectious hazardous waste. Only 16.3% of health staff was aware that non-infectious hazardous waste should not be thrown with the general waste. The awareness level about the issue was found to be good among health-care staff, especially the waste handlers, a majority of whom were following best waste management practices. 95% of staff did not know how to handle a mercury spill.

The study recommended that the hospital needs to emphasize proper segregation of waste; should label waste bags; strictly supervise and monitor the system; conduct regular training programmes; review the current waste management guidelines and install required treatment equipment.

In another study conducted in 2016 to study the biomedical waste management system of JDWNRH, it was pointed out that even though the Waste Management and Regulation Act was passed in 2009 and the regulation in 2012, many people throughout the country are still not aware of it. The country majorly disposes its medical waste in deep burial pits, which are ordinary earthen pits and have no protective lining, making it easy for chemicals and other liquid wastes to leach out into the soil and nearby water bodies. Although all district hospitals have pits with well-sealed roofs, the BHUs mostly have ordinary open pits in the ground. Although the regulations requires infectious waste to be autoclaved before discarding it with the general waste, the country has only two autoclaves available–one in JDWNRH and the other in Mongar Hospital.

40% of the total waste produced in JDWNRH is medical waste. This points towards inefficient segregation as according to WHO, only 15–20% of the hospital's waste is medical waste.

JDWNRH autoclaves its infectious waste before disposing it with the general waste. The hospital also conducts training programmes for its waste handling staff.

The study concludes that the major issues that the hospital is facing are:

- Lack of efficient segregation
- Low availability of chemicals
- Low budget – since there is no separate budget head for waste management, to meet expenses is difficult.

Conclusion

Bhutan generates a total of 358 tonnes of medical waste per year with an average of 0.2kg/day/patient. The country has a waste management and prevention guideline including medical waste and has a Draft National Infection Prevention and Medical Waste Policy and Strategic Plan, 2015. The guideline as well as the strategic plan requires hospitals to segregate their waste into a number of categories and treat their waste onsite before sending it for deep burial or landfill. Open burning has been reported in one hospital, though most of the hospitals depend on deep burial. Almost 99% of HCFs are aware of the risks associated with medical waste mismanagement, yet only 10% are following best waste management practices. Since there are only two autoclaves present in the whole country, most of the waste goes untreated or is treated chemically. The country lacks infrastructure to deal with its medical waste.

Although the country has guidelines on epidemic preparedness, only 15% of the facilities have the capacity to manage outbreaks.

Improper segregation leads to the increased proportion of hazardous waste. Lack of infrastructure, insufficient financial and human resources, and low priority given to the issue are the most common problems in the country.

A high level of awareness in the country is laudable and worth documenting, so that others can take cue. Two positives that the country is doing that can benefit the other countries are – Inclusion of PEP protocols in the health-care waste management plan and making a policy for liquid waste management in HCFs.

Recommendations

- Most of the hospitals are disposing their waste in deep burial pits. But these are normal holes without any liners. This may lead to groundwater contamination. Thus stringent siting requirement and monitoring of these pits is suggested.
- The regulations should emphasize on the need of a waste management policy in all the facilities. It should emphasize on formation of a waste management committee in hospitals along with its proposed members (as per Annex 10 of the guideline).
- Non-burn, low-heat technologies should be encouraged for waste treatment. All the facilities can be made self-reliant in waste management with the combination of non-burn disinfection methods and deep burial pits. All recyclables should be mutilated after disinfection and be given for recycling.
- Municipalities should be given additional charge of collecting disinfected and shredded recyclable health-care waste on specific days of the week. This would help conserve resources and conserve space for biodegradable and pathological waste in hospitals.
- Sharps waste management is another major concern. Facilities do not have needle cutters in use and recapping is a common practice in the country. Guidelines give an option for shredding needles and dumping in municipal waste. Sharps even after shredding should not be thrown in a municipal dump. It should either be recycled or put in a sharps pit. The country's legislation should prohibit recapping.

- A strict monitoring system is needed in the country to have an efficient waste management system in place.
- Assigning a separate budget for medical waste management would help improve the system and provide required infrastructure for waste management.
- Guideline 2015 requires 'Institute health insurance/coverage for staffs exposed to accidental injury or exposure to hazardous health-care waste'. But the guideline fails to qualify an accident. If the government wants to start such an initiative, this would require having details on what qualifies as an accident.
- There is no provision of training the staff to handle an epidemic situation in respect to health-care waste management. The country can start training few facilities on handling epidemics and related health-care waste in collaboration with WHO.
- The country has a high awareness and this should translate into high compliance of the rules. The government needs to identify the gaps that keep these aware staff from not following the rules and work towards plugging the loop holes.

8

India

Introduction

India is the seventh largest country in the world and the second most populated. The average annual exponential growth rate stands at 1.64% during the period 2001–2011.[26]

The global economic growth was estimated to be 3.1% in 2015 against 3.4% in 2014.[27] In India, the health-care sector is growing at a tremendous rate due to its strengthened coverage, services and increasing expenditure by public as well as private players.

Inventory of biomedical waste generation and management

General information

India has a total of 169913 health care facilities with bed strength of 1786108.

National data on medical waste

Data on medical waste generated in the country is reported annually. All health-care facilities submit these data annually to the State Pollution Control Boards. The data from states are then compiled by the Central Pollution Control Board (CPCB). They are updated every year and were last updated in 2014. These data are available in the public domain on the CPCB's website.

Total quantity of medical waste generated in the country – 495.30 tonnes/day (495300 kg/day)

Average per bed per day medical waste generation of the country – 0.277 kg/day (495300/1786108: waste generated per day/ number of beds).

Policy framework

India formulated the Rules on Bio-medical Waste in 1998 and they were called Bio-medical Waste (Management & Handling) Rules 1998.

The rules have been revised and amended and are now called the Bio-medical Waste Management Rules, 2016, notified by the Ministry of Environment, Forest and Climate Change.

26 https://india.gov.in/india-glance/profile

27 https://home.kpmg.com/content/dam/kpmg/in/pdf/2017/01/KPMG-Flash-News-India-Economic-Survey-2015-16%E2%80%93Key-Highlights-3.pdf

The rules provide a broad management framework. Various guidelines have been framed by the CPCB to help in the implementation of the rules, which include:

- Guidelines for management of Biomedical waste management 1998 (under revision)
- Guidelines for Common Bio-medical Waste Treatment Facility (CBWTF)
- Design and Construction of BMW incinerator
- Disposal of BMW generated during Universal Immunization Programme
- Environmentally sound management of mercury waste generated from health-care facilities

National rules/policies on medical waste

Bio-medical waste Management Rules 2016

Agency responsible for framing these guidelines

The Ministry of Environment, Forest and Climate Change is the lead agency for framing the rules, as the rules have been made under the Environment Protection Act (EPA) 1986. The drafting committee includes other important stakeholders such as members from the Ministry of Health, the Indian Medical Association, members from leading public and private hospitals, the National AIDS Control Organization (NACO), CPCB, representatives from SPCB, CBWTFs, NGOs, etc.

The Ministry of Health and Family Welfare is the implementing body. The Central and the State Pollution Control Boards are responsible for monitoring the health-care facilities and the CBWTFs.

Agency responsible for implementation

All the HCFs, Department of Health of the State/Union Territory and MoH are responsible for the implementation of the rule.

In 2015, Kayakalp, an initiative for awards to public health facilities, was launched by the Ministry of Health and Family Welfare. Apart from encouraging public health facilities to keep a clean and hygienic environment, they are encouraged to develop systems for proper bio-waste disposal under the mission.

Annual reports

All hospitals and the CBWTFs are required to send their annual compliance reports in the prescribed format to the SPCB/Pollution Control Committee (PCC). These are then sent to the Central Pollution Control Board (CPCB). CPCB further submits the compiled report to the Ministry of Environment, Forest and Climate Change. The annual reports are made available online on the websites of health-care facilities, State Pollution Control Board and Central Pollution Control Board.

Waste management committee

The rule requires the formation of a waste management committee at all health-care facilities above 30 beds. If the facility is less than 30 beds, a designated person will review waste management in the hospital and submit the report. The committee/designated person is responsible for reviewing and monitoring all activities related to biomedical waste management. The rule also requires formation of a District Level Monitoring Committee under the chairmanship of the District Collector (or District

Magistrate or Deputy Commissioner or Additional District Magistrate) to monitor compliance of the provisions of these rules in the health-care facilities and in the CBWTFs.

It is required to submit a biannual report to the State Advisory Committee and SPCB/PCC.

Segregation

According to the rules, 2016, waste should be segregated into 4 categories viz. yellow, red, white and blue.

Yellow – human and animal anatomical waste, placenta, foetus, soiled waste, pretreated microbiological and biotechnological waste, pharmaceutical and cytotoxic waste; linen and mattresses are discarded into yellow non-chlorinated plastic bags. These bags are to be incinerated by the CBWTF.

Red – all recyclable waste such as tubing, bottles, IV sets, vaccutainers, catheters, gloves, etc. are discarded into red non-chlorinated plastic bags. These bags are to be autoclaved and shredded and then sent to authorized recyclers.

White – this puncture-proof plastic container is for discarding sharps waste such as needles, syringes, scalpel, blades, etc. This waste is also autoclaved and then sent to an appropriate site (landfill, sharp pit or any iron foundry).

Blue – a blue cardboard container is for glassware and metallic body implants. This waste has to be disinfected and then sent for recycling.

Collection and transportation

Intramural waste collection and transportation is done by hospital staff/contractual staff. All the colour-coded and labelled bags are collected from the wards by the ward boys or any hired agency. Waste is generally collected once/twice a day in colour-coded labelled trolleys. The trolleys are required to be covered. The collected waste is transported to the storage area within the hospital. Extramural transport is done by the common biomedical waste treatment facility (CBWTF). The agency is required to collect the waste everyday from the registered HCFs. It is supposed to use bar-coded bags and a GPS-enabled vehicle to transport waste to the site of treatment and disposal. The CBWTF's staff collecting the waste should wear proper personal protective equipment and should note down the quantity of waste collected. These vehicles should comply with the conditions stipulated by the State Pollution Control Board or Pollution Control Committee in addition to the requirement contained in the Motor Vehicles Act, 1988 (59 of 1988).

Storage

The facilities are required not to store certain waste falling under yellow category beyond 48 hours. Facilities should have a safe, ventilated and secured location for storage of segregated biomedical waste. This storage area should have compartments for each waste category. It is the responsibility of the hospital to ensure that there is no secondary handling, pilferage of recyclables or in advertent scattering or spillage by animals.

Treatment and disposal

In India, the Central Pollution Control Board (CPCB) is responsible for laying down standards for new technologies for treatment and disposal of BMW and the Ministry of Environment Forest & Climate Change (MOEFCC) is responsible for their notification. The country uses the specific technologies for treatment of different categories of medical waste as given in Annex 5.

The hospitals are required to pre-treat their microbiological and biotechnological waste before giving it to the CBWTF. All segregated waste is then supposed to be treated offsite by the Common Bio-medical Waste Treatment Facility (CBWTF). All HCFs would have to be tied up with a CBWTF. A facility can seek special permission for onsite treatment in case there is no CBWTF available in the radius of 75 kms.

Although the country has a total of 191 operational CBWTFs, these are not enough to treat the quantum of waste generated in the country. Some states have surplus treatment capacity while a few states still do not have a single plant. The new CBWTF guidelines are trying to address these issues.

The CBWTF is required to monitor stack gas emissions once in three months through an approved laboratory. It should also install a continuous emission monitoring system for the parameters and transmit the data real time to the servers of the authorized body.

After the waste is treated, the incineration ash has to be disposed of at a common hazardous waste treatment and disposal facility. The disinfected and shredded plastic waste has to be sold to an authorized recycler. Lastly, sharps waste is sent to a landfill or a sharps pit. (There have been some attempts to send this waste to a metal smelter.)

Health-care facilities that are not connected to a CBWTF and are in a rural/remote place can adopt the deep burial method for disposal of their medical waste. The rules have specific standards for deep burial.

Occupational safety

Health-care facilities as well as the CBWTFs have to provide required vaccinations and personal protective equipment to the staff handling medical waste. Training and an annual health check-up should be conducted atleast once a year.

Sharps waste management

According to the Bio-medical Waste management rules, 2016, sharps should be segregated at the source and discarded into a white translucent puncture-proof container. When it reaches the CBWTF, it is autoclaved, shredded and sent to a landfill or a sharps pit.

Post-exposure prophylaxis

NACO has a guideline on PEP.

Sero-prevalence of HIV has dropped from 0.7% in 1993 to 0.3% in 2009.

Injection safety

Auto-disabled syringes are used in the country. Recapping is found to be prevalent in many health-care facilities of the country. Injections are an integral part of health services such as in prevention programme (immunization), diagnosis and during treatment. In India,[28]about 3 billion injections were administered for various purposes. This comes to an average of 2.9 injections per person per year. It is estimated that nearly two-thirds of injections are unsafe. Amidst increasing steps for improving safe care, issues of safety remain.

The issues recognized in injection safety are reuse of injection equipment, accidental needle-stick injuries (NSIs), overuse of injections and unsafe sharps waste management. The MoH, India, issued a 'Handbook on safe injection Practices' in 2014.

WHO is implementing a three-year injection safety project in India. WHO India is planning to implement the project in Punjab (a state of India) jointly with the central and state health ministries. The project will focus on injection safety and address related programmes on infection prevention and control practices, patient safety and quality of healthcare and health-care waste management.

Pharmaceutical waste

According to the rules, health-care facilities should either send discarded/expired medicines back to the manufacturer or dispose of them in a yellow bag that will be ultimately incinerated by the CBWTF. Since the take back system by the drug manufacturers is not readily available in the country, hospitals generally discard this waste in the yellow bags.

Genotoxic/cytotoxic waste

The existing rule requires cytotoxic waste to be incinerated at a temperature >1200°C. Hospitals discard their cytotoxic drugs as well as all items contaminated with such drugs in the yellow bag and send it to the CBWTF.

Chemicals

The country does not have a specific guideline or policy on the use of chemicals (especially with regard to disinfectants) in hospitals.

The solid chemicals waste has to be disposed of in the yellow containers by hospitals. This waste is treated by incineration or encapsulation in a hazardous waste treatment, storage and disposal facility (TSDF). The liquid chemical waste generated in facilities after resource recovery is pre-treated and then discharged with other wastewater.

Mercury management

The country has a guideline for mercury waste management developed by the CPCB called "Environmentally sound management of mercury waste generated from the health-care facilities". BMW management rule requires mercury management to be done according to these guidelines. The country is slowly phasing out mercury-based health-care equipment. The MoH has issued guidelines

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for the phase out of mercury in the health-care sector. States such as Delhi, Punjab and Manipur, and the Municipality of Hubli-Dharward (Karnataka) have issued phase-out orders for mercury-based equipment. The discarded mercury or mercury-based equipment is being stored securely until the country comes up with a final disposal plan.

Mercury spill management techniques are mentioned in the Hospital Infection Prevention and Control guidelines. The Indian Public Health Standard (IPHS) also lists non-mercury equipment in the procurement list of facilities.

Wastewater treatment

Average use of water/hospital bed/day is 400– 500l/day. According to the rules, health-care facilities are required to ensure segregation of liquid chemical waste at the source and ensure pretreatment or neutralization prior to mixing with other effluent generated from health-care facilities (ensure treatment and disposal of liquid waste in accordance with the Water Prevention and Control of Pollution Act, 1974 (6 of 1974)).

Some states have made mandatory a wastewater treatment plant (ETP/STP) within the hospital (with 50 beds or more). They can discharge their wastewater only after meeting the required standards.

In practice, the facilities are struggling with the installation of such a plant and are directly discharging the wastewater into the sewer line.

Capacity-building of people handling waste management

Health-care facilities are supposed to provide training to all its health-care workers and others involved in handling of BMW at the time of induction and thereafter at least once every year. The proceedings of these training programmes are required to be reported along with the annual report.

The Central/State Ministry/Department of Health and Family Welfare is responsible for coordinating with SPCB the organization of training programmes for health-care and municipal staff on BMW. It is also responsible for organizing or sponsoring trainings for regulatory authorities and health-care facilities. CPCB is responsible for conducting training courses for authorities dealing with BMW management.SPCB is responsible for organizing training programmes for health-care, CBWTF, SPCB and PCCs staff.

The Ministry of Environment, Forest and Climate Change is responsible for developing a standard manual for trainers and training.

The subject is also covered in the curriculum of medicine and nursing.

Monitoring (within hospital/national)

Monitoring is a continuous and ongoing process. SPCBs are responsible for monitoring the management of medical waste. MOEFCC reviews the implementation of the rules in the country through the State Health Secretaries and Chairmen or Member Secretary of SPCBs and CPCB. In the new rules, all the districts in the country are required to conduct monitoring through the District Level Monitoring Committee.

At the hospital level, the waste management committee is responsible for conducting monitoring.

Records

Health-care facilities are required to maintain records of the generation, collection, reception, storage, transportation, treatment, disposal or any other form of handling of biomedical waste. Records have to be kept for a period of 5 years.

The Central or State Pollution Control Boards and MOEFCC are responsible for verification of these records.

Accident reporting

Hospitals are required to report all major accidents within 24 hours('major accident' means an accident occurring while handling of biomedical waste having the potential to affect large masses of public and includes toppling of a truck carrying biomedical waste, accidental release of biomedical waste in any water body but exclude accidents like needle-prick injuries and mercury spills). All other accidents along with remedial steps taken are required to be reported along with the annual report.

Funding

The State/Union Territory Government is responsible for allocation of adequate funds to government health-care facilities for BMW management. It is also responsible for procurement and allocation of treatment equipment and to make provision for consumables for BMW management in these facilities.

Patient safety guidelines

[29]Recent efforts at standardization of healthcare institutions have involved the setting up of a national voluntary accreditation structure, the National Accreditation Board for Hospitals and Health-care Providers (NABH) in 2006 by the Quality Council of India (QCI). There is now a Clinical Establishment Act, a central legislation being passed in 2010 to ensure registration and uniform enforcement of minimum standards across both public and private sectors. The All-India Institute of Medical Sciences (AIIMS) in collaboration with WHO has also launched the National Initiative on Patient Safety (NIPS) in 2009, underscoring the increasing priority to patient safety. NIPS aims to train and sensitize clinical professionals across the country on adverse events, reporting systems and patient safety practices .

Injection Safety Guidelines- In 2014, MoH published the injection safety guidelines which are available on their website. [30]

Deterrence

In case of any violation of the rule, health-care facilities and CBWTFs are liable to action under section 5 and section 15 of the Environment Protection Act. (Whoever fails to comply with or contravenes any of the provisions of this Act, or the rules made or orders or directions issued there under, shall, in respect of each such failure or contravention, be punishable with imprisonment for a term which may extend to five years with fine which may extend to one lakh rupees, or with both, and in case the failure or contravention continues, with additional fine which may extend to five thousand rupees

29 https://www.researchgate.net/publication/259865839_Institutionalizing_Patient_Safety_Culture_A_Strategic_Priority_for_Health-care_in_India

30 http://www.ncdc.gov.in/safe_inj_practice2014.pdf

for every day during which such failure or contravention continues after the conviction for the first such failure or contravention. If the failure or contravention continues beyond a period of one year after the date of conviction, the offender shall be punishable with imprisonment for a term which may extend to seven years[31])

Awareness

The awareness level varies between various states and among different health-care facilities.60–70% of facilities show average awareness, while 10% of facilities show very good awareness levels.

Infection control committee

The country has Hospital Infection Prevention and Control Guidelines, which call for hospitals to organize a Hospital Infection Control Committee (HICC). The major role of this committee is to implement the annual infection control programme and policies (including its monitoring, surveillance, reporting, research and education).

Health-care staff are required to take standard precautions, including hand hygiene, using personal protective equipment (gloves, face masks, eye protection, face shields and aprons) while handling health-care waste.

The country is a signatory to the Patient Safety Pledge of the World Health Assembly.

Success stories

Examples of the many hospitals in the country that have achieved great strides not just in waste management but also in water and energy management include the Sir Ganga Ram Hospital, Holy Family Hospital, St. Stephen's Hospital, King Georges's Medical University (KGMU), etc.

International treaties

The country is signatory to the Basel, Stockholm and Minamata Conventions and has ratified the former two treaties. Most of the national laws have tried to align to the said Conventions. The country has done some projects with GEF funds, for example, at KGMU in Lucknow, and upgrading of a CBWTF in Chennai, Tamil Nadu.

The UNDP-GEF Project in India –the Global Health-care Waste Management project– was implemented by UNDP in partnership with the Ministry of Environment and Forests and supported by WHO and Health Care Without Harm. The project helped promote best practices in health-care waste management and mercury waste management at King George's Medical University (KGMU) in Lucknow, Uttar Pradesh. The United Nations Environment Programme (UNEP)– MoEF&CC is starting a mercury assessment project in India with the help of UNEP.

The United Nations Industrial Development Organization (UNIDO) project – UNIDO has launched a project called "Environmentally Sound Management of medical wastes." UNIDO has selected five states, namely Punjab, Gujarat, Karnataka, Maharashtra and Orissa, for implementation of the project.

31 Environment Protection Act 1986

Primary assessment

A study was conducted in four states, namely West Bengal, Bihar, Uttarakhand and Jharkhand, to analyse the biomedical waste management system that hospitals are following. In addition to this, some facilities in Karnataka and Rajasthan were also surveyed. The assessment is detailed in Annex 6 .

Survey outcome

Figure 1: Segregation Status of Hospitals – India (%)

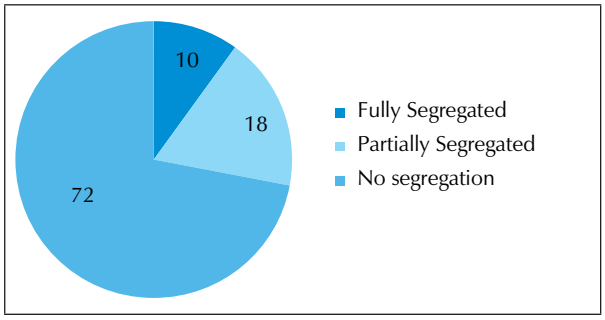


Figure 2: Connectivity with CBWTF (%)

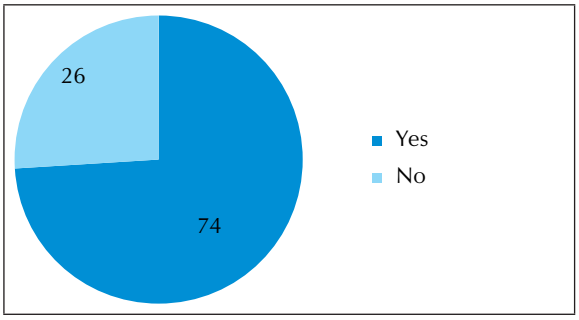


Figure 3: Frequency of waste collection by CBWTF Vehicle (%)

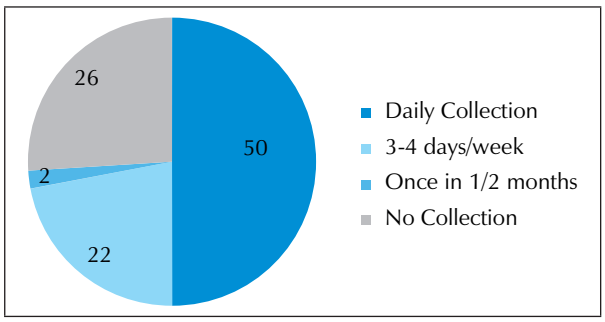


Figure 4: Nature of waste Dumping (%)

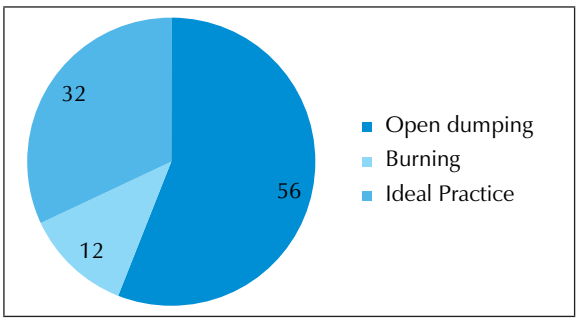


Figure 5: Interim Storage Facility (%)

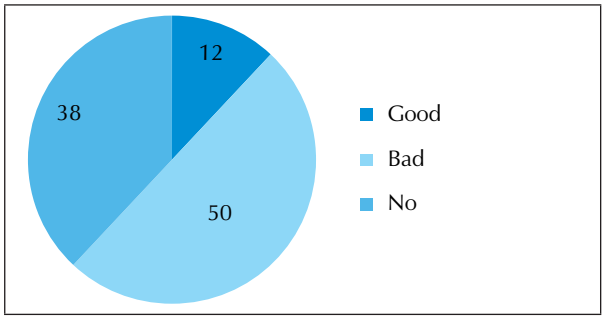


Figure 6: PPE Availability (%)

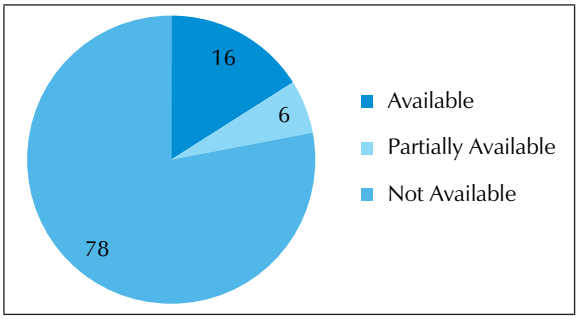


Figure 7: Needle-stick injury reporting (%)

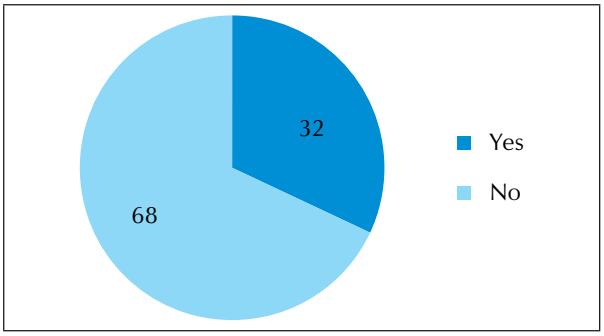


Figure 8: Availability of funds (%)

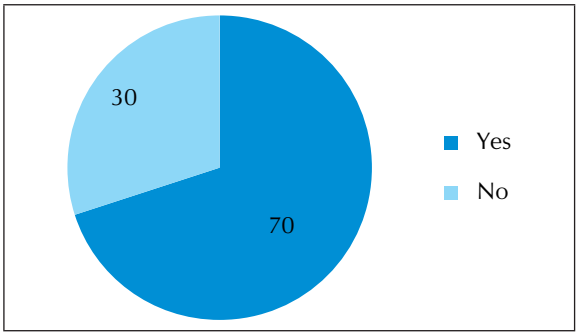


Figure 9: Staff awareness level (%)

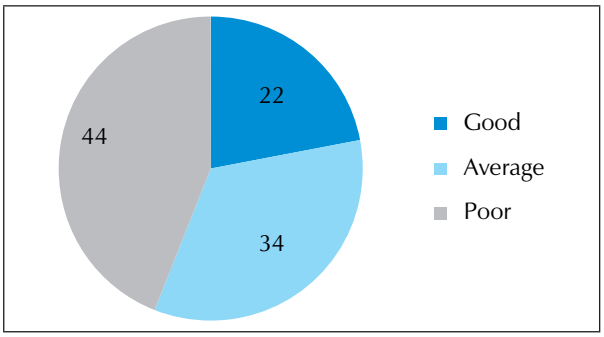
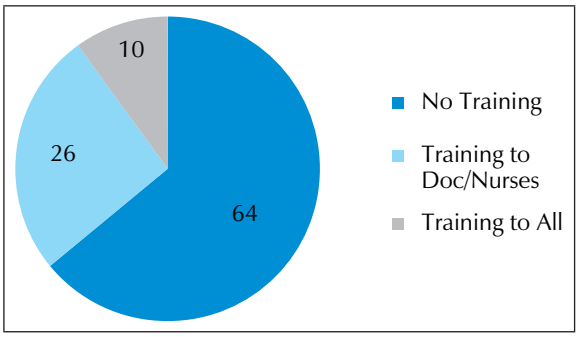


Figure 10: Training mechanism (%)



The study concluded that hospitals are still not segregating their waste as required by the rules. The country lacks the number of CBWTFs for treating its waste, and the existing CBWTFs lack proper functioning as the frequency of waste collection is not adequate. It is shocking to see that open burning is still being done in some parts of the country. A large number of health-care facilities still do not have a proper storage facility as required by the rules. Even though the rules have existed in the country for 19 years, staff awareness levels were still low. It can be attributed to the fact that a large number of facilities do not have any training mechanisms for their staff. Underreporting is still a major issue; a large number of staff does not report needle-stick injuries. Overall, the survey indicated a lack of awareness and poor implementation strategy.

Secondary analysis of biomedical waste management

CAG Audit

The Comptroller and Auditor General of India (CAG) perform an audit of various policies at the central and state levels. All the audits done in the last 4 years were compiled and analysed. Performance audit reports stated the presence of unauthorized HCFs, unavailability of treatment and disposal facilities, inefficient segregation at the source, disposal of untreated medical waste, open burning of medical waste, dumping and mixing of BMW with solid waste, illegal selling of infected plastic wastes to unauthorized recyclers, and improper working of CBWTFs as major issues in most of the states.

All SPCBs have invariably reported lack of staff and infrastructure as the major bottleneck in implementation of the rules.

Most of the states have not yet accounted for veterinary facilities in their state as covered under BMW rules. The SPCBs were oblivious of the fact that these HCEs are also covered under the BMW rules.

The new BMW rules have further increased the scope of the rules to cover many other outreach facilities; thus, a stringent plan and methodology needs to be made centrally and circulated to all SPCBs on how to account for all the occupiers. While reporting, they could report the number for various HCEs separately in Annex 7.

Central Pollution Control Board

The board is responsible for maintaining records on the progress of compliance of BMW rules in the country. In various reports, it was noted that the CPCB has major problems such as the non-submission of annual reports by SPCBs, lack of awareness and segregation in HCFs. They have also shown concerns about liquid waste management.

Analysis of the secondary literature

Annual reports

In the last few years, many states have failed to submit their annual reports. In many instances, there has been a mismatch in the data in the CPCB reports and data available on the sites of respective state health department's web site. Some SPCBs have acknowledged that in the absence of data from hospitals, most of the data of waste produced are merely extrapolation. The data of waste treated in the state are more or less dependent on the data provided by CBWTFs.

Authorization Status

Over the years, authorization status in the states has varied between 3% and 100%. CAG surveys in 15 states of the country showed that SPCBs had failed to map HCEs in their respective states. In most of the states, veterinary institutes have not applied for authorization and in most cases, SPCBs were unaware that these facilities are covered under the rules. Almost all SPCBs have cited lack of human resources and infrastructure with SPCBs as reasons of noncompliance of the rules.

Goa and Haryana have recorded 100% authorization status in its report to CPCB. But an audit by CAG in 2014 records- "It was also noticed that as of March 2014, all the 2669 government veterinary institutions in the state had not applied for authorization under the rules due to lack of directions from HSPCB." There could be a possibility that the concerned officer never realized that these facilities were covered under the rules. Training and capacity-building of SPCB staff should also be considered.

Number of health-care facilities

The total number of health-care facilities in the states has been reported very randomly in the CPCB reports. Maharashtra shows a paradigm dip in facilities by almost 5000; Chhattisgarh and Sikkim follow by a dip of 1000 and 33 respectively.

There seems to be a major underreporting of facilities in some cases. Bihar, for example, has about 1900 HCEs under the National Rural Health Mission (NRHM) (primary health centres (PHCs), CHCs,

DHs and sub-district hospitals (SDHs)). All these are bedded facilities and would need authorization. This figure of 1900 does not account for specialists and referral hospitals and medical colleges.

But the SPCB data show only 600 facilities in the CPCB report.

CAG – *Bihar SPCB in its audit by CAG reported 3700 facilities that would be needing authorization. Similar discrepancies can be seen in other states.*

SPCB and the Department of Health need to start a public drive to request all HCEs to seek authorization; otherwise, their license would be cancelled. Strict timelines with increased monitoring can help this process. Mapping of health-care facilities through the help of various agencies should also be done.

Number of treatment technologies at CBWTF

As per the CAG reports and the primary survey undertaken by Toxics Link, most of the CBWTFs visited claimed that the autoclave was out of order since the last 1–2 days of the visit. Thus it is evident that the bulk of biomedical plastics is leaving CBWTFs without disinfection. This raises serious concerns about the working of these facilities.

KAP assessment

KAP assessment studies have been conducted across the country to understand the level of knowledge, awareness and practice of biomedical waste management rules in different HCEs in various states. A total number of 26 studies from 16 states were selected and analysed for this assessment. Refer annex 8 for the detailed studies.

Out of these 26, 20 studies talked about the staff awareness levels on overall BMW management as well as its specifications such as BMW rules, segregation and colour coding. Twelve studies reported poor awareness; 7 studies reported average levels of awareness; and just 1 study pointed out good awareness levels on BMW among respondents.

Five studies analysed the knowledge of staff regarding the potential of transmission of diseases because of improper disposal of BMW. The studies reported that staff in 3 out of these 5 studies had good knowledge, and in 2 of the studies, the awareness was poor.

When surveyed in terms of practice of BMW rules, out of 16 studies, 12 reported poor practice levels; only 3 studies had average practice levels; and only 1 study reported good practice levels.

Lack of training was identified to be one of the major reasons of inefficient management of BMW as the majority, i.e. 6 out of 8 studies concluded a very low number of training programmes. Two out of these 6 studies stated that the facilities had never conducted any training. Out of the 2 studies that have reported trainings, 1study pointed out an average number of trainings, and 1 pointed out a good number as the facility is one of the regional training centres.

Some studies surveyed reporting of needle-stick injuries by staff and in a total of 2 out of 5 studies, the majority of staff was not reporting NSIs; in 2 cases, such an injury has never been reported, and in only 1 study, an average number of workers were doing the reporting.

Three of these studies covered availability as well as usage of personal protective equipment by waste handlers and in 1 of these studies, the majority of staff was wearing PPE; 1 reported average usage and in the third study, the facility was not providing any PPE to its workers.

Five out of 7 studies reported that HCFs were not following the required method for sharps disposal and only 1 of these studies reported good sharps disposal practices. Two out of these 5 also mentioned that all the sharps collected were being disposed of without any treatment.

Lack of CBWTFs is also one of the major aspects that the 4 studies covered in their analysis, and out of these 4, only 1 study reported connectivity to a CBWTF, 2 did not have any such connectivity; thus, they are discarding their waste through deep burial; and the last study stated that only 36% of clinics surveyed in a city were connected to a CBWTF.

Two of these studies also included the frequency of waste collection and 1 reported that the facility was storing a certain category of waste for more than 10–15 days before sending for treatment and one facility was storing certain categories of waste for more than 2 days.

These studies pointed out lack of waste management agency services, lack of knowledge and awareness, improper waste management systems, inadequate resources, logistic problems, language barrier in training efforts as well as lack of sense of hygiene among hospital staff as well as the patients as major constraints in effective management of BMW, and emphasized on the need for strict implementation of the rules and on the need for regular training programmes.

Summary of various KAP studies done in the country concluded the percentage of respondents having poor, average or good awareness and practices on BMW as follows:

Parameter	% Poor	% Average	% Good
Awareness	60	35	5
Practice	75	18.75	6.25

Case Study

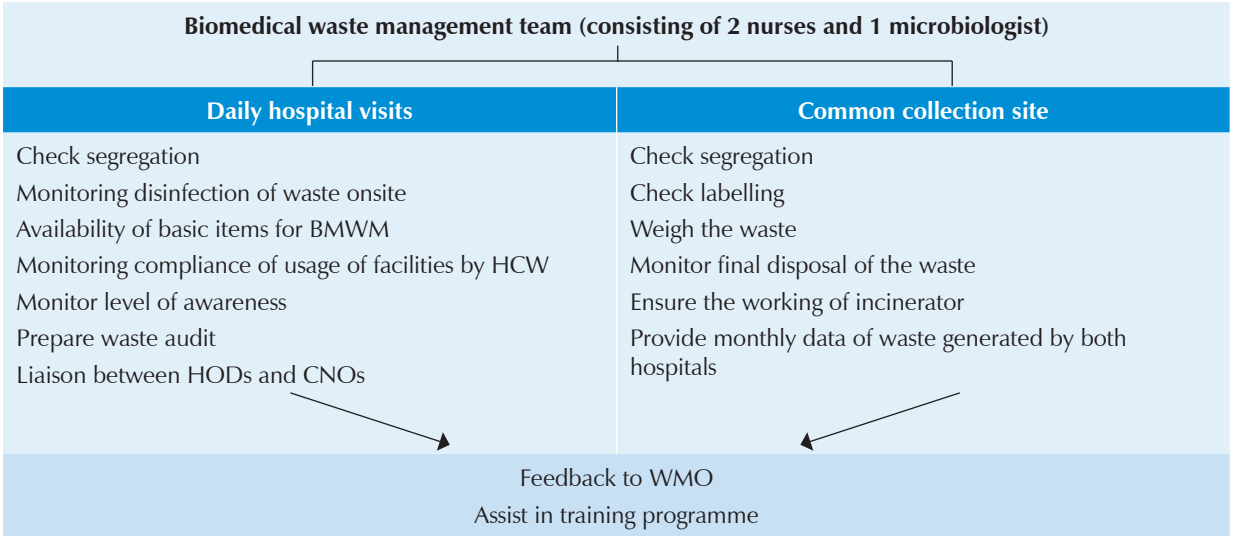
Biomedical waste management in a tertiary care hospital, India[32]

Lady Hardinge Medical College (LHMC) and associated hospitals have constituted a biomedical waste management committee. Members of the committee are from infection control, microbiology units and stores, civil and electrical sections chaired by the Director of LHMC. The senior microbiologist of LHMC is the nodal officer or waste management officer.

The hospital has a good monitoring system in place, which is implemented by the BWMM team. Its feedback is used for improving the system as well as tailoring a training programme.

Waste management system in LHMC (presented by India at regional workshop on HCWM in November 2016):

32 Report on Regional workshop on health-care waste management, Nepal, November 2016



The hospital conducts a regular training programme for all categories of health-care workers. Training for doctors, nursing staff and group C and D employees are conducted every week. Pre- and post-test evaluations are carried out. Waste disposal methods are demonstrated in the training. Post-exposure prophylaxis of HIV infection and infection control practices are included in the training. At the end of the training, certificates are issued. A total of 550 doctors, 396 nurses and 144 cleaners have been trained in 2015 and a similar number has been trained in 2016.

A team from the Department of Microbiology from the hospital has conducted two studies – one to understand the awareness regarding biomedical waste management among health-care workers in the same hospital and the second, to look at the impact of onsite training of health-care workers on biomedical waste management. The first study found that awareness was much higher in those staff that had attended regular trainings. The study recommended carrying out regular and refresher training to improve awareness levels. It also recommended to make training mandatory at the time of recruitment and to include it in medical and nursing curriculums. The second study found that waste segregation practices were higher in staff who attended onsite training.

Conclusion

India generates a total of 495.30 tonnes of medical waste in a day. The country has Bio-medical Waste Management Rules, 2016. Hospitals segregate their waste into the required categories and then send the waste for offsite treatment. There are several model hospitals in the country. Various institutions in the country have developed good training resources.

Although the country has 191 operational offsite treatment facilities, they are not sufficient to treat the large quantum of waste being produced.

Audit reports have identified the presence of unauthorized HCFs, unavailability of treatment and disposal facilities, inefficient segregation at the source, disposal of untreated medical waste, open burning of medical waste, dumping and mixing of BMW with solid waste, illegal selling of infected plastic wastes to unauthorized recyclers, and improper working of CBWTFs as major issues in most of the states.

Lack of staff and infrastructure is also a major constraint in the implementation of the rules. The country needs stringent monitoring and evaluation framework to ensure compliance.

Recommendations

- Although India's policy framework is well drafted, the country has fallen weak on its implementation strategy. Data discrepancy is highlighted as one of the major issues. The CPCB and the SPCBs have to map all health-care facilities that require authorization. A specific criterion should be made and all SPCBs should follow a standard protocol in finalizing the type of facilities that would need authorization. These data need to be updated along with the annual report.
- Onsite incinerators are not allowed according to the biomedical waste management (BMWM) rules; still, a large number of such facilities are installed throughout the country. The pollution control board should take immediate action and shut down these facilities.
- The monitoring bodies, viz. SPCBs and CPCB, should make a strict timeline and visit the health-care facilities and CBWTFs regularly and update their data on time. Stringent monitoring would help improve compliance.
- Since the health-care facilities are not being monitored by pollution control boards frequently, a lack of implementation has been seen on their part. The newly formed district level monitoring committee should plan out a strategy and monitor these facilities as required by the rules to fill in this gap.
- Since the existing CBWTFs are not enough to treat the quantum of medical waste generated by hospitals, the country should focus on installation of more CBWTFs and should work on increasing connectivity upto the PHC level. A ground check before approval of common treatment facilities (CTFs) is necessary to avoid excess of CBWTFs, which can make them economically unfeasible.
- CBWTFs also need to be monitored frequently as many hospitals reported that these facilities do not collect the waste on time. Also their staff are not trained and thus do not handle the waste as required. As these facilities do not let hospitals make an unplanned visit, the CPCB should issue a notice to them on the same. The SPCB should also visit them frequently.
- Although the rules require health-care facilities to conduct training programmes for staff, only a few facilities actually conduct them. Since now, district level monitoring committees are monitoring BMW management at the district level, they should ensure that training sessions are conducted at least biannually and include all health-care staff as well as CBWTF staff.
- The MoH/SPCB/CPCB should come up with a detailed training module and provide it to all health-care facilities of the country emphasizing on the importance of such training sessions.
- A large portion of hospitals in India do not have an ETP/STP and are thus discharging their wastewater without meeting the required standards. The major reason for this is the lack of technical competency of hospitals. It is thus imperative for the pollution control board to frame SOPs and to provide guidance to hospitals in the installation of wastewater treatment plants.

- Underreporting of waste generation and accidents is common. Training sessions should include a major chapter on the importance of the issue and the dangers associated with needle-stick injuries, consequences of recapping and the need for reporting of such accidents.
- Although the scenario remains bad at most of the facilities, it is heartening to see many private and some government hospitals trying to strive for perfection in the field. These are models from which the whole country can learn. However, these are not being recognized in the right manner. Therefore, the country should come up with some system of providing them with the required appreciation in the form of some certificate or some reward to keep them motivated and set them as leaders that other hospitals can follow.

9

Indonesia

Introduction

Indonesia is the world's third most populous democracy and the world's largest archipelagic state (island country) with approximately13466 islands.[33]About 53.7% of the total population lives in the urban and the rest in the rural areas.[34] The urban areas have specialized hospitals with more physicians and central government funding. Community health services are organized in a three-tier system with community health centres – CHCs (Puskesmas) being first in the hierarchy.

Inventorization ofbiomedical waste generation and management

General information

Types of health-care facilities

Public sector hospitals are categorized as national, provincial and district hospitals and community health centres. Other than these, there are non-profit hospitals and private (Persero) hospitals. According to the specialty, hospitals are categorized as Class A, Class B and Class C.

Total number of health-care facilities in the country	2576 hospitals
Government (all ministries) bedded and non-bedded	904
National	45 hospitals
State/subnational	119 hospitals
District	573 hospitals
Military/Police	167 hospitals
Private	1672 hospitals

Total number of beds	317025 beds
Government (all ministries)	165382
National level	17880 beds
State/subnational level	28795 beds
District level	100525 beds
Military/Police	18182 beds
Private	78244 beds
Community hospitals	73399 beds

33 http://nationalgeographic.co.id/berita/2012/02/hanya-ada-13466-pulau-di-indonesia
34 https://www.cia.gov/library/publications/the-world-factbook/geos/id.html

National data on medical waste

Data on medical waste generated in the country are collected from hospitals electronically and substantiated by direct visit to the hospital for verification purposes. The Ministry of Health is the nodal national body for this purpose. Selected, general data are available in the public domain. Data are updated every three months.

Total quantity of medical waste generated in the country – 225 tonnes per day

Average per patient per bed per day waste generation of the country – 0.68 kg/bed/day

Policy framework

Indonesia has several regulations on health and environment and on hazardous waste with an aim of protecting human health, minimizing risks to patients, health workers and the community at large by promoting best practices in health-care waste management. The country has ratified the Stockholm Convention on Persistent Organic Pollutants (POPs) and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposaland has signed the MinamataConvention on mercury.

Government regulation number 6 issued in 2013 requires all hospitals to be assessed with a rating system ranging from black, red, blue, green and gold. Black means no efforts taken to manage health-care waste; red means environmental management efforts are not implemented in accordance to the law; blue means implementation of environmental management efforts are in accordance with the law; and green and gold is beyond criteria/ or compliance is more than what is required.

A total of 121 hospitals were monitored against the criteria and the ratings were as follows: black – 8; red – 70; and blue – 43, which means that most hospitals were not implementing the government rules and regulations. However, such monitoring will help hospitals to improve in future.

The strategies for managing wastes are:

- Obligate all health-care facilities to manage waste properly in accordance to standards
- Reduce and recycle the waste
- Capacity-building of human resources
- Strengthen public-private partnerships
- Improve monitoring and evaluation
- Explore alternative treatment other than incineration

National rules/policies on medical waste

- Government Regulation number 101, 2014, on Hazardous Waste Management
- Government Regulation number 74, 2001, on Management of Hazardous Substances
- Health Minister Decree number 1204, 2004, on Hospital Environmental Health Requirement
- Minister of Environment and Forestry Regulation number P.56 year 2015 on Technical Guideline and Requirement of Hazardous Health-care Waste Management

Agency responsible for framing these regulations/guidelines/policies

Ministries of the Environment, Health, Transportation and Home Affairs are together responsible for framing these policies.

Agency responsible for implementation

Health-care institutions (including hospitals) are implementing the rules. The Health Ministry is responsible for technical guidance, and the Environment Ministry is responsible for enforcement.

Waste management committee

The waste management committee is not mandatory but national policy requires district/province agencies (environment/health sector) in every province/district to look after the implementation of medical waste by supervising and providing infrastructure.

Policy also requires the formation of a unit in every HCE, which deals with environmental health including waste management. 80% of the health-care facilities have this committee.

Segregation

The national policy requires segregation of waste into the following: non-hazardous waste, sharps, infectious, pathological, chemical, pharmaceutical, pressurized tube, heavy metals, cytotoxic and radioactive waste. 97% of hospitals in Indonesia segregate hazardous and non-hazardous waste, but only a few hospitals segregate the waste specifically as defined by the policy.

Collection and transportation

Hospital staff is in charge of intramural waste collection and transportation. The waste is collected by using trolleys or wheeled bins. The bins are covered and marked with a hazardous waste symbol. Separate lifts for waste are available only in big hospitals. Extramural transportation is done by private sector firms with a permit from the Ministry of Transportation and monitored by the Ministry of Environment. The firm is also responsible for any accident during transportation.

Storage

The requirements for storage are included in MoH Decree No. 1204 year 2004 on Hospital Environmental Health Standards. Infectious and pathological wastes can be stored for a maximum of 48 hours. For other wastes, 90 days maximum storage is permitted. Storage temperature recommended for infectious and pathological waste is less than 0^{o}C. The storage area should not be in a flood-prone area;it should have easy access to vehicles and should be well ventilated with good drainage.

Treatment and disposal

The Ministry of Environment and Forestry is responsible for ensuring technology standards/validation and inclusion of new technologies. Non-incineration and incineration technologies are recommended for use for all types of waste. Onsite and offsite treatment facilities exist. Onsite treatment mostly includes incineration. Incinerator capacity ranges from 50 kg to 200 kg per hour, but performance of most of them is unsatisfactory. Hospital administrators are divided in their opinion of onsite systems – half is

satisfied and the other half is dissatisfied. But they do feel that onsite incineration is more expensive than offsite treatment and also increases chances of occupational hazards.

Only six offsite treatment facilities exist at the moment, but they are not adequate for the country. All the plants run on incineration, and rotary kiln incinerators (with controlled emissions) are used by all of them (having rotary kiln for health-care waste treatment is not mandatory).

The incineration standards (for health-care waste treatment) have been issued by the Ministry of Environment (Minister Regulation No. P.56 year 2015). These standards also include standards of mercury (0.2mg/Nm^3) and dioxins and furans (0.1ng TEQ/ Nm^3).

Incinerators are tested for emission standards regularly. Dioxin and furan,polycyclic aromatic hydrocarbons(PAH) andpolychlorinated biphenyl (PCB) testing is done for offsite treatment facilities every 3 years.

Occupational safety

Personal protective equipment is generally used for all procedures of health-care waste management, as they are covered under the Guidelines and requirement of hazardous waste in health-care facilities. Vaccination of staff against hepatitis B is not mandatory. There is a sharps waste management policy in the country, which requires proper segregation, the use of PPE and safe disposal. About10% of HCEs use a needle destroyer. The final disposal of the sharps is either by incineration or deep burial. About 60% of hospitals and 10% of health centres use auto-disabled syringes (ADS use is mandatory by the government). PPE policy of the government is elaborated in the Minister Regulation No. P.56 year 2015.

Pharmaceutical waste

There are provisions in place for safe disposal of expired or unwanted drugs. The enforcement is good. The Ministry of Environment and Forestry regulation on pharmaceutical waste also includesEPR according to this Minister Regulation No. P.56 year 2015. The EPR implementation is achieved by agreement of user and pharmacy supplier/producer in procurement contracts.

Genotoxic/cytotoxic waste

Cytotoxic waste management is included in the Environment Ministry Regulation No.56 year 2015.

Chemicals

Use of chemicals (especially disinfectants) in hospitals is regulated by the internal policy of each hospital based on material safety data sheet (MSDS). Generally chlorine is used as a disinfectant. There are two ways of disposing liquid waste – either by engaging a third party or managing it themselves.

This is done as per the Ministry of Health Decree no. 1204 year 2004 on Hospital Environmental Heath Requirement Environment, and Regulation No. 56 year 2015.

Mercury management

Indonesia has developeda National Implementation Plan on Mercury. The country is drafting a Law for ratification of the Minamata Convention. It is also drafting a Ministry of Health Regulation on

National Health Action Plan on Mercury Elimination. Although mercury equipment is still being used in the country, it has started pilot projects to stop their use. The discarded mercury is disposed of into a Class I sanitary landfill, after solidification treatment.

Wastewater treatment

The average use of water in a hospital is ~1.120 KLD/bed. The health-care facilities discharge their wastewater after treating it in sewage treatment plants. The biological process for treatment of wastewater is recommended. The Province/District Environment Agency monitors the sewage output in accordance with the Ministry of Environment Regulation No.5 year 2014, but it does not regulate the requirement and specification of STPs.

Capacity-building of people handling waste management

Training is conducted by the national and subnational authorities, and also by the respective HCEs. National accredited training modules (can be downloaded via http://kesling.kesmas.kemkes.go.id/limbahfasyankes/) on health-care waste management exist for training of health-care staff. Training of trainers (TOT) and technical training is conducted annually by the Ministry of Health/subnational governments/HCEs. The environmental health officer in hospitals is responsible for undertaking these trainings.

Monitoring (within hospital/national)

Frequency of monitoring is every three months at state/province and national level, and every month on an average in a hospital.

Some gaps thatexist in the monitoring are – low response rate from HCEs and lack of training of people who monitor. They are uninformed on the method of monitoring.

Compliance

There are gaps in health-care waste management in emergency or epidemic situation. Compliance is also relatively low in remote areas of the country. 68% of total waste is collected, treated and disposed as per the regulation.

Records

The health-care facilities are required to maintain records of the health-care waste generation and management, and report it every three months. TheProvince/District Environment Agency monitors/verifies these records. These reports are not available tothe public.

Accident reporting

The MoH Decree No. 1087/2010 on Occupational Health and Safety Standard of Hospital provides a template for accident reporting. Each HCE maintains these records.

Funding

Roughly only 1% of the hospital budget is allocated under the environmental health budget/sanitation unit for health-care waste management expenses. Thehealth directorate allocates the budget for health-care waste management to public health-care facilities. These funds are not adequate, and some revisions can be considered. The Inspectorate of the MoH monitors the efficient budget utilization of these funds.

Infrastructure

Based on the online monitoring system, 67% of health-care facilities have an infrastructure for management of health-care waste in accordance with Minister Regulation No. P.56 year 2015. The government provides funding and technical guidance to develop infrastructure for the handling and management of medical waste.

Deterrence

The Environment Agency has a provision toimposefines/imprisonment if health-care facilities do not manage theirhealth-care waste as required by law.

Awareness

According to estimates, 95% of total health-care facilities are aware about the risks associated with mismanagement of the health-care waste and about70% were following best waste management practices.

Epidemic preparedness

There are guidelines/documents available on highly infectious diseases, surveillance mechanisms, response mechanisms, isolation units and epidemic preparedness. Big hospitals (B and A class hospital) are eligible for handling an epidemic.

The Ministry of Environment Regulation no P.56 year 2015 covers the management of health-care waste in case of any disease outbreak.

But the required infrastructure is not available for the management of health-care waste in case of any disease outbreak. Occasionally the Ministry of Health provides training to staff to handle an epidemic situation with respect to health-care waste management.

Infection control committee

The national regulation requires formation of an infection control committee in health-care facilities. The key roles and responsibilities of the committee are to look into disinfection, sterilization, reducing HAI, etc. Staff are required to wear protective equipment (such ashelmets, masks, goggles, aprons, gloves, boots, etc.) while handling health-care waste.

The country is a signatory to the Patient Safety Pledge of the World Health Assembly.

International treaties

The country is signatory to all international conventionssuch as theBasel, Stockholm and Minamata Conventions. Waste laws of the country are in conformation with these conventions. There aresome implementation gaps in the Minamata Convention, which is the most recent. To date, no projects (inventorization, compliance improvement/any other) have been undertaken with the help of GEF funds.

Primary assessment

A primary assessment was conducted in four hospitals in the country. The list of hospitals is given in Annex 4.

Average waste generated by facilities

80% of the surveyed facilities quantified their health-care waste. The average health-care waste generated by tertiary, specialty facilities was 1.11kg/bed/day.

Segregation

80% of the facilities segregate their wastes but the segregation system varies between different facilities. There is no specific category followed.

Policy

80% of facilities have a policy in accordance with the Health Minister Decree No. 1204 (2004).

Collection and transportation

As per the survey done in health-care facilities, only one facility has an onsite incinerator. All the facilities surveyed use PPE such as masks, gloves, boots and aprons.

Treatment and disposal

None of the facilities follows any pretreatment of health-care infectious waste. 80% of facilities send the waste either for incineration or landfill.

Storage

All the surveyed facilities have a separate storage area for health-care waste.

Record

80% of facilities maintain the records of the waste that they generate.

Accident reporting

60% of facilities report accidents to the Occupational Safety and Health Committee of the hospital. Some of the facilities report accidents to their sanitary inspector.

Miscellaneous

Sharps waste is generally stored in a safety box. Only one facility among the surveyed facilities mentioned that they had a needle destroyer but it has not been working for a long time. Another facility is sending the sharps wastes for incineration once the safety box is 3/4th filled.

Annual reports

Some of the facilities submit their annual report to the Ministry of Environment; Daerah Khusus Ibukota Jakarta (DKI Jakarta), Jakarta provincial health department and a few facilities have internal reporting systems. The frequency of reporting varies between once a month or once in three months.

Capacity-building

40% of the facilities train their newly appointed staff. There is a legal mandate for any facility to give training to staff. The government does not impart any training. There are no NGOs or international agencies involved in capacity-building with regard to health-care waste management.

Infrastructure

All facilities have required infrastructure.

Monitoring

Hospitals do monitoring on a daily basis and it is done by sanitary staff. Monitoring is also done by "BPLHD Propinsi DKI Jakarta Dinas Kesahatan Prop. DKI Surveyor akreditasi RS Auditor ISO 14001-OHSAS 18001". Frequency of monitoring varies between once in a year or once in three months.

Funding and human resources

Approximately 40% of facilities received state/government funding for health-care waste management. Apart from the State's fund, only 20% of facilities received funding from the United Nations Development Programme (UNDP) and the Dian Desa foundation.

Chemicals

Approximately 80% of facilities handle chemical waste according to the guideline/policy shown below.

Epidemic preparedness

Most of the facilities have an epidemic response team; none of the facilities give capacity-building for epidemic handling.

Compliance

There is no provision of any deterrence.

Wastewater treatment

80% of facilities have installed ETP/STP.

Secondary literature review

The amount of health-care waste generated in Indonesia is between 0.43 kg/bed/day[35] and 1.5kg/bed/day.[36] Health-care facilities segregate their wastes into two categories, leaving a mixture of infectious and sharps wastes in the same containers, which are not usually puncture proof. As for sharps waste, only a few hospitals weigh them, indicating that many hospitals mixed the sharps waste with infectious waste to reduce the expense on sharps containers. Only 50% of hospitals used the colour-coded system and approximately 50% of them did not due to the unaffordable costs of colour-coded plastics and bins.[37]

Health-care facility research (HFR) was carried out in 2011 in public health-care facilities including community health centres (CHCs). The study showed that CHCs located in the Java Bali region in the main islands (i.e. urban areas) are more likely to practice medical waste segregation and less likely to practice open burning than their rural counterparts.

One in three community centres do open burning of their health-care waste due to lack of knowledge of risks associated with it, lack of human resources, lack of budget and other such factors.[38]

In Indonesia, the municipality is responsible for dealing with the general waste (thus the general waste from hospitals is disposed with that of the municipality). On the other hand, the responsibility of handling medical waste lies with the hospitals. To avoid responsibility of managing medical waste, it is mixed with municipal solid waste and disposed of into a final disposal site without any prior treatment. Open dumping in most cities in Indonesia and waste scavenging at a final disposal site worsens the problem.[39]

As of January 2014, Indonesia started implementing universal health coverage (UHC) according to National Social Security System Act No. 40/2004. As coverage of health insurance is expanded, health-care utilization will increase. Thus sustainable HCWM will become more important in terms of quantity and its potential impact.[40]

Regulation to govern hazardous waste management has been established since 1999, butmost of health-care facilities have not yet complied with the regulation. In May 2008, the central government enacted a new Act of Solid Waste Management No 18/2008, and one of its clauses dealt with health-care waste. Another regulation is the Ministerial Health Decree No 1204/2004 concerning Environmental Health Standards of Hospitals, including medical waste management. The Decree has no legal sanction since it is only a guideline for hospitals to improve their environmental health. There are limited HCWM regulations and poor implementation. The government should sufficiently provide regulations and policies to direct and guide hospitals and other health-care establishments to improve the existing management of health-care waste in a more comprehensive way with other internal programmes within health-care establishments.

35 https://www.researchgate.net/publication/253340497_Current_Status_and_Future_Challenges_of_Health-care_Waste_Management_in_Indonesia

36 Risk Minimization For Medical Waste Management System in bandung city, Indonesia:A Linear Programming Approach – Chaerul et al 2013.

37 https://www.researchgate.net/publication/258246846_Determinants_of_hospital_waste_management_in_Indonesia_Focusing_on_the_importance_of_segregation_at_source_and_color-coded_collection_system

38 NIHRD (2012) *Final Report of Health Facility Research (Laporan Akhir Riset Fasilitas Kesehatan)* Jakarta: National Institute of Health Research and Development, Ministry of Health, Republic of Indonesia.

39 http://pslh.ugm.ac.id/id/wp-content/uploads/20.2-3.Minimasi-Risiko-Chaeruldkk.pdf

40 Chartier Y, Emmanuel J, Pieper U, et al. (2014) Safe Management of Wastes from Health Care Activities. 2nd ed. Geneva, World Health Organization

Conclusion

Indonesia generates a total of 225 tonnes of medical waste per year with an average of 0.68 kg/bed/day. The country has a decree on Hospital Environmental Health Requirement, 2004, and Technical Guidelines and Requirement of Hazardous Health-care Waste Management. The country data say that 97% of HCFs are segregating their waste as per the national policy categorization. But the primary assessment states that hospitals do not follow uniform colour coding for waste segregation. Studies also indicated that HCFs segregate their waste only in two categories and mix sharps waste with infectious waste.Hospitals use both incineration and non-incineration technologies for the treatment of their medical waste. For onsite treatment of waste, HCFs majorly uses incineration. Studies indicate that some facilities openly burn their medical waste due to lack of awareness. The country has only six offsite treatment facilities thatare insufficient to treat such a large quantity of waste. The primary survey indicates that hospitals dispose of their infectious waste in municipal dumps without pretreating it. Overall compliance is found to be low especially in the remote areas. According to the government, 68% of total waste is collected, treated and disposed as per the regulation.

The lack of funding, large quantum of waste and low priority given to this issue by policy-makers are reasons given for inefficient management.

The country has guidelines on epidemic preparedness and although its class A and B hospitals are eligible for handling an epidemic, the country still lacks the infrastructure required to manage waste in such situations.

Recommendations

- Availability of funds seemslike a major deterrent in compliance of health-care waste management.The government can help standardize bags and bins for waste management and make them available to hospitals at a reasonable price.
- Medical waste segregation should be promoted in CHCs to ensure sustainable HCWM. Infection control and waste management can be made a part of all rural health-care delivery services to improve segregation in rural HCFs.
- The use of non-incinerator technologies for the final disposal of medical wastes should be promoted.
- Training of health-care staff would be the most important driver in establishing a sustainable health-care waste management system in the country.
- The use of incinerators and open burning is a common way of waste disposal. More environmentally sustainable technologies should replace this method. Most of the old incinerators would need upgrading; thus, it would be advisable to phase out these machines with more non-burn options.
- Segregation can be substantially improved by – having a clearer and more stringent policy, increasing monitoring, and having regular enforcement drives.
- The guideline should have a separate section to address specific problems and concerns of rural and remote hospitals/CHCs.
- As seroprevalence of HBV is very high in the country, it would be advisable to make hepatitis B vaccine mandatory for all health-care staff.

- Sharps waste can be collected and the possibility of recycling it through a smelter can be explored at the national level.
- EPR for pharmaceutical waste is a very good step. It would be helpful if a factsheet is made on the implementation of this provision and shared with other South-East Asia Member States for taking up similar advances.

10

Maldives

Introduction

Maldives is a South–East Asian island country, situated in the south-west of Sri Lanka, on the equator. The Maldives economy is growing at an average of over 10 % since the past two decades. Tourism is the main industry, contributing almost 20% to GDP.[41]

The Decentralization Act 2010 states that the administrative divisions of the Maldives consist of cities, atolls and islands; each is administered by itsown local council. Administratively, the islands are grouped into 20 atolls and at present, 187 islands are officially declared as inhabited islands.[42]

The Indira Gandhi Memorial Hospital (IGMH)and ADK Hospital are the only tertiary hospitals in the Maldives located in Malé. Regional hospitals and atoll hospitals provide curative services with major specialties including obstetric, medical and surgical for both routine and emergencies supported by laboratory and radiological investigations. Health centres located onislands offer general medical services and preventive and health promotion services.

Inventorization of biomedical waste generation and management

General information

Types of health-care facilities

There are mainly two different health-care providers that are generating health-care waste: public and private. The health system consists of hospitals (tertiary, regional, atoll, private, specialized), health centres and private health clinics.

Total number of health-care facilities in the country	22 hospitals and 165 health centres
Government (all ministries) bedded and non-bedded	
Tertiary	1
Regional	6
Atoll	14
Health centres	165
Private	
hospitals	5
Non-bedded clinics	257

Total number of beds Government (all ministries)	1626

41 http://www.themaldives.com/maldives/
42 National Health-care Waste Management Policy, Maldives, 2016

National data on medical waste

According to the Country Level Evaluation of Maldives, the medical waste generated was about510 tonnes per year in 2012.[43]

Policy framework

The country has a National Health-care Waste Management Policy notified in April 2016. The policy mentions that the current health-care waste management system in the facilities is not standardized. It states that the implementation and monitoring of safe management is weak and has listed certain shortcomings. The policy entails responsibilities of each authority such as the Ministry of Health, Ministry of Environment, Environment Protection Agency, Local Councils, etc. This policy document is to be revised every two years by the Ministry of Health. The policy is more like a guidance document that enlists various facets of good medical waste management.

This could be considered the first step towards establishing systems and protocols in the country. Various guidelines and policies have to be framed in accordance with this policy. These documents include the Health-care Waste Management Guideline and the National Implementation Strategy, including an implementation plan and a comprehensive set of safety operation procedures.

The country also has a draft National Strategy on Health-care Waste Management (2016–2021). The purpose of this strategy is to enforce the "National Health-care Waste Management Policy" and the "National Health Master Plan" by establishing a countrywide integrated health-care waste management system (which is managed without adverse effects on human health and environment and is environmentally and economically sustainable).

On a national level, there are some documents that can be referred for the management of health-care waste:

Local Government Authority

The Act on Decentralization of the Administrative Divisions of the Maldives, 2010, provides for general waste management by local councils. Health-care waste management is not included in this document.

Waste management regulations of island councils (this document provides for the basic methods of waste management; it does not provide in detail information regardinghealth-care waste management).

Ministry of Health

- Public Health Protection Act, Law 7/2012 (includes general waste management)
- 2016–2025 Draft Health Master Plan
- National Infectious Control Guideline in Health Facilities, 2008
- National Standard on Clinical Laboratories, 2013
- Minimum Standards on HCWM, 2008

43 https://www.oecd.org/countries/maldives/47234192.pdf

Ministry of Environment and Energy (MoEE)

- Environmental Protection and Preservation Act of Maldives, Law No 4/93 (waste management in general)
- Policy on Waste management, 2015
- Waste Management Regulation, 2013 (doesnot specifically mention health-care waste management, but provides for hazardous waste)

Agency responsible for framing and implementing this policy

Health Protection Agency, Ministry of Health is the nodal agency for framing the policies regarding health-care waste management.

Greening the health-care sector

The new Policy of 2016 gives impetus on greening the health-care sector. The policy includes provisions to minimize the use of toxic, hazardous compounds such as poly vinyl chloride (PVC) and phasing out heavy metals such as mercury in the health-care sector as much possible without compromising product performance. The policy also emphasizes on following the international green procurement rules. It states that all materials which are planned to be procured shall follow criteria that ensure that less toxic and less hazardous products are selected, without compromising product performance.

The Ministry of Environment and Energy has been entrusted with the duty to develop the necessary regulatory tools for implementation of and compliance with best available technologies (BAT) and best environmental practices (BEP) for the treatment and disposal of waste from health facilities and to ensure the protection of human health and the environment.

Waste management committee

The HCW management guideline requires formation of the waste management committee at the hospital level. It should be recognized as an integral part of the organization and should have active members representing key departments of the hospital. The committee is required to periodically review and update the waste management plan and is responsible to monitor:

- Compliance to waste processing procedures
- Amount, types and sources of waste generated
- Disposal costs and savings
- Success of waste minimization activities
- Awareness and compliance
- Incidents/accidents related to waste handling

At present, only two hospitals have formed an infection control committee, which is responsible for HCWM.

Segregation

The national policy requires segregation of waste into general waste and medical waste, where medical waste is further segregated into infectious waste; highly infectious waste; pathological waste; sharps; pharmaceutical waste; genotoxic waste; chemical waste; pressurized containers; radioactive waste; waste with high content of heavy metal; and liquid waste.

70% of the facilities segregate waste according to the defined segregation system.

Collection and transportation

The segregated medical waste from different locations in the facility is collected in one container/bag by auxiliary staff and contracting companies. Uncovered and unlabeled trolleys are used for transportation and no separate lifts or chutes are used for this purpose. The Waste Management Corporation Private Limited is responsible for the collection of general waste from the facilities. 100% of the waste generated in greater Malé is transported to Thilafushi (an island for waste management).

The waste collectors wear clothing protecting their full bodies. The clothing includes:

- Specific shoes used for such undertakings
- Waterproof and cut-resistant heavy-industry gloves

The vehicles transporting the waste are required to follow certain minimum standards according to the route of transportation that they are following. Drivers have to get their registration and license from the Environment Protection Agency. According to the policy, transporting health-care waste on public roads and by sea shall be in accordance to the "Waste Regulation (2013)".

Storage

The policy states that the storage facilities for health-care waste should be suitably sited, lockable, hygienic and appropriately sign-posted. Public health shall be protected by limiting access to waste receptacles, waste stores, and treatment and disposal areas for patients, visitors and the general public. Details are given in Annex 9.

Treatment and disposal

There is no provision for treating the waste onsite/offsite in the country. The country does not have many waste treatment technologies. Handmade burners are used for burning medical waste. Only one facility has an incinerator and some have autoclaves in labs. 70% of the rural facilities burn the wastes inside the facility. Overall, open burning and in some cases the use of burners seems to be the major way of waste treatment in the country.

Landfills and incinerators need to be approved by the EPA to meet the required standards (Annex 10).

Occupational safety

Generally, health-care staff do not use proper PPE. 85% of facilities use only gloves while segregating waste. No PPE is used during collection, transportation, treatment or disposal of medical waste.

At present, only two hospitals have vaccinated their staff.

Sharps waste management

Although there is no separate policy for managing sharps, all health-care facilities use a sharps box to dispose of their sharps waste. Some facilities also use needle cutters.

The country has the "Guidelines for Prevention of HIV Infection following an Occupational Exposure to Health-care Worker"/PEP Guideline (November, 2011).

The country is 'highly vulnerable' to an HIV/AIDS epidemic largely because of a sharp rise in the number of people injecting drugs, as revealed by a government assessment (in conjunction with UNICEF and WHO assessments) conducted in 2006 on AIDS. The country is characterized by 'high risk and vulnerability and low prevalence'. This means that while the number of cases of HIV infection remains low – from 1991 to 2006, there were 13 cases involving Maldivians – the potential for an explosion in infection rates remains real.

Pharmaceutical waste

The Maldives Food and Drug Authority has to develop a mechanism for the collection and disposal of pharmaceutical waste and inform all parties/health facilities to follow the same procedure. It shall ensure the collection and proper disposal of expired pharmaceuticals in all health facilities and pharmacies in accordance to the policy, guidelines and SOPs. Records of the disposal of pharmaceutical waste must be maintained and shared with the relevant health facilities/pharmacies to minimize waste generation.

Gentoxic/cytotoxic waste

Although there is no specific policy for the management of genotoxic waste, the national HCWM policy has provisions to adopt waste management practices (such as segregation, transportation and disposal), which support conventions such as the Basel Convention.

Chemicals

There is no policy on the use of chemicals in facilities. Hospitals generally use cidex and hypochlorite for cleaning. Antiseptics such as savlon and dettol are used as disinfectants. Liquid waste is directly disposed of in a drain.

Mercury management

There are no policies restricting mercury use in the country. But, with the development of the National Health-care Waste Management Policy, 2007, many health facilities including clinics, government and private hospitals, have substituted mercury thermometers and blood pressure (BP) apparatus to digital instruments. In the last 2 years, the MoH has stopped procuring mercury medical instruments. The national waste management regulation and law has provisions for the disposal of this toxic waste. At present, mercury containing equipment is being stored in health facilities.

Mercury waste is categorized under special waste in the Waste Management Regulation; and the following rules apply to it:

- The importing of such waste to the Maldives is an offence.

- The exporting, transporting from one island to another, recycling, recovering and carrying out any waste treatment work of such without obtaining permission from the implementing agency is an offence.
- This waste should be kept in places especially allocated for them by the implementing agency.
- This waste should not be burned under any circumstances.

Wastewater treatment

The country does not have any onsite treatment facilities for the treatment of wastewater being produced. Untreated wastewater is directly discharged into drains or the sewerage system. A policy on water use and a law on national water and sewerage are in the drafting stages.

Capacity-building of people handling waste management

The country's policy has a provision of capacity-building of health-care staff. In the process of implementation of the policy, training workshops/ToTs have been conducted by experts and local facilitators. There is no training module available as of now but there is a plan to develop it after the implementation of the National Health-care Waste Management Strategic Plan 2016–2021 (developed after the endorsement of the National Healthcare Waste Management Policy (NHCWM) 2016). The policy provides a provision to develop online and face-to-face training modules. The aim is to use these for one-time and recurrent trainings. Master trainers would be identified and trained. Medical waste is part of the nursing curriculum and it would soon be made part of all education materials.

Monitoring (within hospital/national)

In urban areas, monitoring is efficiently conducted biannually.

Due to geographical challenges, the Quality Assurance Division of the MoH was able to monitor 45% of health facilities in the rural areas during the past 2 years. However, a capacity-building programme was conducted, and quality assessors are now trained from all the Atolls. Hence, they will be used for future monitoring of health facilities.

Records

At present, facilities are not required to maintain any record of their medical waste management. But according to the 2016 policy, a national health-care waste management monitoring system and plan shall be developed and set up. Data shall be collected on how health-care facilities and/or institutions are implementing their health-care waste management programmes and activities countrywide.

According to waste regulation 2013, a sectoral waste management monitoring report shall be submitted to the Environment Protection Agency (EPA) annually.

Accident reporting

There are no provisions of reporting accidents occurring in facilities. The country has PEP guidelines notified in November 2011.

Funding

All the requirements of health-care facilities are met through the general annual budget, and there is no separate funding available for waste management. The budget is allocated by the Ministry of Health, which is also the monitoring agency. These funds are not sufficient for the facilities. The new policy, however, states that all public and private health-care facilities should adequately budget for safe and environmental friendly health-care waste management and designate an annual budget for periodic maintenance and repair of treatment technology used.

Infrastructure

No health-care facility has the required infrastructure for management of health-care waste as of now. As per the recent policy, it is the mandate of the MoH to provide infrastructure to government facilities.

Deterrence

The exporting/transporting of waste from one island to another, recycling, recovering and carrying out any waste treatment work of such waste stated as special waste under this regulation, without obtaining permission from the implementing agency is an offence. The penalty for this offence is a fine of 2000/- (two thousand) Rufiyaa.

Infectious waste is categorized under Hazardous Regulation number: 2013/R-58. Exporting or transiting of hazardous waste across the Maldives without obtaining permission under this regulation is an offence. The penalty for this offence is a fine between 501/- (five hundred and one) Rufiyaa and 100000000 (one hundred million) Rufiyaa. The EPA is the authority for imposing fees or giving deterrence.

Awareness

Although 100% of the facilities are aware of the risks associated with the mismanagement of medical waste, none are following best management practices.

Epidemic preparedness

There are guidelines/documents available on highly infectious diseases, surveillance mechanism, response mechanism, isolation units and epidemic preparedness. Tertiary level 1 and level 2 hospitals are eligible for handling an epidemic. Ebola SOPs 2014 and the Middle Eastern respiratory syndrome coronavirus (MERS-CoV) SOPs are available, and they give a detailed outline on how to handle epidemics.

In 2006, the MoH developed a draft Disaster Preparedness and Emergency Response Framework outlining the objectives of achieving a satisfactory level of preparedness to respond to any emergency situation; it included a national emergency preparedness and response policy, and indicated the general directions to strengthen the technical and managerial capacity of relevant institutions, communities and organizations involved. In 2014, the country has framed a Health Sector Emergency Risk Management Framework.

But no training is being provided to staff on ways to handle an epidemic situation with respect to health-care waste management.

Infection control committee

There is a draft national guideline for infection control. Staff are required to wear protective equipment – mostly gloves – while handling health-care waste. The country is a signatory to the Patient Safety Pledge of the World Health Assembly.

International treaties

The country is signatory to international conventions, viz. Basel and Stockholm. The waste laws of the country conform with these conventions. To date, no projects (inventory, compliance improvement/ any other) have been undertaken with the help of GEF funds.

GEF has supported in the formulation of the national health-care waste management policy in 2016. The GEF small grants programme (SGP) has funded 27 community-based projects. These projects have targeted diverse objectives including the establishment of proper waste management in an effort to prevent pollution and degradation of sensitive habitats.

The National Strategy on Health-care Waste Management in Maldives (2016–2021) prioritizes its main objectives for the next 5 years as follows:

Strategic Priority 1 Objectives

- Review and revise existing legal documents
- Strengthen policy and regulatory structures for HCWM

Strategic Priority 2 Objectives

- Develop national training packages on health-care waste management
- Implement developed HCWM training programmes
- Increase advocacy awareness for behavioural change
- Promote research, new technologies and innovative methods for sound management of HCW

Strategic Priority 3 Objectives

- Assess the current waste management situation
- Set up an integrated system in a pilot Atoll

- Initiate HCWM planning
- Promote green procurement and minimizing waste
- Improve infectious waste and sharps waste management
- Improve pharmaceutical and chemical waste management

Strategic Priority 4 Objectives

- Assess current monitoring situation
- Strengthen reporting, monitoring and evaluation mechanism on HCWM
- Provide regular monitoring and evaluation of the health-care waste management system and performance of the equipment

Strategic Priority 5 Objectives

- Establish sustainable sources of funding
- Complete budget

Primary assessment

Based on a survey of four facilities in the country (see details in Annex 11), average medical waste production is 0.4 kg per bed per day. The majority of health-care facilities segregate their medical waste into the following: infectious, general and sharps. Hithadoo Hospital has the following categories: general wastes; plastic wastes (infected plastics, non-infected plastics); infectious waste (clinical and pathological); sharps waste (contaminated, uncontaminated, broken glass, intact glass); hazardous waste (mercury waste, pharmaceutical, toxic and pressurized containers); linen (infected and non-infected).

Only Hithadoo Hospital has a waste management policy in place. IGMH is in the process of finalizing its draft policy document. Out of all the four hospitals, only that in Fuvahmulah Atoll has a waste management committee.

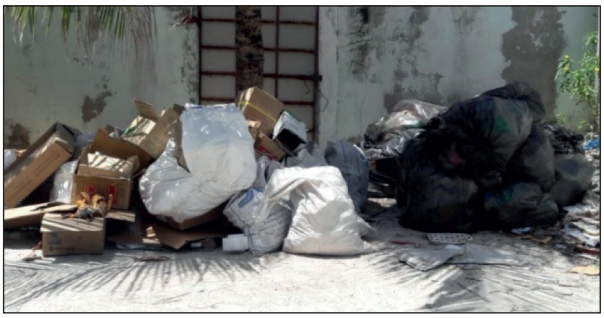
Waste segregation

Segregated waste is collected by the hospital's staff and is transported to an identified site and stored until final disposal. The facilities majorly use gloves and face mask as PPE.

Waste storage area

All three facilities, except for IGMH, have a storage area.

Storage area of Fuvahmulah Atoll Hospital



Storage area of Hithadhoo Regional Hospital

Storage area of Hulhumale Hospital

Burner

Burner in Fuvahmulah Atoll Hospital

IGHM and Hithadoo Hospital autoclave their laboratory and highly infectious wastes onsite before sending it for disposal. All these hospitals openly burn their medical waste either on hospital premises or with other municipal waste (on Thilafushi – an island for waste management).

None of these facilities are required to maintain records of their daily waste generation.

All the facilities – except for Hithadoo Hospital – report all accidents occurring while handling medical waste to the nursing/lab in-charge for quality control. The in-charge is responsible for screening of the sources, providing post-exposure prophylaxis for hepatitis B, doing root cause analysis and working to address the gap. Spill of blood, needle-prick injuries, any cuts during surgeries, employee health and safety incidents, sentinel events and patient safety incidents are considered to be accidents and are required to be reported.

Apart from IGMH, none of the facilities have needle cutters. All the facilities collect their sharps waste in a safety box and openly burn it. The country has no provision for reporting the annual waste generation and management.

Sharp container

Sharps collection at Hithadhoo regional Hospital

Sharp container in Fuvahmulah Atoll Hospital

Sharps waste management

There is no legal provision in the country to conduct a training programme on health-care waste management. All of the three facilities except for Hithadoo Hospital conduct these programmes in their facilities. Hulhumale Hospital conducts these sessions once a year but they do not include any collection and treatment staff. In Fuvahmulah Atoll Hospital, only one training session – in 2016 – has been conducted, which also included waste collection and treatment staff. IGHM conducts these programmes randomly only for nursing staff and attendants. The state also conducts capacity-building programmes based on budget allocation. Although no NGO has been involved in providing training to these facilities, in 2007 and 2010, WHO conducted capacity-building programmes under the Colombo Plan.

Although the state provides infrastructure for handling and management of medical waste to government health facilities, facilities find it insufficient.

Since Hulhumale and IGMH are located in the Malé region, biannual monitoring is conducted. The other two facilities have a provision of yearly monitoring. At the national level, monitoring is conducted by the Quality Assurance Division of the MoH. The person in charge of infection prevention and control is responsible for monitoring in IGMH and the quality control person is responsible for monitoring in Hulhumale. The other two facilities do not conduct any in-house monitoring.

Except for Hulhumale, all three facilities receive government funds for managing their medical waste. None of the facilities have explored possibilities of receiving funds from any national or international organization.

None of these facilities have any policy on the use of chemicals. IGMH has an isolation ward in its facility, but none of its staff is trained for handling health-care waste in case of an epidemic. The other three facilities do not have any such provision.

None of the facilities have any provision for giving any deterrence or rewards in case of noncompliance/ excellent waste management respectively.

None of the surveyed facilities have any effluent/sewage treatment plants; the wastewater is directly discarded into the sewage system.

Secondary assessment

Health-care facilities in Maldives[44] are currently delivered by a four-tier referral system comprising island, atoll, regional and central level services. At the tertiary level, IGMH in Malé serves at the central level in the referral system. The regional hospitals in six strategic locations across the country deliver health care at the regional level. These six regional hospitals serve as referral centres for two to four atolls, providing services in a number of specialty areas of medical care. Atoll hospitals provide basic medical care. The island level primary health-care, health posts (HP) and family health-care units form the lowest level of delivering health services.

According to the Country Level Evaluation of Maldives, the medical waste generated was about510 tonnes per year in 2012.[45]

According to ADK Hospitals located in Maldives, at present, none of the health facilities in the Maldives has an exceptionally good waste management system. In many institutes, the collection and segregation is present, but for disposal, all the waste is mixed up again. There is no mechanism to collect, treat and dispose this segregated waste. It is thus important that health facilities take an initiative to ensure that such mechanisms are put in place. In addition, regulatory authorities should develop and implement guidelines to that effect.[46]

Medical waste is administered, managed and operated by the Health Protection Agency.[47] Medical waste is incinerated according to strict guidelines as suggested in the Waste Incineration Guidelines, 2016, in order to mitigate and avoid adverse environmental hazards.

Conclusion

The country has endorsed the National Health-care Waste Management Policy last year. The policy is more like a guidance document that enlists various facets of good medical waste management. It

44 Maldives NSP 2014-2019 National Strategic Plan for TB Control 2015-2020 Core Plan Republic of the Maldives
45 https://www.oecd.org/countries/maldives/47234192.pdf
46 http://www.adkhospital.mv/en/page/teamtalk/clinical-waste-management
47 Maldives Clean Environment Project Environmental and Social Assessment and Management Framework (ESAMF) & Resettlement Policy Framework (RPF), November 2016

requires hospitals to segregate infectious and general waste at the point of generation; however, studies indicate that when waste is taken out of hospitals, these are mixed into one bin. There is no provision of treating the waste either onsite or offsite; the majority of hospitals openly burn their medical waste or in some cases use handmade burners. Few hospitals treat waste by autoclaving before disposal and the majority still burn waste in open areas. The country lacks infrastructure and funds to manage its medical waste. There is a need for a proper monitoring and evaluation system to be established.

Recommendations

- Maldives has taken big strides in health-care waste management in the past year. The National Health-care Waste Management Policy 2016 (NHCWM) and the Draft National Strategy on Health-care Waste Management (2016–2021) enlist the salient features of establishing a sound waste management system.
- The country has prepared a clear action plan of how the policy would be implemented in the next 5 years. It has touched on almost all important aspects related to capacity-building, funding, segregation and in-house management of waste, etc.
- The national policy in its present form can be called a guidance document that needs to be complemented with a number of practical guidelines and SOPs to make it workable on the ground.
- Hithadhoo Regional Hospital has been practicing medical waste management since 2005 and it has developed its own guidelines. These guidelines can serve as a base document for national guidelines.
- Since the hospitals lack a proper waste management system, a strict monitoring plan is needed.
- The country has developed elaborate guidelines on management of Ebola and MERS. These guidelines can be merged and revised to form one national guideline on epidemic preparedness. Although the NHCWM policy talks about treatment technologies that are more sustainable, the Ebola and MERS policies talk only about burning waste. These policies thus need to be revised with regard to the new policy.
- The country is characterized by 'high risk and vulnerability and low prevalence' in terms of AIDS. Thus, special focus needs to be placed on sharps management.
- Development of a policy framework with regard to the new guidelines would be the major task in the next few years. The existing guidelines on PEP (Nov. 2011) and the Guideline on Ebola and MERS (epidemic preparedness) should be referenced in policies related to health-care waste management.
- The primary method of waste treatment at the moment is open burning/burning in small burners. But it is heartening to see that the national policy is putting substantial focus on technologies complying with BAT/BEP. These should be taken up very soon.

11

Myanmar

Introduction

Myanmar is officially the Republic of the Union of Myanmar and also known as Burma. It is a sovereign state in South-East Asia bordered by Bangladesh, China, India, Laos and Thailand.

Health-care system

Public hospitals are categorized into general hospitals (up to 2000 beds), specialist hospitals and teaching hospitals (100–1200 beds), regional/state hospitals and district hospitals (200–500 beds) and township hospitals (25–100 beds). In rural areas, sub-township hospitals and station hospitals (16–25 beds), rural health centres (RHC) (no beds), and sub-rural health centres (no beds) provide health services, including public health services.[48]

Inventorization of biomedical waste generation and management

General information

Types of health-care facilities

Health-care facilities are categorized in the country by establishment status, i.e. national/state/district level, and based on public or private ownership.

Total number of health-care facilities in the country
Government (all ministries) bedded and non-bedded
Government
Total 1123 hospitals including
Central and state and regional – 37
District – 68
Station – 760
Rural health centres (RHC)– 1778
Sub-RHC –9083
Private
Hospitals – 206
Clinics – 4776
Dental Clinics– 855

48 Health-care in Myanmar, Su Myat Cho et al, Nagoya J. Med. Sci. 78. 123 ~ 134, 2016

National data on medical waste

There are 74 districts in the country which form a middle tier of administration, linking the union government and the 14 state and regional governments with all 330 townships.

There is no national data available**,** except for 3 independent municipalities,

Naypyitaw: Estimated medical waste – 4 tonnes/week

Yangon: Estimated infectious waste– 1.5 tonnes/day; and estimated sharps waste– 0.7 tonnes/day

Mandalay: Estimated medical waste– 1.2 tonnes/day

Policy framework

The country has laws and policies such as the 1972 Public Health Law and the 1993 National Health Policy in place wherein health and environmental protection are explicitly mentioned. However, there is no separate legislation or policy on health-care waste management. There is a plan to develop them in future.

There are two existing general policies by the Department of Medical Services, namely–

The Hospital Infection Control Guideline and the Hospital management manual (2011)

As these two documents are not very specific to waste management, the Department of Public Health (DoPH) is in the process of developing SOPs and guidelines for health-care waste management.

Some municipalities in the country have started waste management voluntarily.

Agency responsible for framing the guidelines

The Ministry of Health Sciences (MoHS) is responsible for framing the guidelines.

Agency responsible for the implementation

The MoHS is responsible at both the national and the state levels.

Efforts in place for greening the health-care sector

To reduce and minimize waste and become zero waste remains a priority as well as to focus on non-burn options for waste management.

Annual reports

There is no provision of submission of annual reports by the health-care facilities.

Waste management committee

According to the hospital management manual of 2011, each hospital should have a hospital waste management committee chaired by the medical superintendent with a microbiologist or pathologist as secretary and members as follows: ward in-charge, pharmacist, hospital engineer and sister in charge.

Nearly 100% of hospitals have a hospital waste management committee, which is in charge of developing a management plan; assigning roles and responsibilities; categorizing waste; providing PPE; providing immunization; providing training to staff; and conducting monitoring and evaluation.

Segregation

According to the hospital management manual of 2011, the current practice is to segregate in three colour-coded bins – general waste in a black bin, infectious waste in a yellow bin and highly infectious waste in a red bin. Infectious wastes are incinerated; sharps, syringes and needles are buried in deep concrete wells; and general wastes are disposed with municipal wastes. 100% of the hospitals follow segregation in the following manner: general waste (black); infectious waste (yellow); highly infectious waste, including sharps (red).

Collection and transportation

Workers collect waste on a daily basis. They collect the waste in trolleys. Some trolleys are covered and some are opened. There are no separate lifts/chutes for waste collection, and the trolleys are not marked with a hazardous symbol. Municipalities collect waste from township HCFs, but regional health centres and sub-centres are not covered by them. Collection of waste is at regular intervals. The municipality transports this waste to disposal sites using separate vehicles for hazardous waste. Approval for these vehicles is given by the municipality, and there is no private licensing. There is no approved responsible body if an accident occurs.

Storage

The Hospital Management Manual (2011) rules are to be followed. These rules lay the minimum requirements for area, space, building and barrier specifications.

Treatment and disposal

The WHO Guidelines are followed for treatment technologies. No government body has been approved yet for ensuring technology standards/validation and inclusion of new technologies. Waste is treated both onsite and offsite. Incineration is recommended for infectious waste and autoclaving for infectious specimens in labs. Only some central hospitals have provision of a captive/onsite treatment facility for the treatment of medical waste. An autoclave machine is used for autoclaving some highly infectious waste (e.g., alpha-fetoprotien (AFP)+ glass slides in labs). The infrastructure for waste treatment is highly insufficient. More than 90% of hospitals do not find the onsite treatment adequate. Offsite treatment facilities are also not adequate to cover waste generated from all the health-care facilities in the country. The government has not specified operation standards for installed treatment technology and emission and effluent standards. The end disposal methodology is incineration, open burning or deep burial. At the central and state/regional levels, waste is collected by the municipality and at the district/township levels and RHC and sub-RHC levels, open burning and burial methods are followed. The treatment technologies are not tested on a regular basis.

Occupational safety

About 50% of the overall staff uses personal protective equipment while handling waste. Hepatitis B vaccination is not administered to all the staff.

Sharps management

Sharps are managed in accordance with the hospital management manual (2011). They are collected in sharp-proof containers, safety boxes and in red bins. Needle cutters/destroyers/pullers are used in only a few central hospitals (1%). Auto-disabled syringes (ADS) are used in immunization in all RHCs and sub-RHCs. Each and every hospital has its own guidelines for PEP. Sharps are disposed of by burial in deep pits. The seroprevalence of HIV, HBV and HCV in the country is not available.

Pharmaceutical waste

At the central level, pharmaceutical waste is collected by the municipality. Some items are incinerated and some are deep buried. There is no enforcement in the public sector. In private hospitals, it is in accordance with the clinic law.

Gentoxic/cytotoxic waste

There is no specific law/policy for this type of waste.

Chemicals

There is a policy on the use of chemicals (especially with regard to disinfectants) in hospitals. General chemical waste is disposed of with municipal waste or discharged into sewers. Hazardous chemical waste of different compositions has to be stored separately to avoid unwanted chemical reactions and buried in a concrete pit (spirit, halogenated organic solvent, etc.). Waste containing heavy metals is treated as per WHO guidelines. 1% hypochlorite is used for disinfection of instruments/waste in health-care facilities. Some facilities dispose of the liquid waste directly into a municipal drain but some use septic tanks for disposal.

Mercury management

There is no policy to restrict the use of mercury-based equipment. Mercury-based equipment is being disposed of according to hazardous chemical waste disposal.

Wastewater treatment

Some health-care facilities discharge their wastewater in a municipal drain and some dispose of it in septic tanks. The National Environmental Policy (1994) and the National Environmental Conservation Law (2012) and Rules (2014) address only water use and pollution in the country.

Capacity-building of people handling waste management

There is no provision in the country's policy/rule/guideline for training of health-care staff for the management of health-care waste. The required guideline is being developed by the Occupational and Environmental Health (OEH) Division of the DoPH.

The division is also looking into developing a national level training module for staff and to develop the training modules for incorporation into the medical, nursing and health assistant curricula.

Monitoring (within hospital/national)

There is no provision for national monitoring.

Records

There is no recording system.

Accidentreporting

The OEH Division is still in the process of getting the needle-stick injury data from all hospitals.

Funding

No separate funding is available for the management of medical waste in the country.

Infrastructure

About 10% of health-care facilities have infrastructure for management of health-care waste.

Deterrence

There is no provision at the national level for imposing fines or deterrence on health-care facilities that are not managing their health-care waste as required. At the hospital level, a warning and careful watch is being practiced.

Awareness

No data are available on awareness levels of health-care staff.

Epidemic preparedness

A document is available on highly infectious diseases (surveillance mechanism, response mechanism, isolation units and epidemic preparedness). It is mainly carried out by the Central Epidemiology Unit (CEU) of the DoPH, MoHS. Less than 5% of central and state/regional hospitals are capable of handling epidemics. There are no guidelines or infrastructure available for the management of health-care waste in case of any disease outbreak. There is a provision of training staff to handle an epidemic situation with respect to health-care waste management, which is carried out by the CEU, DoPH, MoHS and monitored by the Ministry.

Infection control committee

There is a guideline that focuses on infection control systems and requires formation of a committee thatis managed by the Department of Medical Services, MoHS. PPEs such as gloves and masks are worn by health-care staff for infection control.

International treaties

Myanmar ratified the Basel Convention in 2015 and the Stockholm Convention on Persistent Organic Pollutants in 2004 and plans to ratify the Minamata Convention. The country does not consider

incineration as a suitable option in the future, and feels the need to shift to non-burn methods for waste treatment. Some options identified are onsite steam autoclaving, offsite wet thermal treatment facility, and mobile wet-thermal treatment unit and then sanitary landfill as the disposal site.

Primary assessment

A primary assessment was conducted at Zabu Thiri Specialist Hospital. It is a private specialist 100-bedded hospital.

Segregation

Medical waste is segregated in colour-coded bags as per the Hospital Management Manual (2011).

Committee

The hospital has a waste management committee, which is responsible for developing a management plan, assigning roles and responsibilities, waste categorization, provision of PPE, training of staff, and collaboration with other departments (e.g., MoHS, the municipality, etc.).

Collection and treatment

General waste is collected from wards daily in the morning and piled at the dumping area. The municipality collects waste from the dumping area every day. Sharps and infectious waste is collected by the municipality everyday using different vehicles. The staff wear rubber gloves and maskswhile collecting the waste. Except for lab specimens, no medical waste is pretreated (by onsite autoclaving) before disposal.The final disposal method is open dumping for general waste, burial in deep pits for sharps and incineration for infectious waste including body parts. The waste is dumped at a place in the hospital for a few hours until it is collected by the municipality. The state acts as a service provider as per the local municipalities Enactment and Enforcement municipal law .

Reporting

The quantum of waste is not recorded, and there is no reporting of accidents. There is no provision of submission of an annual report with regard tomedical waste.

Capacity-building

The hospital doesnot conduct training on medical waste management for staff. There are no legal provisions to ensure an inherent/built-in system of building capacity within the institute. The only training that is given to staff is Hospital Management Training by the MoHS (but there is no specific frequency of the programme). There are no NGOs that have worked with the hospital in order to build capacity for management of medical waste. The hospital has adequate infrastructure for segregation, collection treatment and disposal of waste.

Monitoring

Monitoring is done once a year by the MoHS and also by the local municipality. The hospital has a ward in-charge nurse in each ward and a hospital management team for monitoring in the entire hospital. The hospital does not receive any government funding or support to manage medical waste.

Wastewater

Wastewater generated within the hospital is drained into a septic tank. There is no ETP/STP installed within the premises.

Secondary literature review

Hospital waste accounts for 7% of total waste generated in the country. Overall health-care waste management practices in Myanmar are not very good, but there is basic awareness at all levels. Both the Yangon City Development Committee (YCDC) and the Mandalay City Development Committee (MCDC) collect medical waste from large hospitals and special clinics on a daily basis. Collection service to smaller facilities is provided once a week or on-call basis. Three different colour bags are used for separating the waste. Infectious waste is incinerated or burned in cemeteries while sharps wastes are buried underground in landfills. Other waste is treated as domestic waste. Although there is incomplete information on the current levels of medical waste generation in the country, YCDC and MCDC estimate that on average, 280 and 779 tonnes per year of medical waste is generated respectively. A significant portion of this (more than70%) is infectious waste.[49]

The estimated quantity of health-care waste generated by various health facilities in two big cities of Yangon and Mandalay is about1.5 tonnes/day. Yangon had a good HCWM system from 1966 to 2000; however, it became weak after that.

Conclusion

The country generates medical waste in the range of 0.6–1.5 tonnes per week. There is no separate legislation or policy on medical waste management; however, the Hospital Infection Control Guideline and Hospital management manual are available. Some municipalities in the country have started waste management voluntarily, and the DoPH is in the process of developing SOPs and guidelines. Despite the fact that there is no specific waste management policy in the country, hospitals are segregating their waste. This is an encouraging beginning. The treatment method largely remains open burning or incineration and thus there is a need to strengthen regulations to tide over this 'out of sight, out of mind' approach. Current onsite and offsite treatment equipment are also not sufficient. There is basic awareness among health-care staff but there is a need for more capacity-building programmes. Health-care waste management is not very good, and regular monitoring is needed to improve it. After development of guidelines, dissemination, regulation as well as enforcement will be major concerns. More training will be needed for staff to comply with these guidelines. Therefore, more specific laws and regulations, cleaner technologies, funding as well as human resource development are the major requirements for improving waste management in Myanmar.

Recommendations

- There is no specific health-care waste management policy in the country. The compliance level of health-care waste management in the country will increase dramatically as soon as a specific policy covering health-care waste is notified. This process should be hastened.

49 Quick study on waste management in Myanmar : Current situation and key challenges (June 2016) Institute for Global Environmental Strategies (IGES)

- The treatment method largely remains open burning or incineration and thus there is a need to strengthen regulations to tide over this 'out of sight, out of mind' approach. Stringent policy initiatives and awareness drives to stop waste burning should be considered.
- More training will be needed for staff to comply with the new guidelines. Thus, while preparing the guidelines, a national training manual and a municipality level training schedule should also be prepared.
- Hospitals are mostly dumping their waste in the open. Public hospitals would benefit if the government provides a dedicated budget for health-care waste management. This would help build required infrastructure and provide resources for managing waste.
- There should be guidelines or infrastructure available for management of health-care waste in case of any disease outbreak. The new guidelines on health-care waste management could include a section on 'waste management in epidemics'.
- Hepatitis B vaccination does not cover all staff all over the country. The new guideline should cover this aspect to ensure safety of health-care workers.
- Each and every hospital has its own guidelines for PEP. A national guideline/SOP should be prepared for PEP under the new guideline.
- According to some estimates, the proportion of infectious waste in the country is high – ~70%. This calls for improving segregation practices in health-care facilities through rigorous trainings and regular monitoring drives by concerned officials.

12

Nepal

Introduction

Nepal is a relatively small, land-locked country with a population of about26.5 million. The country is greatly fragmented with mountains and terrains, making it inaccessible by modern transport and communication systems. Approximately 86% of Nepal's population lives in rural areas. The country is divided into 5 development regions, 14 zones and 75 districts. However, the Constitution of Nepal, adopted on 20 September 2015, provides for the division of the country into 7 provinces.[50]

Health-care administration

The divisions, central hospitals and centres are administrated by the Ministry of Health. In rural areas at village level, there are primary health centres (PHC) and health posts (HP). The health post is the first access for getting primary treatment at the community level. At the district level, there are district hospitals with an average of about25 beds. The hierarchy starts from tertiary care given by central and regional hospitals; secondary care is provided by zonal and district hospitals; and primary health care is delivered through PHC and HP. The Environment Protection Rules 2054(1997) state that health facilities with more than 25 beds and facilities that generate hazardous and radioactive waste have to prepare an environment impact assessment (EIA) for getting a license.

Inventorization ofbiomedical waste generation and management

General information

Types of health-care facilities

Public sector hospitals are categorized as central, regional, subregional, zonal, district level and medical college hospitals. Other than these, there are private hospitals.

Total number of health-care facilities in the country Government (all ministries) bedded and non-bedded	5290 4122
Central hospitals (central, teaching and specialized)	16
Regional/zonal hospitals	16
District-level hospitals	84
Primary health care centres	201
Health posts	3805
Private (all health-care facilities)	1168

50 http://kathmandupost.ekantipur.com/news/2017-03-15/744-new-local-units-come-into-effect.html

Total number of beds Government (all ministries)	
Central hospitals	4229 beds
Regional hospitals	350 beds
Subregional hospitals	200 beds
Zonal hospitals	1494 beds
District-level hospitals	1802 beds
Medical colleges	5776 beds
Private	13360 beds
Total	**27211 beds**

National data on medical waste

National data on medical waste generated in the country is collected from hospitals by direct visit to the hospitals. The Ministry of Health and Department of Health Services (DoHS) are the nodal national and regional bodies for conducting the survey. General data about the amount of health-care waste generated is not available to the public. As per study conducted by the MoH in 2015, the health-care waste generation rate is ~1.35 kg per patient per day.

The data below were collected by conducting a7-day-long health-care waste assessment in the five regional hospitals. The MoH and the DoHS (Management Division) conducted the following assessments:

- Average per patient per bed per day waste generation of the country– 1.35 kg/bed/day
- Total quantity of hospital waste generated in the country – 1.35 kg/bed/day * 27211 beds (as given in records)
- Approximate figures based on extrapolation would be ~36735 kg/day. The actual amount would be more as it would also include waste from non-bedded facilities/ laboratories/ blood banks/veterinary institutions, etc.

Policy framework

National rules/policies on medical waste

The country has a national policy called the 'Health-care Waste Management Guideline 2014'. It provides instruction for all level of health-care facilities ranging from immunization camp to large teaching hospitals on implementing a safe health-care waste management system.

Agency responsible for framing these regulations/guidelines/policies

The Ministry of Population and Environment (MoPE), Ministry of Health and Ministry of Federal Affairs and Local Development in Nepal are together responsible for framing these policies.

Agency responsible for implementation

TheMoPE, MoH and Ministry of Federal Affairs and Local Development in Nepal are responsible for the overall implementation of the rules. At the regional/district level, the Regional Health Directorate and District Public/Health Office are responsible respectively . The municipality and the village development committee (VDC) are responsible at the local level.

Policies/efforts in place for greening the health-care sector

More than 20 large and small health-care facilities in Nepal have already adopted a safe health-care waste management system based on autoclave technology. Some other facilities have also initiated the system.

The HCWM guidelines, 2014, do not encourage using incineration but encourage opting for the best available non-burn technologies, such as autoclaves, for various types of hazardous/infectious wastes.

Waste management committee

The HCWM guidelines require that a focal person be identified at each health-care facility.They also require the formation of a waste management committee. This committee should comprise the Chief/ Director of the HCF; Department head; matron; waste management officer and a representative from support staff (sweeper).

The roles of the committee have been specified as follows–

- Promulgate a strategy formalizing the commitment of a health-care facility to implement proper HCWM with the prime goal of protecting health and the environment.
- Establish baseline data and develop the HCWM plan, which must include training and written guidelines on waste management from waste generation to waste treatment, and final disposal.
- Implement the HCWM plan and review and update the plan and guidelines annually.
- Ensure adequate financial and human resources for the implementation of the HCWM plan.

Segregation

The national policy requires segregation of waste into risk and non-risk health-care waste. Non-risk health-care waste includes biodegradable and non-biodegradable waste. Risk health-care waste includes pathological; infectious; sharp (glass, metal); cytotoxic; pharmaceutical; chemical; radioactive and other hazardous waste.

There are no country data available for health-care facilities on waste segregation.

Collection and transportation

There is no central facility for the treatment of health-care waste. The waste generated in hospitals is segregated into different coloured bins and transported to onsite treatment facilities in different colour-coded trolleys. On many occasions, all the waste is mixed up and finally transported together

to the final disposal sites. In a few cases, private contractors transport the waste (in separate vehicles used only for health-care waste transportation) to the landfill site.

In a few instances, the trolleys are marked with hazardous symbols. Health-care facilities are responsible for the collection and transportation of the waste generated by them. Most HCFs hire private contractors/companies to transport waste to the municipal dump.

The Solid Waste Management Act, 2011, strongly advocates that waste generators should be responsible for the treatment of hazardous waste generated by them. The HCWM guidelines, 2014 (MoHP) specifies the mode of transportation and other requirements in case of offsite treatment, if needed. Most of the hospitals hire private contractors, who transport the waste to the landfill without the knowledge of the authorities, which is not legally acceptable. Mostly in the urban areas, health-care facilities with a limited area find it difficult to manage the waste that they generate. In this regard, a common treatment facility (CTF) is recommended as one option in the HCWM 2014 guideline.

Storage

The national guidelines mention the standards required for the construction of a storage area within the facilities. Details are given in Annex 12.

Treatment and disposal

The Ministry of Population and Environment, Ministry of Health, municipalities and local bodies are responsible for ensuring technology standards/validation and inclusion of new technologies.

Treatment technologies recommended by HCWM guidelines in the country include biological procedure, autoclave, chemical disinfection, encapsulation, sanitary landfill, burial, septic/concrete vault, incineration and inertization.

Different technologies are specified for different kinds of health-care waste as follows: biological procedure for biodegradable waste; autoclave for the treatment of highly infectious waste; chemical disinfections for the treatment of infectious and highly infectious HCW; and encapsulation for sharps and pharmaceutical waste.

Generally, hospitals have onsite treatment facilities, as in the following examples:

Non-burn technology: autoclave for infectious waste and biogas for biodegradable waste. Autoclave is tested using an autoclave tape; and a strip integrator and biological spore are used as indicators for autoclaves.

Equipment

- Several hospitals in the country are using autoclave for treating medical waste.
- The following autoclaves are available in the country:
- A 175 L autoclave is in use in Bir Hospital;
- 500L and 300 L autoclaves in Western Regional Hospital Pokhara; and
- 155L autoclave in Civil Service Hospital and others

Facilities that have adopted non-bun technologies are performing well and find it comfortable to use them. There are no central treatment facilities in the country. In general, waste is either burned openly/incinerated in locally constructed machines, mostly single chambered, with no mechanism for monitoring the parameters (temperature). Waste is incinerated in the backyard or is simply sent to municipal dumps for final disposal (mostly through waste management private companies). In many hospitals, incinerators installed are not as per the standard required, and hence are being replaced by autoclaves.

In health-care facilities where a waste management system is established, most of the waste is sent for recycling and a very small amount of waste is sent to a municipal stream after treatment.

Occupational safety

In the majority of facilities, waste handlers do not use a complete set of PPE. But in health-care facilities where a waste management system is in place, the use of a complete set of PPE is promoted. With regard to vaccination, only some staff are vaccinated against some critical diseases such as hepatitis B.

Sharps management

The National Immunization Injection Safety Policy (MoH, 2003) advocates the use of AD syringes in immunization programmes. All HCFs abide by the policy. Some facilities use a needle cutter and then encapsulate cut needles. Some of the HCFs send sharps for recycling after treatment.

PEP

PEP is mentioned in the consolidated guideline on HIV Prevention and Treatment (National Centre for AIDS and STD Control (NCASC) 2016). PEP is explained in training sessions/orientation/onsite coaching. Persons having exposure can get treatment from concerned hospitals.

All HCFs use auto-disabled syringes for immunization programmes. According to the NCASC, the prevalence of HIV among total population group of 15–49 years is 0.2%.

Pharmaceutical waste

According to HCWM guidelines, 2014, pharmaceutical waste is recommended to be categorized as health-care waste requiring special attention and monitoring. The final disposal that is recommended is encapsulation followed by sanitary landfill.

Gentoxic/cytotoxic waste

According to the HCWM guidelines, 2014, expired drugs should be returned to the supplier. The Department of Drug Administration (DDA) has focused on safe management and disposal of hazardous drugs, but there is no specific law/policy related to it. HCWM guidelines recommend that HCFs should prepare a separate guideline for handling cytotoxic wastes. As a result, now with WHO's technical assistance, the DDA is preparing a separate pharmaceutical waste management guideline, and issues of cytotoxic waste are anticipated to be well addressed.

Chemicals

The government has clear guidelines on the use of disinfectants in hospitals and other health-care facilities.Hospitals are using 0.5% chlorine solution for disinfection.

Hospitals use sodium hypochlorite for general disinfection. Glutaraldehyde is used to disinfect surgical material such as endoscopes, catheters, etc. Liquid waste is disposed of in drains. Laboratory waste has to be disinfected before disposal in drains. There are no specific guidelines for other liquid effluent from hospitals.

Mercury management

In March 2013,the Ministry of Health decided to make mercury-free health-care services available by imposing the blanket ban on import, purchase and use of mercury-based equipment in the health sector of Nepal; the decision became effective on16 July 2013 (Directive: FY-2070/71).

The MoH, DoHS and some local organizations provide training/ orientation programmes/ sensitization workshops on substitution and awareness regarding mercury-based equipment.

Wastewater treatment

Hospitals are mandated to have a sewage treatment plant, but few of them have a sewage treatment plant in their premises (Dhulikhel Hospital, Sushma Koirala Hospital, Sankhu and a few other private hospitals are among the few).

Nepal has a policy called the Water Resources Act, 2049 (1992), which mentions the rationale utilization and conservation of water resources and prevention from pollution. This act also mandates that no one shall pollute water resources by way of using or littering, industrial wastes, poison, chemical or toxic chemicals beyond the pollution tolerance limit of the water resource as prescribed in the national standard.

Capacity-building of people handling waste management

According to the HCWM guidelines, training is provided by the government regularly and information, education and communication (IEC) materials are also provided. The guidelines also suggest that hospitals should have the responsibility to train their staff.

The MoH, DoHS and MoPE are providing regular training/orientation/onsite coaching to hospital/ primary health care/health post staff. They are also monitoring these capacity-building programmes.

Local authorities such as the municipality in coordination with DoHS and with various local organizations are also providing sensitization programmes. Different NGOs (such as the Health Care Foundation (HECAF) and the Centre for Public Health and Environment Development (CEPHED)) are also working with direct support from international NGOs/ partners.

The frequency of training is based on available resources and budget. Mostly training is organized every year.

A training notebook is available and serves as a module for training in the country. The government is providing training materials, with support from WHO Nepal, United Nations International Children's

Emergency Fund (UNICEF) and other organizations. The government is also using other awareness tools such as television, radio, newspapers, etc.

Monitoring (within hospital/national)

As per the "Guideline for Health institutions establishment, operation and upgrade standard 2070", hospitals are monitored on a yearly basis. Monitoring frequency is not sufficient, and recommendations after monitoring are not implemented properly.

Records

Health-care facilities are required to maintain records of waste treatment at the institutional level, accidents and training sessions. There are no means to verify the records. Even if the hospitals maintain records, there are no means to check at a higher authority level. A reporting mechanism needs to be created and adopted, wherein all hospitals would need to submit their annual reports to a government agency.

Accident reporting

An accident reporting format has been established. The NCASC under the MoH is responsible for collecting data for needle-stick injuries. In the guidelines, a few studies about NSI in Nepal are mentioned, but no recent data are found.

Local authorities and concerned health-care facilities are responsible in case of any accidents. No clear policies have been defined in case of accidents of waste handlers. Mostly all health-care facilities provide basic treatment such as vaccination against tetanus in case of accidents, whereas the actions to be taken during accidents are not clearly defined by the local authorities. Apart from the first-aid after the accident, waste handlers are responsible for further treatments.

Funding

The DoHS allocates a separate budget for HCWM under the budget head "District hospital/PHC quality and service strengthening".

Since the last three years, district level hospitals are receiving a separate budget for health-care waste management, which is 15% of the total "District hospital quality and service strengthening" budget head. And since2016, PHC is receiving 16 % of the total "PHC quality and service strengthening" budget head.

For central/zonal/ regional/ sub regional level hospitals, the Ministry of Health allocates the budget, including for HCWM.

The MoH and DoHS are monitoring budget utilization, but these funds are not adequate to meet the needs of the entire system.

Infrastructure

Health facilities have health-care waste management infrastructure, although these are not properly maintained.

Each health-care facility needs to go through an initial environmental examination (IEE) and EIA procedures where the infrastructures required for HCWM are listed. These studies are approved by the government before the facility operation is approved.

Deterrence

As per the Solid Waste Act, 2011, the local authority imposes a fine to noncompliant health-care facilities.

Awareness

All facilities surveyed were aware of the risk of mismanagement of biomedical waste.

Epidemic preparedness

There are guidelines/documents available on highly infectious diseases, surveillance mechanisms, response mechanisms, isolation units and epidemic preparedness. Although each HCF has a rapid response team to handle epidemics, it is only the central and specialized hospitals that specialize in handling such situations.[51]

There is no guideline on how to manage health-care waste during an epidemic outbreak. Most of the facilities do not have the infrastructure for handling a disease outbreak. There is also no training module available for staff in this respect.

Infection control committee

The Health-care Waste Management Guideline requires formation of an infection control committee in all health-care facilities. The committee should be empowered to take all decisions related to infection control. The infection control manualis followed during training. The management committee in all health-care facilities is responsible for quality improvement activities, including infection control. Staff are required to wear protective equipment such as masks, goggles, aprons, gloves, boots, etc.) while handling health-care waste. The country is a signatory to the Patient Safety Pledge of the World Health Assembly.

International treaties

The country is signatory to the Basel, Stockholm and Minamata Conventions. The country's waste management laws confirm to all of these.

Some of the health-care facilities have been developed as model facilities for health-care waste management.

51 As per the Health facility Survey- 2015 final report (https://dhsprogram.com/pubs/pdf/SPA24/SPA24.pdf): Epidemiology and Disease Control Division comes under Department of Drug Administration. Epidemic response team is available in most of the health-care facilities. Some of the facilities also have specialized trained staff for particular diseases like malaria, TB etc. (Date referred: 19th April 2017)

Nongovernmental support in health-care waste management

WHO has played a major role in health-care waste management in Nepal. It has helped in framing the Health-care Waste Management Guideline and training ofhealth-care professionals.

Different NGOs (such as CEPHED and HECAF) are working in the health-care sector. These NGOs in collaboration with WHO have been involved in several training and capacity-building programmes in Nepal as well as in other SEAR countries.

The UNEP Eco-Peace leadership centre has made Madhyapur Thimi Hospital of Nepal a model hospital in terms of proper management of health-care waste in 2015.

Bir Hospital has initiated health-care waste management in 2010 with the help of HECAF. Previously, around 325kg of waste was being dumped along with the municipal waste. Now, nearly 80% of this waste is recycled.[52]

Primary assessment

A total of 10 hospitals were surveyed; out of these, 3 were health posts and 7 were tertiary health-care centres. Details of the facilities are given in Annex 13.

Average waste generated by the facilities

Health posts did not provide data on the amount of waste generated by them. The average health-care waste generated by other tertiary, specialty facilities is 1.28kg/bed/day.

Segregation

Waste is generally segregated as risk and non-risk waste. Plastic waste and other recyclables are segregated and sent for recycling. The HCWM guidelines mention a colour-coding system according to which hazardous and infectious waste should be segregated at the source. But many facilities collect mixed waste and then segregate the infectious waste at the storage site. There is lack in uniformity of the colour coding used in different facilities.

Policy

About 77% of health-care facilities do not have a hospital policy regarding HCWM. About 50% of facilities have a waste management committee; one of the surveyed facilities has a waste management committee, but it is currently inactive.

Collection and transportation

Generally infectious waste is treated onsite by autoclaving or by burning. The other waste is collected by the municipality twice a week, but all waste is mixed in the process. 77% of the facilities said that they use protective gear while handling health-care waste.

52 http://nepalitimes.com/news.php?id=18794#.WNOTv9J94nR

Treatment and disposal

77% of facilities pre-treat used syringes and needles using autoclave. As far as final disposal of health-care waste is concerned, some health posts are recycling the recyclables and using vermin composting as an ideal waste management practice for biodegradable waste. Some facilities do not treat their waste and send untreated waste to the landfill site for final disposal.

Storage

60% of facilities have a storage area. A few facilities have constructed a storage area according to WHO guidelines. Thankot health post located in Chandragiri municipality has been appreciated by the District Public Health Officer for having a BMP in place. They attribute this to continuous training.

Record-keeping

About40% of facilities maintain the record of waste generated in the facility.

Accident reporting

Apart from a few of the health posts, all the facilities have an accident reporting system, but there is no specific format of reporting.

Miscellaneous

About 60% of the facilities have needle cutters. Syringes and needles are autoclaved, burnt, or encapsulated. There is no mention of disinfecting needles and syringes after use.

Annual report

None of the facilities have an annual reporting system on health-care waste management.

Capacity-building

Health posts do not undertake capacity-building exercises, but specialty and multispecialty hospitals train their staff once every six months. There is no legal mandate for any facility to give training to their staff. The country also does not impart any training. HECAF and WHO have provided training to health-care facilities in most of the districts.

Infrastructure

Most of the facilities have infrastructure for waste management. Only Tribhuvan University Teaching Hospital (TUTH) received funds from the state government for development of infrastructure. The rest of the hospitals use their own funds or funds from HECAF and WHO. A few of the health posts receive a budget from the District Public Health Office.

Monitoring

Hospitals do the monitoring on a daily basis and it is done by house-keeping staff, nursing supervisors or administrative staff. The municipality does the monitoring in the case of regional hospitals. The Department of Public Health does the monitoring in the case of health posts. The frequency of monitoring is either half a year or yearly.

Funding and human resources

A health post does not receive any funds for health-care waste management. Approximately 30% of facilities received state/government funding for medical waste management. Apart from the state funding, WHO and the Japanese International Corporation Agency (JICA) have also funded some facilities.

Chemicals

None of the facilities has any guidelines for the disposal of chemicals being used. Chemicals are directly disposed of into drains.

Epidemic preparedness

None of the facilities has any isolation ward in case of epidemics; also, staff is not really trained for handling any epidemics.

Compliance

There is no provision of any deterrence; mistakes are corrected verbally. Most of the facilities have a rewarding system for cleanliness in their wards.

Wastewater treatment

None of the facilities has ETP/STP for treatment of wastewater. Wastewater is sent directly into the city sewerage system.

Case studies

Western Regional Hospital Pokhara: A HCWM system has been set up using the principles to reduce, reuse and recycle. The system is coordinated by the HCWM Committee and Environment Unit in the hospital. Risk and non-risk waste are segregated at the source, and transported in separate trolleys. Risk waste that has recycle value is autoclaved and sold to vendors. Non-recyclable risk waste is autoclaved and then disposed of with municipal waste.

Color coded waste collection trolley in Western Regional Hospital Pokhara

Paropakar Maternity and Women's Hospital

The hospital along with HECAF conducted a baseline assessment in 2012 and it showed that the hospital generated an average of 400kg of waste per day. About 332 kg was a mixture of risk and non-risk waste, hence rendering the entire waste as risky. After a segregation system was introduced in the hospital, risk waste was drastically reduced to 42%.

A waste management system based on a zero waste concept was first introduced in one ward. Once the system was tested and found efficient, it was then replicated in other units of the hospital. The system is now fully functional in all inpatient wards. Safe injection practice has been introduced as part of the new system whereby nurses are trained and then they commit to safe injection by signing on a banner. A waste tracking system was introduced to track wastes from point of generation until final disposal.

Kathmandu Medical College (KMC) and Teaching Hospital

A baseline assessment in 2013 showed that KMC produced about 300 kg of waste per day during 59% occupancy. 85% was risk waste which was incinerated and the remaining waste was sent to a landfill.

The rooftop of KMC was converted into a waste treatment and storage centre. An autoclave replaced the incinerator to treat infectious wastes.

The new waste management system comprises proper segregation, and two bio-digesters for processing food and placenta waste. This plant can treat about 20 kg of food waste and 5 kg of placenta waste. It has been producing 1.2m^3 of biogas per day, which is used for cooking.

Secondary literature survey

Health-care waste management in Nepal

The General Health Plan, 1956, ensures the reach of health-care services to each and every citizen of Nepal. Once the health system improved, the management of waste generated by them became critical. In this regard, Nepal Health Research Council (NHRC) in collaboration with MoH and WHO developed the Health-care Waste Management Guidelines and a training manual for health-care professionals[53]in May 2002. The HCW generated in 1997 in Nepal was 0.7 kg/patient/day; consecutively in 2001, the amount of HCW generated was 2.18kg/patient/day.[54]The Ministry of Health in 2015 had estimated an HCW generation rate of 1.35 kg/patient/day, out of which 37% of the waste was risk waste.[55]

According to survey done in 2012 by the Ministry of Health in Nepal, there were about 33594 public health-care facilities.[56]According to a 2013 survey, there are approximately 301 private health-care facilities out of which 97% are following health-care waste segregation. The main concern is that the country lacks a central treatment facility for final disposal of waste. Hence, they have to give the waste to the municipal waste collectors or undertake onsite treatment of waste. Mostly onsite treatments include landfill, incineration and open burning.

The Health-care Waste Management guidelines have been circulated to all health-care facilities, but still, implementation is lacking. The incinerators installed in some facilities remain inoperable due to high running costs. Hence, the wastes are dumped into shallow trenches, burnt at low temperatures or dumped near rivers and ponds.[57] Most importantly, sharps wastes are not managed properly and the infectious waste is mixed with the general waste. Onsite treatment includes open burning or using low technology incinerators made of bricks, which obviously leads to the release of toxic gases in the surrounding areas.

Health-care facilities do not have an effective policy for management of health-care waste. Occupational health is given least importance; most of the facilities do not provide the sanitary staff with vaccinations and they are not obliged to use personnel protective gear.

Gaps identified

Despite the success stories, the country still faces some challenges, as listed below:

- Insufficient resources
- Low priority for HCWM
- Inadequate knowledge of HCWM
- Focus on burning
- Lack of transportation of waste from rural and remote areas
- Lack of enforcement of law and regulations
- Poor monitoring mechanisms

53 nhrc.org.np/files/download/ed32b0ee0a52b31 (Training manual for health-care professionals)
54 documents.worldbank.org/curated/en/705441468757824489/pdf/E9730vol03.pdf
55 Report on Regional workshop on health-care waste management, Nepal, November 2016
56 www.searo.who.int/entity/human_resources/data/hrh-profile-nepal-rev2014.pdf
57 Documents.worldbank.org/curated/en/705441468757824489/pdf/E9730vol03.pdf

Conclusion

The country generates approximately 36735 kg of medical waste per day. Although the Health-care Waste Management Guidelines, 2014, specifically focus on adoption of non-burn technology for the proper management of HCW generated, facilities still use onsite treatments such as open burning or low technology incinerators made of bricks, which leads to the release of toxic gases in the surrounding areas. The primary assessment has pointed towards inefficient segregation practices and lack of capacity-building programmes. The incinerators installed in some facilities remain inoperable due to high running costs. Hence, wastes are dumped into shallow trenches, burnt at low temperatures or dumped near rivers and ponds.

Although implementation of the guidelines is lacking, since the country has received funds from WHO and JICA,a number of NGOs (such as the Centre for Public Health and Environmental Development (CEPHED) and HECAF) are working there and producing some good models on the ground.

Recommendations

It has been 14years since the first Health-care Waste Management Guidelines were issued. There are a few improvements that would make the situation better in the country.

- The country needs a stringent policy on health-care waste management. There has to be a legal deterrent for improper management such as illegal dumping, open burning, mixing with municipal wastes, etc. There should be a centralized committee for monitoring health-care waste management. Capacity-building on health-care waste management and occupational safety should be focused on strengthening the knowledge base and ensuring that knowledge and practice on health-care waste is sustained. Some specific areas where the country could work in the future are:
- A comprehensive policy document on waste management, which would include concepts of injection safety, chemical safety, cytotoxic /other hazardous drugs and liquid management needs to be framed.
- The Solid Waste Rules of the country make the generator responsible for the hazardous waste that it generates. The role of the generator can be elaborated and it could include framing of a waste management policy, constituting a waste management committee in each HCF above a particular bed strength. Although the present guidelines state this, it is not being implemented.
- Open burning seems to be the common way of waste treatment. There should be a strict penalty on such practices. Rural health-care facilities should be given options for disinfecting their plastic waste by chemicals and storing them for a few days until collection of waste is feasible. This would dissuade the burning of plastic waste.
- It is difficult for each health-care facility to transport its own waste to the disposal site (as cited in the guidelines). This provision is leading to noncompliance. The new rules should have a provision where the municipality collects medical waste and general waste in separate compartments (in a vehicle) or facilitates this collection through an approved transport agency. The same transport agency / municipality can take up autoclaving of infectious waste.

- Gaps in regular capacity-building can be bridged by making a few zonal hospitals training centres and enabling them to train the vast chain of medical fraternity.
- There is no system of reporting of waste generation and management or accident reporting. A system to record all these and report to a central authority would help in efficient documentation and increased compliance.
- Wastewater is not being treated in any of the facilities. As a preliminary step, the wastewater from laboratories, pathology unit, oncology unit and radioactive unit should be pretreated before disposal.
- The monitoring system should be strict and at tier level (at zonal, district, etc.) to ensure compliance.

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Sri Lanka

Introduction

Sri Lanka is an island in the South-East Asia. Sri Lanka has maritime borders with India to the north-west and Maldives to the south-west. The population is about 20million and the land area is about 65000 sq. km.

Health sector of Sri Lanka

The country's public health sector has a history of more than 100 years and provides wide coverage that is accessible throughout the country at all levels. The health system consists of a hospital-based curative care system and a preventive community health-care system, which are administered by the Ministry of Health and the Provincial Health Services.[58]Health care, including specialized care, is provided free of cost to all citizens.[59]

Inventorization of biomedical waste generation and management

General information

Types of health-care facilities

Public sector hospitals are categorized as national, provincial and special hospitals.

Total number of health-care facilities in the country	1084
A. Government	
National	1
Teaching	20
Provincial general hospitals	3
District general hospitals	18
Base hospitals Type-A	22
Base hospitals Type-B	46
Divisional hospitals Type-A (more than 100 patient beds)	42
Divisional hospitals Type-B (50-100 patient beds)	129

58 Environmental management framework for health-care waste &infrastructure development, Ministry of Health

59 Recommendations through a Complete Study on Health-care Solid Waste Management Practices of Government Hospitals in Colombo, Sri Lanka, Bandunee C. L. Athapattu, A. P. Priyanthaand MasafumiTateda

Divisional hospitals Type-C (less than 50 patients)	322
Primary Medical Care Unit (central dispensaries and medical homes)	474
Board Managed Hospitals	2
Special hospitals	5
B. Private	
Health institutes registered	204
Medical laboratories	623
Part-time medical clinics	1288
Full-time clinics	480

National data on medical waste

The Ministry of Health is currently undertaking an island-wide survey on generation of medical waste in the country.

The Ministry of Health and Environment Authority are the responsible agencies for waste management. It updated the data in 2012 by conducting a survey in health-care facilities. These data are not yet available to the public.

Total quantity of medical waste generated in the country–15-20MT per day (island-wide) and 4MT per day (Colombo city) (old data). Total quantity of medical waste generated in the country can be estimated at 27 tonnes/day (average per patient per bed per day waste generation of the country – 0.36 kg/bed/day).According to another estimate, it is cited at 5400 MT/annum.

Policy framework

Sri Lanka has a draft policy on "Health-care Waste Management," 2001, and a Health Sector Policy under the National Cleaner Production Policy. This policy focuses on efficient use of resources, minimizing wastage of resource and making all processes more environmental friendly (covering – administration, waste management, laundry, food supply, disinfection, patient care, water and power usage). This policy is the key to green hospitals.

The National Environment Act (NEA) No. 47 regulates health-care waste management in the country.

According to the Legislation, 2008, facilities are required to obtain two licenses – Environmental Protection License (EPL) and Scheduled Waste License (SWL), which deal mainly with infectious waste and other categories of hazardous waste within health institutions). Health institutions functioning without these licenses are considered to be violating the law.

Agency responsible for framing these guidelines as well as its implementation

The Legislation of 2008 has been framed by the Ministry of Environment (Central Environmental Authority– CEA), and implementation is looked after by the Ministry of Health.

Greening the health-care sector

The facilities practice the concept of green health care by adopting non-burn technologies (steam sterilizers) at a mega scale. Hospitals carry out energy audits. Rain water harvesting is also introduced in the country and some facilities have started practicing it. The government has initiated the development of green hospital guidelines and its draft has been prepared. Hospitals have also been encouraged to use solar power.

Waste management committee

The country has a National Steering Committee on Health-care Waste Management. The health-care facilities have a waste management as well as an infection control committee. Both of these committees are responsible for monitoring infection control and waste management activities respectively. 90% of the health-care facilities have these committees.

Segregation

The national policy requires segregation of waste into 7 categories: general waste; paper/cardboard waste; biodegradable waste; infectious waste; sharps; plastic/polythene waste; and glass waste.70% of the facilities are following this segregation system.

Collection and transportation

The policy entails the following collection system:

- Hazardous waste should be collected in yellow polythene bags (with the international biohazard symbol) of minimum 300μm gauge.
- Sharps are required to be placed in specific cardboard or plastic (puncture and leak proof) yellow boxes with red stripes and a biohazard symbol. These boxes are to be designed with a small opening so that items can be dropped in but no item can be removed.
- General waste should be placed in black polythene bags of minimum 200μ gauge.

Labourers and contractual cleaning service providers collect and transport the waste in both covered/open trolleys specially meant for transporting medical waste. Some of these trolleys are labelled. Although all the facilities do not have separate lifts or chutes for the transportation of medical waste, some newly constructed buildings have made such provisions.

Government and private agencies are responsible for transporting the waste outside the facility. All agencies have to obtain the approval of the CEA for transportation of health-care waste outside the hospitals.

The private agencies transport the waste in specially designed vehicles. There are norms that these vehicles have to abide by:

All vehicles should display the infectious waste symbol and indicate that they are transporting health-care waste.

The vehicles should be washable, lockable and should not emit any odor, and should not spill any waste, including liquid waste, on roads.

The Department of Motor Traffic is the licensing authority for these vehicles. Facilities are required to report accidents to the Ministry of Health. The existing data show that no accidents have occurred until now.

Storage

According to the policy, health-care facilities are supposed to construct a storage area as per the national colour code. The standards are given in Annex 14. Most of the facilities are storing waste in ventilated rooms within their institutions.

Treatment and disposal

Medical waste is treated both onsite and offsite in the country. Medical waste is required to be treated by using steam sterilization as well as high temperature incineration (1200°C). The country has only 1functioning treatment facility, 2established but non-functional and 20 pending/in the pipeline.

Smaller institutions that generate a small quantity of waste either bury their waste safely in lime pits (which should not be located close to any water body or there should be a sufficient depth gap from the water table) if considerable land area is available/or incinerate the waste at low temperatures (single chamber incineration at 500°C).

The Central Environment Authority (CEA) is responsible for ensuring technology standards/validation and inclusion of new technologies. The treatment technologies are tested for their emission levels at the time of installation and when repaired. Ash pits/landfills are used as the end disposal technology. Placenta disposal pits are made for disposing of the placenta. All infected plastics (blood bags, urine bags, IV set, etc.) are incinerated, and non-infected plastics are sent for recycling (non-contaminated saline bottles). Provincial hospitals are facing difficulties in maintaining these technologies due to lack of funds. Treatment technologies used for various kinds of waste is given in Annex 15.

Occupational safety

According to the policy, staff is required to wear personal protective equipment, viz. face masks, aprons, boots and heavy duty gloves while handling waste. According to estimates, 60% of health-care establishments provide PPE. Immunization against hepatitis B is carried out among relevant staff.

The facilities destroy their sharps waste either by incineration or by autoclaving and shredding. Small hospitals dispose them in a sharps waste disposal pit. Some facilities also openly burn their sharps waste. Only 10% of health-care facilities use needle cutters.

Post-exposure prophylaxis

Sri Lanka has a PEP policy for HIV and hepatitis B with clear guidelines for implementation.

Pharmaceutical and genotoxic/cytotoxic waste

The facilities dispose their expired/unwanted drugs at a cement kiln. Cytotoxic drugs are incinerated at a high temperature. The facilities follow a standard practice on management of its genotoxic waste and the Ministry of Health has issued a circular to all health institutions on its management.

Chemicals

Under infection control, facilities have developed a standard practice on the usage of disinfectants. All wastewater should be treated to meet the wastewater discharge standards stipulated by the CEA. These chemicals are used for varied purposes, including wastewater treatment. A wastewater and sewer management circular has been issued to all health institutions by the Ministry of Health.

Mercury management

Since Sri Lanka is a Signatory to the Minamata Convention, it is running a mercury phase-out programme in the country according to which:

- Mercury-containing blood pressure apparatus are being phased out and the Ministry of Health has been procuring only digital apparatus for the last several years.
- The country is providing education on mercury spill management and neutralization of mercury using sulphur during spillages.
- Mercury waste is being stored in glass bottles until a disposal facility is established.
- The country will be phasing out dental amalgam within the next two years. Dental amalgam separators are procured at dental facilities to collect disposed dental amalgam.
- Mercury containing compact fluorescent light (CFL) bulbs are being sent to a mercury recycling factory.

Wastewater treatment

According to the policy, all facilities have to treat their liquid infectious waste onsite before discharging it into the sewerage system. Effluents of all diagnostic medical laboratories, operating theatres, etc. have to be neutralized in a buffer tank of concentrated hypochlorite (10%) before discarding into the sewerage. Radioactive effluents of inward patients shall be discharged into the sewerage or into a septic tank only after it has decayed to adequate background levels in retention tanks.

The private hospital Pannipitiya collects its wastewater in a tank and releases it in the sewer after treating it with bioremediation, sand filter and ultraviolet filter.

Capacity-building of people handling waste management

Sri Lanka has a provision of providing training to its health-care staff for management for medical waste. Health-care waste has been included in the curriculums of medical and public health staff. The Ministry of Health conducts TOTs, and regular trainings are conducted by provincial authorities, universities and faculties of community medicines. The proceedings of these training programmes are required to be reported. The Central Environment Authority is the monitoring agency.

The country has a standardized training module by the Ministry of Health. The government also makes use of posters, leaflets, video clips and training programmes to create awareness on environmental issues.

The state conducts about 30 training programmes per year. The health-care facilities conduct TOTs annually and have also developed a training module for it. Since these training sessions are not adequate, more sessions are required by facilities.

Monitoring (within hospital/national)

National level monitoring is done by the National Steering Committee for Clinical Waste Management (NCCWM). Provincial level monitoring is vested with the relevant bodies in the provincial council. At the institutional level, hospital management has to make health-care waste management plans. Theinfection control committee, headed by the director, monitors the situation in institutions.[60]

Frequency of monitoring is once a year at the state level and is required to be conducted on a daily basis in facilities. But due to shortage of staff, the monitoring is not being conducted efficiently.

Records

Health-care facilities are required to maintain records of the amount of waste generated and report it to the Ministry of Health. Health authorities as well as the Central Environmental Authority verify these records. The government is developing a web-based system for reporting. These reports are not put up in the public domain.

Accident reporting

Health-care facilities are required to maintain injury registers and report accidents.

Funding

Hospitals under the central government have a separate budget for health-care waste management. The Planning Division of the Ministry of Health is responsible for checking efficient budget utilization.

Funds are not found to be sufficient by facilities.

Infrastructure

60% of health-care facilities have the required infrastructure for management of health-care waste. Apart from the funds allocated by the government, foreign funding is also made available for infrastructural requirements. Standards for infrastructural requirements are provided in Annex 16.

Awareness

According to estimates, 95% of total health-care facilities are aware of the risks associated with mismanagement of health-care waste, yet only 30% were following best waste management practices.

Rewards

The country has instituted awards for best performing and green hospitals. Base hospitals in Moneragala and Ninthavur were awarded silver and bronze respectively for green awards.[61]

60 Report on Regional workshop on health-care waste management, Nepal, November 2016
61 Report on Regional workshop on health-care waste management, Nepal, November 2016

Epidemic preparedness

There are guidelines available on highly infectious diseases, surveillance mechanisms, response mechanisms, isolation units and epidemic preparedness. The country also has a guideline on the management of health-care waste in case of a disease outbreak and is developing infrastructure for it. Although there is a provision of training staff to handle an epidemic situation with respect to health-care waste management, it is conducted based on the requirements. The Ministry of Health is the monitoring body.

Infection control committee

The country has an infection control guideline, which requires formation of an infection control committee in health-care facilities. Staff are required to wear protective equipment (gloves, masks, goggles, caps, gumboots, aprons, etc., depending on the nature of exposure) while handling health-care waste.

International treaties

The country is a signatory to the Basel, Stockholm and Minamata Conventions. The waste laws of the country are in conformation with these conventions. Lack of waste disposal facilities is identified as a major gap. The GEF has identified health-care waste for future funding.

International funding[62]

The Ministry of Health in 2000 initiated a three-phased programme funded by the World Bank under the direct supervision of the NCCWM. After carrying out an assessment of HCWM practices in HCFs in the country, National Guidelines and the National Policy for HCWM were drafted and a National Action Plan was prepared. These aimed at gradually expanding improved HCWM practices throughout the country in a systematic way over a period of 5 years including a specific system for hospitals in the greater Colombo area.. The final phase will be the implementation of the recommendations.

Other initiatives

The country has also taken several initiatives on the following issues:

- Draft policy on HCWM is being updated
- Sectoral policy on cleaner production developed
- National guidelines on HCWM developed
- Energy and water audits are being conducted

Circulars on the following issued to all health institutions:

- Waste segregation
- Cytotoxic waste management
- Mercury waste management

62 Environmental management framework for health-care waste &infrastructure development, Ministry of Health

- Electronic waste management
- Wastewater and sewage management
- Plastic and polythene waste management

Secondary assessment

In a study[63] conducted in 2015 by Bandunee C.L.et al. (according to the records of the CEA Sri Lanka), the generation of health-care waste was about 5400MT/year in 2014. The Waste Management Authority in the Western Province reported that out of total dumped waste at Karadiyana, 0.03% is treated health-care waste. Management of health-care waste is a major environmental issue in the country. Although health-care services are responsible for managing the health-care waste they generate, most of them fail to do this efficiently.

This study concluded that:

- Most of the investigated hospitals are aware of the risks or health impacts of health-care waste, but are not aware of the environmental damage or pollution that may result from the poor management of health-care waste.
- Policies and regulations of health-care waste management do not address the lack of physical and financial facilities, or the absence of adequate and responsible staff in hospitals.
- In some hospitals, health-care waste practices were satisfactory, but most of them were unsatisfactory.
- There is no proper storage area and waste is being burnt openly.
- Pharmaceutical waste in investigated hospitals is not categorized as waste, and outdated pharmaceuticals are returned to the manufacturing companies to be destroyed.
- Users of sharp objects sometimes leave them on hospital beds, which could be very dangerous to patients, their attendants and health-care staff.

A document titled "Policies and Procedures for Disposal of Waste and Safe Handling and Disposal of Sharps and Needles" framed by the Central Hospital in Colombo has a chapter on prevention and control of infections (PCI), which mentions that the hospital segregates its waste at the source according to the national colour-coding system. The hospital does not allow recapping of the needles and they are disposed of in a sharp bin. All the waste handlers are required to wear PPE.

A study[64] was conducted in six hospitals (both public and private) in Colombo district in 2015. According to the assessment, in most of the hospitals, infectious waste generation is the highest; it is also higher than in other countries.

The findings concluded that public hospitals generate more clinical waste than private hospitals mainly due to the high number of patients. Public hospitals were allocated Rs.84084.22 per day while private hospitals were allocated Rs.42101.89 per day for management of clinical waste.

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63 Recommendations through a Complete Study on Health-care Solid Waste Management Practices of Government Hospitals in Colombo, Sri Lanka, Bandunee C. L. Athapattu, A. P. Priyanthaand MasafumiTateda

64 Comparison on Disposal Strategies for Clinical Waste: Hospitals In Sri Lanka by G. Karunasena, W. M. D. M. Jayathilakaand R.M.N.U. Rathnayake, University of Moratuwa, Moratuwa, Sri Lanka, 2015

The hospitals treat their medical waste by the following methodologies:

- Infectious and sharps waste disposal – Incineration, hydroclaving and outsourcing
- Pharmaceutical waste disposal – Outsourcing and disposal in separate lands
- Pathological waste disposal – Incinerators, burying in the cemetery, transferring to florists and outsourcing
- Radioactive waste disposal – Outsourcing and transferring to the sea through drain line

It identified the following major challenges that these hospitals are facing:

- Attitude and behaviour of patients
- Lack of awareness among staff regarding clinical waste management and the colour code system
- Lack of space to use incinerators
- Problems from animals
- Increasing charges of the outsource company
- Lack of safety bins to collect infectious waste

The regional workshop at the WHO South-East Asia Regional Office in 2016 mentioned that the country has commissioned several treatment equipment in various major HCFs with funding from the government as well as from external sources.

Case study

Diagnostic assessment of Valachenai Hospital[65]

Valachenai base hospital (VBH) is a 186 bed hospital. It was disposing all its wastes with municipal wastes and this was posing a risk to waste workers and the community. The average waste generation rate of VBH was 1.05 kg/bed/day. The risk waste generation rate and non-risk waste generation rate was 0.21 kg/bed/day and 0.84 kg/bed/day respectively. More than 50% of waste generated is biodegradable.

According to the survey conducted among 121 doctors, nurses and support staff, 54% reported having a needle-stick injury within their last one year period of work. About 72% of injuries occurred while using this device during medication. About 8% of injuries happened from sharps that pierced the disposal container, 3% of injuries occurred from items left on the floor and 3% of injuries occurred during recapping the needle. More than 71% of waste was not segregated; waste bins were kept in locations that were not easily accessible; more than 91% of bins were found unclean; and there was no proper labelling of the bins. Waste was collected in an open area in the backyard of the hospital and then sent off with municipal waste. There was no proper timing, protocols and staff safety for storage and disposal. Syringes were burnt in a low temperature brick incinerator. Training is now being undertaken to make it a model hospital.

65 Report on Regional workshop on health-care waste management, Nepal, November 2016

Low Temperature Brick incinerator used for burning syringes

Conclusion

Sri Lanka generates a total of 15–20 tonnes of medical waste per day. The country has a draft policy on "Health-care Waste Management," 2001, which requires hospitals to segregate their waste at the source. The policy requires this waste to be treated onsite or offsite. There is a lack of offsite treatment facilities, owing to which hospitals are either burning their waste openly or in small kiln incinerators. Studies point out that the majority of waste leaves the health-care facilities untreated.

Lack of awareness among staff regarding the hazards due to mismanagement of medical waste, lack of infrastructure, an inefficient monitoring system and lack of treatment facilities are identified as the bottlenecks in health-care waste management. A high rate of needle-stick injuries has been reported, and the country needs to focus on injection safety and PEP.

The World Bank has provided funds for health-care management in the country, and GEF has plans for providing future funds.

The compliance level of the existing policy is only 40%. The country needs formal regulations to properly implement the system. It is also moving towards the concept of green health-care by adopting non-burn technologies and has also made draft guidelines for it.

Recommendations

- The draft guidelines are required to be finalized soon so that the country can move ahead with its implementation.
- According to WHO,[66] some facilities are still openly burning their medical waste. The policy should strictly prohibit this practice and impose deterrence on the non-abiding hospitals.
- Incinerators complying with the Stockholm Convention standards should be advocated to be used in the country through the new guidelines.

66 Report on Regional workshop on health-care waste management, Nepal, November 2016

- Lack of an outsourcing agency and rising prices also came across as a problem faced by facilities. The government should plan for development of more of these agencies and work with them on the cost issue.
- Hospitals as well as the government should conduct regular training programmes for all staff handling medical waste.
- In a case study done in Valachenai Hospital, 54% of staff reported having a needle-stick injury within their last one year period of work. The country should focus on the infection control programme. Injection safety and PEP should form an integral part of the HCWM guidelines to increase awareness on the issue.
- The country has a standardized training manual and this may be the reason that awareness on health and occupational hazards is quite high. But, a primary assessment showed that people are not aware of the environmental concerns from medical waste mismanagement. Thus, the manual can be revised to include environmental concerns and pollution prevention. It should also align the training content with international environmental policies and convention.
- Only 10% of the staff is using needle cutters, and stick injuries are high. The government should make an effort to increase the use of needle containment and sharp safety devices.

14

Thailand

Introduction

Thailand is a South Asian country. In 2011, the country's population was 64 million.[67] The forecast for gross domestic product (GDP) percentage change is estimated to be 5.1 for the period from 2013 to 2017. The country has made progressive efforts in providing education and health-care facilities to its population.[68]

Inventorization of biomedical waste generation and management

General information

Types of health-care facilities

Hospitals under the Ministry of Public Health (MoPH) are categorized as regional, general, community and sub district hospitals. There are some hospitals under other ministries. Other than these, there are private hospitals.

Type of health-care facilities	Number of health-care facilities	Number of beds
Government hospitals	10845	
Hospitals under Ministry of Public Health	10730	99193
Regional hospitals	28	
General hospitals	88	
Community hospitals	780	
Subdistrict health promoting hospitals	9777	
Hospitals under departments	57	
Hospitals under other ministries	115	21129
Private hospitals	343	30028
Private clinics	23054	–
Animal hospitals/clinics	2522	–
Pathogenic microorganism laboratory	1198	–

67 https://www.oecd.org/dev/asia-pacific/Thailand.pdf
68 https://www.oecd.org/dev/asia-pacific/Thailand.pdf

National data on medical waste

Data on medical waste generated in the country is collected through inspection reports of the Ministry of Public Health with regard to overall implementation according to key performance indicators(KPIs). Specific data of health-care facilities under the Ministry of Public Health is from hospital inspection reports collected by the Provincial Public Health Office. Data reports are sent to each Regional Health Promotion Centre and all data are analysed by the Department of Health to compile the Thailand overview.

Thailand state of pollution 2015, produced by the Pollution Control Department (country overview) is another source of this information.

The Pollution Control Department, Ministry of Natural Resources and Environment(MNRE), estimated the quantity of infectious waste produced in Thailand in 2015 at 53868 tonnes (an increase of 1721 tonnes (3.3%) from 2014).

The Ministry of Public Health (Department of Health and Office of the Permanent Secretary), Ministry of Interior (Department of Local Administration) and Ministry of Natural Resources and Environment (Pollution Control Department) are all responsible for collection of such data at their level.

The inspection reports of the Ministry of Public Health and Thailand state of pollution report can be downloaded from the website of the Ministry of Public Health and Pollution Control Department respectively. These are done each year.

The average per bed per day waste generation of the country is about0.81 kg/bed/day.

Policy framework

Draft country action plans

Since 2014, waste management has become a national agenda. The government realizes the problems and wants to turn the policy into general practice.

Actions under consideration:

- Develop the national master plan of infectious waste (2017–2021)
- Develop the national guideline for health-care waste and modify the national guideline for infectious waste
- Standardize the collection and transport of health-care waste
- Develop training programmes for health-care personnel (especially highly infectious pathogen)
- Review of technology for HCW management
- Foster technology transfer and perform cost-effectiveness analysis
- Enhance collaboration with 3Rknowledgehub (especially green and clean hospital)

National rules/ policies on medical waste

Major laws

- Policy on management of biomedical waste called the Regulation of MOPH B.E. 2545 (2002)
- Public Health Act (PHA) 2007
- Determining Planning and Staging of Decentralization Act 1999

These policies specify local administrative organization (LAO) responsibilities to provide proper waste management services including the infectious waste and household hazardous waste management. Set up emission standard for infectious waste incinerator as a pollution point source.

The waste management system is similar to that of other countries where waste is segregated at the source using colour-coded bins, then transported in separate trolleys to dedicated waste storage rooms and finally sent to various offsite waste treatment centres.

The Ministry of Public Health had set a goal for 953 health promotion centre hospitals, general hospitals, community hospitals and hospitals under departments to implement standards for infectious waste management. About 880 facilities (92%) are meeting the standards.

Agency responsible for framing these regulations/guidelines/policies

The MoPH, LAO, MNRE

Policies/efforts in place for greening the health-care sector

In 2017, the secretary of the Ministry of Public Health committed to make health-care service providers become green and clean.

Segregation

In Thailand, waste generated or used in medical diagnosis or remediation, immunization or experiments, autopsy or examination of animal carcasses including in research, are deemed infectious waste.

Infectious wastes are segregated into two types as follows:

- Sharp items (e.g. injection needle and glass syringe, blade, glass container, and microscope slide) must be separately kept in a box or red bucket.
- Non-sharp items (e.g. human or animal's body parts from surgery and experiment, blood component, body fluid of human or animal, live attenuated vaccine, cotton, gauze and rubber hose) including any kind of non-sharps waste from infectious disease ward must be separately kept in a red bag.

Collection and transportation

Extra mural transport – Either the private company which is permitted to collect waste or the local administrative organization collects the waste, e.g. Nonthaburi Provincial Administrative Organization. Infectious waste must be collected from its source and specifically disposed in a container for infectious

waste. Sharp materials must be disposed of in a box or a bucket that can resist drilling and chemical erosion, and it must also prevent leakage. Containers having infectious waste must not exceed three quarters of container's capacity. The container must be tightly closed with the lid, put in an infectious waste bag, and tightly wrapped before disposal.

Other types of infectious waste (e.g. non-sharp) must be disposed in a red opaque bag made from chemicals and water-resistant material. Containers having infectious waste must not exceed two thirds of container's capacity. The body of the trolley is covered with opaque material, although they are not marked with a hazard symbol. There are no separate lifts/chutes for intramural waste transport.

The local administrative organization is the licensing authority for vehicles transporting infectious waste. A private company, which is permitted to collect waste, and the local administrative organization have duties to collect and transport infectious waste to the disposal sites. The health-care facility, which is the source of infectious waste, must follow up with the agencies to ensure disposal according to ministerial regulation on infectious waste disposal B.E. 2545. Infectious waste disposal companies use a trolley with an opaque body carrying an empty red bucket – infectious waste container. They switch the empty bucket with a full bucket and transport the full bucket of infectious waste to dispose of it later. There are requirements/norms for waste collecting equipment and waste transporting vehicles (Annex 17).

Storage

All health-care facilities need to allocate a separate room for storage of waste. If waste is not stored beyond a day, there is no requirement for temperature control. But in case of containers collecting waste for more than 7 days, the temperature of infectious waste storage must be 10°C or lower.

Treatment and disposal

The Ministry of Natural Resources and Environment is responsible for ensuring technology standards/validation. Non-incineration (mostly steam sterilization/autoclaving) and incineration technologies and thermal inactivation are recommended for use for all types of waste. Onsite and offsite treatment facilities exist.

There are 10 incinerators that are managed by local government and 6 incinerators are run by private companies. There are 37 hospitals that do not have access to these waste treatment facilities and they have their own incinerators. Four hospitals have thermal inactivation systems to treat infectious waste. There are 6 offsite treatment facilities.

These facilities are not adequate to handle the waste produced by the country. They mostly rely on incineration. These facilities are required to provide personal protective equipment for workers (driver and worker) in a vehicle carrying infectious waste. They are also required to have preservers for spilling out/leakage of infectious waste and fire.

Incinerator standard control according to notification of the Ministry of Natural Resources and Environment B.E. 2546 is 0.5 ng I-TEQ/Nm^3.

Technologies can be used in some area, but other areas do not have temperature control for incineration. Double-chambered incinerators do not meet the standard. Ashes from incineration are taken to a secured landfill.

Mercury management

There is a government order to replace mercury thermometers with digital equipment. Mercury equipment is still being used in the country for all other purposes.

Capacity-building of people handling waste management

The country's law includes training and capacity-building of health-care staff. The Department of Health, Provincial Public Health Offices, hospitals under the Ministry of Public Health (regional hospitals, general hospitals and community hospitals), hospitals under university, university, local administrative offices or organizations which have the potential to arrange training and are approved by the Department of Health are the few bodies which undertake training.

Records

Health-care facilities are required to maintain records of health-care waste generation and management. The Inspector general of the Ministry of Public Health verifies these records. These reports are not put up in the public domain.

Deterrence

The local government has the authority to impose a fine for noncompliance.

Case study

Thailand GREEN and CLEAN Hospital for Safety 2016

The GREEN and CLEAN hospital concept promotes collaborative efforts among state health-care facilities under the Ministry of Public Health to run in a sustainable manner and reduce global warming. It encourages state health-care facilities to serve as a role model for other agencies including local authorities and communities in reducing global warming. Finally, it aims to increase awareness and understanding of health personnel in reducing global warming by sustainable sanitation management.

The major highlights of the progamme are documentation of success stories, tracking carbon footprint of hospitals through a carbon footprint calculator programme, training courses conducted for staff and there is an increasing number of hospitals taking GREEN initiatives.

Some lessons from the programme are summarized as follows:

- The health-care sector is well-positioned to "lead by example"
- Sustainable sanitation and climate change can be linked by the GREEN and CLEAN hospital approach
- Active role of the health sector in sustainable sanitation management can benefit health and contribute to long-term goals of reducing global warming
- Capacity and awareness of health personnel need to be built continuously
- An integrated approach of GREEN activities in routine work should be encouraged among health personnel in hospitals

- GREEN and CLEAN strategy can be applied and promoted in other sectors
- Increase the involvement of the rest of the hospitals and other sectors in the project
- Develop a method of measurement for monitoring and evaluating the effectiveness of project implementation
- Create and strengthen the GREEN and CLEAN hospital network both at national and sub national levels
- Promote innovation and appropriate technologies in managing sustainable sanitation in GREEN and CLEAN hospital

Secondary assessment

The waste generated was 0.81 kg/bed/day3 for the year 2015. In a report in 2009,[69]the rate of medical waste from various medical premises varied from 0.36 to 1.36 kg/bed/day. Health-care centres generate the highest rate of medical waste of approximately 1.36 kg/bed/day. General hospitals have the lowest rate ~ 0.36 kg/bed/day.

The overall amount of medical waste was 37415 tonnes/year.

Transportation of waste[70]

The management of infectious waste (IW) by the private transport sector (PTS) was started using an incinerator. They have no standard guidelines for work and transport. The policy of managing the IW was not clear. There were problems with separation, handling and storage. The PTS should develop and provide standard equipment and vehicles in accordance with the rules prescribed by the Ministry of Public Health and train PTS workers.

Recommendations

- The country is majorly using incinerators as the treatment methodology. The existing infrastructure for waste management is inadequate. Keeping these two things in mind, the government should seek to invest in waste management, and seek GEF funding for installing more non-burn technologies in the country.
- The transport of infectious waste by the private sector is not in compliance with government laws. Strict monitoring of these vehicles and deadlines to comply with the rules should be planned.

69 Sustainable Medical Waste Management by Local Administrative Organization Thailand, Somrat Kerdsuwan in The Waste Incineration Research Center, 2009

70 Hansakul, A., Pitaksanurat, S., Srisatit, T., & Surit, P. (2010). Infectious waste management in the government hospitals by private transport sector: Case study of hospitals in the north east of Thailand. *J. Environ. Res. Develop*, *4*(4)

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Timor-Leste

Introduction

Timor-Leste is divided into 13 administrative districts, 67 sub-districts and 442 sucos/villages and 2225 aldeias/hamlets[71]with 15007 km^2. The two largest urban centres are Dili and Baucau. The country gained independence from Indonesia on 20 May 2002.[72] 70% of the country's population lives in rural areas, with the majority ofpeople living in small, scattered villages mostly isolated with mountain terrain and poor roads.[73]

Health-care sector

Overall, the country has 1national hospital, 5referral hospitals, 12 district health centres, 68 community health centres and 205 health posts. The Environment Health Department under the National Directorate of Public Health, Ministry of Health, is responsible for health-care waste management. The Health sector national strategic plan (2011–2030) has an exclusive indicator on health-care waste management. The Environment Health strategy has 8 components and one of them is on health-care waste management focusing on minimizing the impact of medical waste to the environment and the health of people.[74]

Tertiary health care is provided overseas throughneighbouring countries such asAustralia, Indonesia and Singapore . Primary health care services are provided through the district health service structure with community health centres (CHCs), health posts and outreach activities.

The nearest facility-based services to the community are delivered through a network of health posts staffed with a team of one nurse and a midwife. At the sub-district level, community health centres provide a better facility than services offered by health posts. District CHCs provide inpatient and outpatient facilities with 13–14 staff, including a physician (District Medical Officer).

Health-care waste management

There is no national policy in place for health-care waste management. But, even then, most of the hospitals state that they are segregating waste as "Sharps, glass, infections waste, injections, discarded medicine, needles, syringes, catheters, X-ray, paper or tissue, blood, bandages, gauze, cotton or any others objects in contact with body fluids, human body parts, placentas, tubings IV bottles, etc." Most of the hospitals donot seem to have many bins for segregation.

71 http://www.dhsprogram.com/pubs/pdf/FR235/FR235.pdf
72 http://timor-leste.gov.tl/?p=547&lang=en
73 http://www.searo.who.int/timorleste/publications/national_health_sector_plan.pdf
74 Report on Regional workshop on health-care waste management, Nepal, November 2016

Health-care waste is either burnt in the open or incinerated. The final disposal is in the sanitary landfill, mostly without any pretreatment. PPE such as masks and gloves are used. Before transporting waste to the landfill site, it is being stored in plastic bags and containers.

Health-care staff is quite unaware of the risks associated with improper management of health-care waste. The first-ever training for the management of health-care waste was provided to a hospital and sanitary workers in March 2013 funded by WHO.[75] Currently, there is only one health facility in Timor-Leste that has HCWM guidelines in place (i.e. Dili National Hospital Guido Valadares (HNGV)), where the HCWM training was held. Waste from many facilities are burnt in open or buried near to the facility itself. Medical waste from Dili hospitals are mainly sent to Tibar landfill site, which is located in the outskirts. Apart from that landfill, onsite diesel incinerators were provided to some of the facilities, which are expensive in the long term.

An assessment of environmental health conditions of 74 health-care facilities was carried out in 2011. The assessment results showed that there was no HCWM guideline or policy in the country, only 24% of facilities had a responsible person for waste management, 33% had functioning incinerators and 28% had wastewater treatment.[76]

The country is moving ahead with its health-care waste management. A national guideline on HCWM has been drafted and being approved. Pilots have been initiated in two referral hospitals and two community health centres.

Primary assessment

Community health centres

These are the hospitals that offer primary health care such as first aid with preliminary and on rare occasions, birth delivery. Most of the facilities come under an Integrated Development of Community Health Services (SISCA) scheme. The Community Health Centre of Manatuto municipality has an incinerator but it is not functional.

Figure: Incinerator Manatuto, which is not functional

75 http://www.searo.who.int/timorleste/PressReleaseonHCWMtrainingworkshop.pdf?ua=1
76 Report on Regional workshop on health-care waste management, Nepal, November 2016

The Community Health Centre of Vemase is a 1-bedded facility and has a functional incinerator. A few of the facilities have onsite incinerators, but some of them are not functional. Sharps are generally disposed of in the safety boxes and burnt. There is no mention of disinfection or autoclave of any health-care waste before disposal. Septic tank is installed in almost all the CHC facilities for managing liquid waste.

Guido Valadares National Hospital (Dili, Dili District): Established in 1984, it is a national hospital with 350 beds, with an average occupancy of 34%. The hospital has an onsite incinerator, and wastes are also transported to the Tibar sanitary landfill site and burnt. This is the only hospital in the country thathas offered health-care waste management training to staff and sanitary workers in coordination with WHO.

Referral Hospital Baucau: Established in 1983, it is a 114-bedded referral hospital with an average occupancy of 52%. This hospital has an onsite incinerator and some of the waste is being transported to the sanitary landfill site in Baucau for offsite disposal.

Referral Hospital Maliana: Established in 1982, located in Odomau Village municipality of Maliana,Timor-Leste. It is a 36-bedded hospital with 83% occupancy rate. It has an onsite incinerator and some of the wastes are transported to the sanitary landfill site in Maliana.

Referral Hospital Maubesi: It is a 35-bedded hospital with 85% occupancy rate. The facility has an onsite incinerator and some of the wastes are transported to the sanitary landfill site of Maubesi and openly burnt.

Conclusion

The country does not have any policy on health-care waste management. Yet the hospitals state that they are segregating their waste into certain categories. There is a lack of awareness among staff about the risks associated with the mismanagement of health-care waste. The waste is either openly burned or incinerated or buried near the facility itself.

There is also lack of financial support from the government, and there is no monitoring system in place to check for proper management of health-care waste.

Although there is no policy framework yet, the country is moving ahead with it. A national guideline on HCWM has been drafted and is under approval. Pilots have been initiated in two referral hospitals and two community health centres.

Recommendations

- Most of the hospitals felt the need to have more trainings and study visits to help build the capacity of their staff. They also felt that supplies of safety boxes and PPE (personal protection equipment) are often not sufficient. The following recommendations can be adopted by the country:
- Since the country is in the process of expanding the health-care network with the help of many international and national NGOs and corporates, it is imperative that a policy is drawn up soon. This would help the new hospitals to develop the infrastructure in accordance with good waste management and green hospital norms and principles.

- It seems that non-burn technologies are not being used for health-care waste management. The focus is only on incinerators. The report does not mention the type of incinerators, but they seem to be drum type models. Since the country is in the nascent stage of waste management, it would make good economic and environmental sense to start with non-burn technologies.
- Most of the health-care facilities seem to have a designated place for storage. But in most of the hospitals, it is not fully covered. The rules can make it necessary to have lockable storage areas, which are free from birds, insects and rodents. It should be accessible only to authorized personnel.
- Open burning seems to be a common practice in the country. Staff need to be trained on the problems with open burning and importance of occupational safety. National Hospital Guido Valadares, whose staff has received training from WHO, can act like a training centre for the entire country. Master trainers can be identified from the hospital who can either visit all the health facilities and train their staff or conduct training sessions in the national hospital at a specified interval.
- Since the hospitals seem to have backyard space, it is suggested that they build a sharps pit in the campus for metal sharps. They should segregate the plastic part and give it for recycling. Use of safety boxes is leading to burning of lot of plastic waste, and this can be avoided. A deep burial pit for pathological waste may not be possible as the Region is prone to flooding during monsoons.
- National and international funding received for waste management should give preference to technologies which have a good sustainability quotient.
- All the monitoring and inspection committees under the health department should include waste management in their checklist.
- From the very beginning, the new guideline can try and incorporate these components. The new policy can also address issues such as record maintenance and accident reporting.
- Since it is a small country and most of the health-care facilities are run by the government, giving incentives for good waste management practices would help improve the system of segregation. An award scheme for good waste management can be instituted in the country.

This report has been synthesized using data on health-care waste management collected through questionnaires completed by program managers, primary data collected from health facilities, and literature review. In addition, presentations made by countries at the regional workshop on health-care waste management in Kathmandu, Nepal, in November 2016 were also used in the analysis. The report covers analysis of policies, laws, programmes and practices on health-care waste management in the South-East Asia Region. It also provides information on the status of health-care waste management in 10 countries of the Region

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