Report on assessment of WASH and healthcare waste management in District Sadar Hospital, Cox's Bazar

June 2015

World Health Organization
Country Office for Bangladesh

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Abbreviations

DGHS	Directorate General of Hospital Services
HCF	Healthcare Facility
HCWM	Healthcare Waste Management
ICU	Intensive Care Unit
PWD	Public Works Department
RMO	Resident Medical Officer
UNHCR	United Nations High Commissioner for Refugees
WASH	Water supply, Sanitation and Hygiene
WHO	World Health Organization

EXECUTIVE SUMMARY

WASH and waste management are an essential part of the hospital management system for healthy environment and infection control to prevent the spread of diseases. Currently, healthcare facilities focus more or treatment than prevention. A significant amount of resources are spent on patients infected with parasitic diseases caused by poor WASH and waste management practices. A study shows that patients infected with diseases account for 50 percent of in-patients and 33 percent of out-patient consultations adding an extra burden to hospital services that are often already overstretched. Providing access to sufficient quantities of safe water, adequate and sound sanitation facilities, proper health-care waste management systems and introducing sound hygiene behavior communication systems can reduce the amount of disease transmission.

With this in mind, an in-depth assessment of WASH and healthcare waste management (HCWM) was carried out in Sadar Hospital in Cox's Bazar District in June 2015 by DevCon with the technical support of WHO. The objectives of the study were to:

- assess the environmental health situation for waste management, water, sanitation and hygiene in terms of the service availability and readiness in the hospital
- assess the occupational health and safety status of the hospital staff, patients and caregivers, and
- identify the gaps in environmental health (especially HCWM) and explore the best solutions to reduce the risk of healthcare acquired infections (HAIs).

The WHO's guideline "Essential Environmental Health Standards in Health Care" and the Government of Bangladesh's 'Medical Waste Management Rules-2008' have been used as key references for the study. Key stakeholder interviews, primary and secondary data collection, physical observations and pictorial records were used in the study. The current situation and practice were observed and analyzed. The gaps were identified in the present healthcare facilities and recommendations for improvement have been made. It was found from the assessment that both the WASH and HCWM situations of the study hospital do not conform to the standards stated in the WHO guideline of Environmental Health Standards in Health Care and Medical Waste Management Rules of 2008.

The studied hospital has a running water system but there are no marked drinking water points. The water supply is bacteriologically contaminated, however, E.coli not exceeding 100 cfu/100ml. Most patients and attendants collect drinking water from outside. The male and female patients have separate wards having two toilets with shower facilities in each ward. On an average number of inpatients per toilet are 15. However, there exists no separate toilet facility for the children. Patients manage their own soap for hand washing. Hand washing basins exist but dysfunctional due to missing taps or breakage.

The toilets are cleaned twice a day but the cleanliness and hygiene are not maintained all the time. Hence, there is ample possibility of faeco-oral disease transmission

The operating theatre, delivery rooms, ICU, casualty department and laboratory rooms and adjacent WASH facilities are cleaned with disinfectant. However, no visual advice or instructions are seen for awareness and practice on cleanliness and infection control.

Three types of waste collection bins following the colour code are in place but segregation and separate collection and safe disposal are completely absent. All types of wastes were put together with some exception in the pathological laboratory. The cleaning of bins was done in open place and bins with infectious wastes are not disinfected before placement.

To improve the existing situation the following steps need to be taken by the hospital authority:

i) For safe drinking water supply, at least 10 water points with filters (Membrane or Nano) need to be installed clearly marked as 'Drinking Water Point'. The distribution of the water points could be as follows: Two in OPD, one in each of the Male and female ward, one in each of Doctors canteen and general canteen, one in Neo-natal unit, and one in Hospital superintendent room.

ii) Existing toilets and the hand washing facilities be repaired and maintained to make them functional.

iii) A health education desk be established for raising awareness on hygiene and waste management among the staff, patients and attendants. Messages should be given on the use of different bins for different categories of waste and the dangers of recycling infected medical items. Key hygiene messages, through posters, should be displayed in the hospital premises to educate the people.

iv) Regular sweeping, wet mopping and cleaning services should be closely supervised and monitored. For this a written reporting system should be developed and used.

v) Segregation at source, following the colour coding, separate collection, treatment and safe disposal of healthcare waste should be ensured in the hospital.

vi) A working committee for Infection Prevention and Control, including cleanliness and waste management, should be formed for regular inspection and reporting of the hospital cleanliness and waste management facilities.

vii) Wastes from the pathological laboratory and isolation wards should be disinfected by autoclave before final disposal.

viii) Recycling of hazardous items should be avoided otherwise disinfection with chlorine should be done before recycling to reduce the risks of infections;

1 BACKGROUND

Water supply, sanitation and hygiene (WASH) and healthcare waste management (HWM) are two of the essential components of hospital management from an infection control and management point of view. Reliable drinking water and sanitation facilities should be in hospitals serving both in- and out-patients. In addition, adequate hand washing arrangements (water and soap) need to be ensured for personal hygiene to help control feco-oral diseases, reduce in-hospital stays and out-patient consultations. WHO's 'Essential Environmental Health Standards in Health Care' recommend that drinking water should meet national standards and follow WHO guidelines for drinking water quality. Water for hospital use should be safe and of high quality and sufficient water should be available for use at all times. It is estimated that 40 to 60 liters of water is required per in-patient per day. This can go above 100 liters per patient per day when surgical procedures are performed. Water should also be secured to flush toilets and for washing and hygiene purposes. Hand wash facilities with soap and alcohol based hand rub should be ensured for controlling feco-oral disease transmission.

A significant amount of medical waste is generated most days from the healthcare facilities (HCFs). The Healthcare Waste Management Rules 2008 gives directives for the proper management of healthcare wastes and the Directorate General of Hospital Services (DGHS) has also provided training, equipment and logistics to the hospitals for safe management of such wastes. But it is poorly practiced in many hospitals and health care facilities such as Cox's Bazar, Rajshahi and Mymensingh. Colour coding for segregation and collection is not properly followed in most cases.

In many cases it was observed that general waste and infectious waste are mixed which increases the risk of spreading diseases among patients and attendants as well as the hospital staff and waste handlers themselves. For example the 'sharps' waste products, although small in number, are highly infectious. Contaminated needles and syringes represent a particular threat because they are sometimes scavenged and reused. This unregulated practice spreads diseases such as hepatitis B and HIV/AIDS. In such a situation of hospital waste management system many vital questions arise:

- Is it safe to go to the hospital?
- What are the risks of patients or their attendants catching infection while undergoing treatment?
- Is it safe to work at a hospital?
- Are nursing staff adequately protected against the germs and infectious materials that surround them?
- Are there adequate WASH facilities in the hospital?
- Is it safe to live near a hospital?

- Are dangerous items, infectious dressings and body parts left on piles of solid waste in the hospital premises accessible to scavengers, dogs and birds?
- Is noxious smoke and unpleasant smell discharged from burning of wastes causing air pollution?

Do these questions matter? Of course they do to the patients, their attendants, hospital staff and waste handlers. These unnecessary and avoidable risks of infection, caused by a lack of WASH facilities and careless handling of waste materials in and around healthcare facilities (WHO 2008), are neglected. Healthcare associated infections (HAIs) contribute to morbidity and mortality and to a loss of health-sector and household resources worldwide. 5-30% of patients develop one or more infections during a stay in hospital - a significant proportion of which could be avoided by proper management of WASH and health-care waste in the hospital (*Adams et al. 2008, Allegranzi et al., 2011*). A study conducted in Bangladesh recommended that if hospitals improve access to hand washing locations and promote proper disposal of waste in combination with behavior change communication the risk for disease transmission could be reduced (*Rimi et al., 2012*).

The essential requirements like safe drinking-water, water for hand washing, basic sanitation facilities, safe health-care waste management facilities, clean floors and fittings and hygiene messages need to be provided to the staff, patients and attendants for maintaining clean and healthy environment in the hospital. For effective sanitation and healthcare waste management, every healthcare establishment should have a clear goal and strategy and resources allocated to minimize health hazards and safeguard the surrounding environment. A policy and regulatory support and systematic approach is required and should be clearly defined to identify safety concerns within the medical establishment for handling, storage, transport, treatment and disposal of the generated wastes for minimizing the risk of public health and the environment.

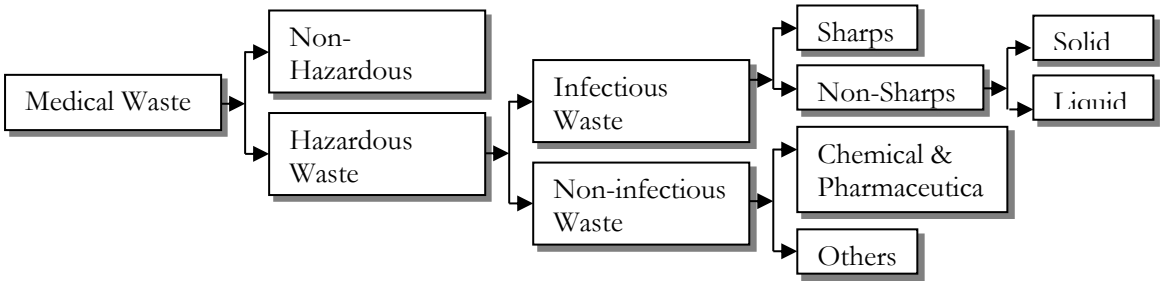

Fig.1. 1: Different types of wastes generated in the hospital (WHO-2001)

Generation of waste varies on a daily basis and depends on the numbers of patients admitted, operations performed and patients visiting outpatient departments (OPDs). Medical wastes are mainly categorized into non-hazardous and hazardous wastes. The

non-hazardous waste includes kitchen waste for which the healthcare authority does not require any special measures and may be delivered to the municipality for management and disposal. This type of waste is generated in the patients' ward areas, OPDs, kitchens and offices. The hazardous waste includes pathological, infectious, sharps and chemical wastes and is normally produced in labor wards, operating theatres and laboratories Fig.1.1

2 PURPOSE OF THE STUDY

This study seeks to help HCF management to identify gaps and improvement measures for safe, effective, economic and environmentally friendly and sustainable medical waste management in the HCF. The study also intends to help improve the occupational health conditions for health care staff and caretakers through reducing the risks to them as well as patients, attendants, visitors, general public, scavengers and also animals (stray dogs, cattle etc.).

3 OBJECTIVES OF THE ASSESSMENT

The objectives of the study are to:

i. assess the environmental health scenario that includes waste management, water, sanitation and hygiene in terms of the service availability and readiness in the hospital
ii. assess the occupational health and safety status of hospital staff, patients and caregivers, and
iii. Identify the gaps of the environmental health (especially HCWM) and explore best possible solutions to reduce the risk of HAIs.

4 METHODOLOGY OF THE ASSESSMENT

The study mainly followed a qualitative approach, capturing relevant information from the hospital by a variety of methods. Primary data was collected by visiting the hospital facilities. A checklist was prepared, based on the rapid assessment in WHO's "Essential environmental health standards in healthcare" and Bangladesh Medical Waste Management Rules-2008 to capture data about existing WASH and waste management facilities and practices and for designing future plans (shown in Annexes-I and II respectively). The study also included key informant interviews (and a meeting with staff to assess occupational health and safety), secondary data collection, and visual observation of different practices including a waste pathway (generation-storage-collection-disposal) study to understand the existing management system. Cross-checking tools were used during the field visit. The overall assessment procedure is presented in the schematic in Fig.1.2.

4.1 Field visit and observations

Field visits were carried out to observe the facilities and existing operational systems for WASH and HCWM facilities in Cox's Bazar Sadar Hospital by a two member team from DevCon. A data sheet and a checklist were used for systematic data collection (annex-.II and III). Physical observation was carried out to assess the existing sanitation and hygiene practice, waste collection, storage, and disposal mechanisms. Different steps in health-care waste management were observed and/or photographed such as segregation practice, cleanliness of waste bins, appropriate size of containers and their locations.

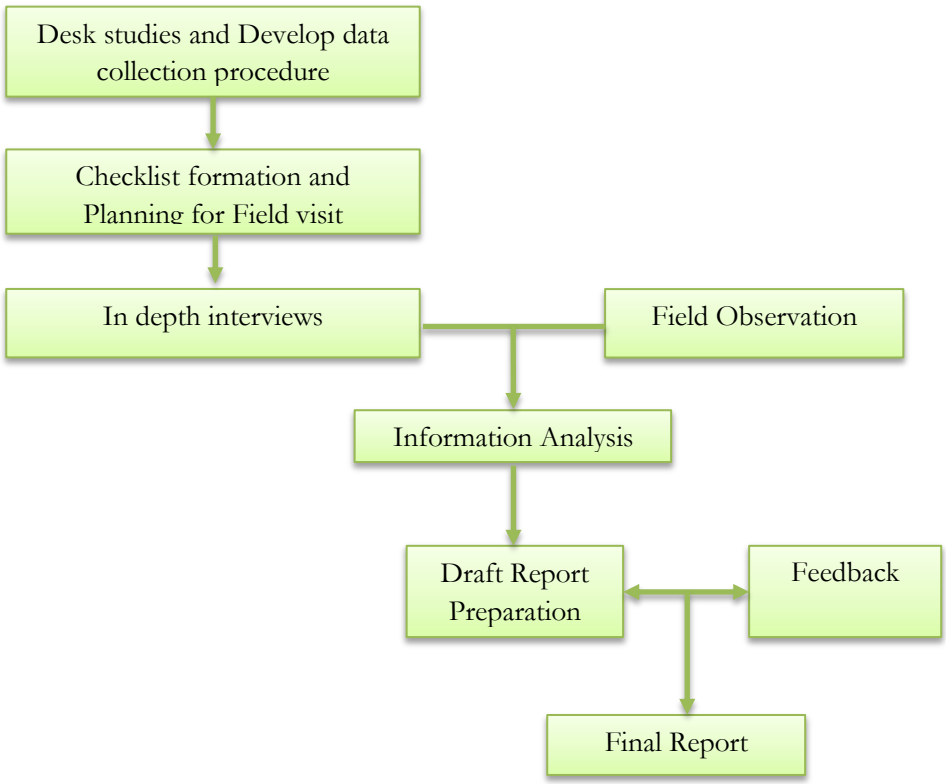

Fig.1. 2: Flow chart for methodological procedures of the study

4.2 Key informant interview

Seventeen people were interviewed (details below). Staffs were asked about hospital water supply, sanitation, hygiene practices and healthcare waste management. Cox's Bazar Pourashava was asked about their support for waste management and patients and visitors were asked about the hospital facilities.

Personnel	Nos.
Hospital superintendent	1
Resident Medical officer (In-charge)	1
Ward master (in-charge)	1
Senior Staff Nurse	1
Nursing supervisor	1
Nurses in the wards	3
Store keeper	1
Medical Technologist (Blood bank)	1
Conservancy Inspector of Cox's bazaar Pourashava	1
Patients and Visitors	4
Cleaner	2
Total	17

5 CURRENT WASH SITUATION IN THE HOSPITAL

5.1 General

Cox's Bazar District Sadar Hospital is a 250-bed hospital but the number of inpatients at any one time varies from 300 to 400 which suggests that a considerable number of patients have no other choice but to lie on the floor. UNHCR has provided 100 additional beds which are placed on the floors. The number of outpatients varies from 800 to 1000 per day while 150 to 200 patients receive emergency services per day. The hospital was managed by a Superintendent and staffed with 39 doctors, 64 nurses, nine medical technicians, 45 class III & Class IV employees (sweepers, ward boys and ayas) and five administrators.

The Superintendent, Resident Medical Officer (RMO) and Ward Masters were responsible for the cleanliness and the healthcare waste management of the hospital. Cleaners collected waste from wards, pathological laboratory and operating theaters and were supervised by the Ward Master. The cleaners were responsible for cleaning floors and collecting, storing and disposing of waste. Most of the cleaners had little or no service training on medical waste handling and they delivered the service in an unprofessional way. Most of the cleaners were not entitled in any formal salary structure. The RMO and Ward master posts were vacant during the visit. One ward boy was in charge of the Ward master. There were 42 cleaners (four from hospital, eight from Pourashava and 30 Rohingas provided by UNHCR) in the hospital. The cleaners had been working in 3 shifts in 10 hospital wards. The security service was contracted out to a contractor named *Gausia.*

There was no official committee to supervise the infection control and waste management. The Superintendent was responsible for maintaining and monitoring the

cleanliness of the hospital with the support of RMO and Ward Master. It was also observed that there was a lack of awareness among the patients, healthcare providers and waste handlers about the health implications of improper and unsafe handling of waste. The doctors and nurses maintained cleanliness by hand washing but the staff and the cleaners were lacking in hygiene and health safeguards.

5.2 Safe water

The main source of water is a deep-tube well installed in the hospital campus. The water is pumped into an overhead reservoir and distributed in various locations of the hospital through a piped network. There was no shortage of water supply except during power failures. There are a few hand tube-wells in the hospital grounds for backup supply during power failures but they do not function in the dry season.

The water is supplied to every location including the operating theatres and pathological laboratory untreated. However, there is a water purifier in the nursing hostel from where the hospital employees collect water for drinking purpose. Observation and interview revealed that the patients do not rely on tap water, therefore they collect drinking water from the water point at the pump house or from the nearby mosque in bottles or water pots. The tap water is not used for drinking purpose by anybody but used for hand washing, toilet flushing and medical activities only. Water quality test revealed that the current water supply is bacteriologically contaminated and hence unsafe for drinking. The Fecal coliform (FC) count in the water samples from female ward, male ward and from the doctors washroom/toilet found to be 100, 68, 72 cfu/100ml respectively. The tubewell water, however, was found safe with 0 cfu/100ml (Annex 1).

Public Works Department (PWD) is responsible for the repair and maintenance of the hospital building and its plumbing facilities. However, due to their poor response, the hospital authority cleaned the water reservoir biannually themselves. To keep the bibcocks serviceable is a challenge because they frequently break or are stolen. During the field visit, it was found that most of the taps in the washbasin were missing and the washbasins themselves were broken.

5.3 Sanitation

The overall sanitation situation in the hospital is grave in terms of cleanliness and functionality. There are two toilets, three urinals and two bathrooms in each ward. The washbasins in some wards are either broken or with bibcocks missing. Soap is not provided for hand washing because of the fear of being stolen. Usually the patients bring soap of their own to meet their need. There is a commode facility in the cabin which is comparatively clean and well fitted.

The sweepers clean the ward toilets twice a day with Harpic, and Phenol. Some toilets are reserved for doctors and staff. The male and female wards are separated. There are separate toilets for male and female in the outpatients department. Sufficient cleaning agents/soaps are provided for the doctors and nurses. The waste water disposal system is covered and cleaned at regular intervals. The septic tank is emptied when it is full. The condition of the sanitation facilities found during the field visit is shown in Fig.1.3.


Handwashing basin


Urinal


Urinals


Toilets

Fig.1. 3: The photograph of the sanitation facilities for the patients in wards

5.4 Waste

Healthcare wastes can be highly infectious and hazardous to human health because they may carry diseases like hepatitis B and C and HIV/AIDS. Healthcare waste must be segregated, collected, transported, treated and disposed of safely. Colour coding with proper labeling is essential for the separate collection and disposal of different types of wastes. It was observed in Cox's Bazar Sadar hospital in particular during the field visit that waste over-flowed from the bins and spread all over the hospital grounds because of the lack of proper waste management system.

According to the 'Bangladesh Medical Waste Management Handling Rules-2008', hospitals have to design a colour coded segregation system with black bins for general waste, yellow bins for infectious waste and red bins for sharp waste. An initiative was undertaken by a project of DGHS for waste segregation practice in the hospital. Doctors, nurses, medical staff and other relevant people were trained and colour coded bins were supplied. Black, yellow and red-coloured bins with proper labeling were provided. The three types of bin were used properly in the operating theatres and pathological laboratory. However, elsewhere, the bins were in use but the colour coding system was not properly followed. In addition the bins were not properly located according to the signs and information. The yellow bins were used for general waste – the most generated waste in the hospital. Wastes like green coconut shells, fruit peels were also disposed in to the yellow bins. It was further observed that the yellow bins are usually filled up and overflows within a short period of time. The photographs of wrongly signed with wrongly placed bins are shown in Fig. 1.4






Wrong colour coding bin | Wrong sign | Proper colour coded waste bins in the laboratory

Fig.1. 4: Photograph of wrongly signed and wrongly placed bins

UNHCR provided 40 yellow wheelie bins for waste collection to fulfill the demand of the hospital authority. Proper colour coding was not considered during the supply by UNHCR. UNHCR also provided three trolleys for waste transportation. The hospital authority also procured six trolleys for internal transportation of bins. Only one trolley was found on the passage, two were not used as the wheels were broken and three were found in the store. It was pointed out by the Ward Master that during the project period, the source-segregation and separate collection of waste was practiced but due to lack of monitoring and supervision, the initiative was stopped after sometime. Some photographs of the trolleys are presented in Fig. 1.5.


Fig.1. 5: Photograph of trolleys not used for internal transportation

The cleaning of the bins was not properly done and they were stored in an open place in the corridor. The workers were not given any protection for waste handling and cleaning. All types of bin were taken to the same disposal point located in the hospital grounds (Fig. 1.6).

Fig.1. 6: Photograph of storage and unloading of bins for washing

The disposal point was a covered dustbin with a ramp (Fig. 1.7) and not protected from scavengers or stray animals. Needle cutters were provided in the respective medical units and wards for destroying the needles. In the laboratory, the needle cutter was found properly used but elsewhere needle cutters were found on the table unused.

The workers of the private contractor *Gausia* wore gowns but no workers wore a mask or gloves when handling waste.

Fig.1. 7: Disposal point at hospital premise

Two types of container (a plastic bowl and a basket) were placed under the patient's bed in the wards and at regular intervals the cleaner emptied the contents of the bowl into a collection bucket with lid. It was also observed during the visit that after giving an injection, the nurse bent the needle manually (no use of needle cutter), cut off the nozzle of the syringe and put everything into the plastic bowl. The IV lines and plastic infusion bottles were also placed in the bucket. It was also disappointing to all these things (with needles either without cap or recapped) in several collection bins, including black bins. All types of bin were taken to the disposal point and without segregation or treatment unloaded in the dustbin for municipal collection. The municipality truck comes daily to collect waste. The hospital authority paid money directly to the truck driver to ensure daily collection. The wastes were transported

Fig.1. 8: Photograph of Plastic bowl under the bed

uncovered and dumped in the disposal ground with other wastes.

5.4.1 Type and amount of waste generated

A study was carried out by WHO and DGHS in 2012 on waste generation and composition in the Health Care Centers of Bangladesh including Cox's Bazar Sadar General Hospital. According to that study, average total waste generated per day was 485.5 kg of which general waste was 249.6 kg (51.4%), sharps were 12.4 kg (2.55%), liquid waste was 107.2 kg (22.08%), recyclables were 40.7 kg (8.38%) and infectious waste was 75.6 kg (15.57%). Average waste generation per day per bed was 1.94 kg. During the visit, it was difficult to estimate the different types of waste as all the waste was mixed into same container without segregation, except from the pathological laboratory, blood transfusion centre and operating theatres.

5.4.2 Collection and transportation of waste

Waste was collected and transported twice a day on a shift basis. Some of the containers during the collection were found to be empty and some were overflowing. It indicated that the size of containers used for waste collection or the frequency of empting did not match the amount and type of waste generated in a day. It seemed from observations that the trolleys were not used for transporting the containers. The containers were transported manually. The waste was collected even when the patient flow in the hospital was high and transported through the patients' walking route which was risky for the patients and visitors.

5.5 General cleanliness

Cleanliness is a basic measure for preventing infection. In general, the hospital appeared fairly clean. It was found during the visit (Fig 1.9) that the outpatient, inpatient and waiting space of the hospital was crowded with patients and their attendants. The floors seemed clean but the bins were overflowing with waste. Littering was also a big problem observed. Although bins were placed for waste people threw waste material indiscriminately. Spit from coughs and sneezes were observed in and around the areas where the bins were placed. A cleaning and mopping system existed in the hospital.

Dry sweeping is done in offices and lounges twice a day followed by a wet mopping. The specialized rooms such as operation theatres, delivery rooms, pathologies were cleaned with detergents or disinfectants. The toilets were cleaned with disinfectant (e.g. bleaching powder, Phenol and Harpic) daily and when required. The outside areas of the hospital were swept daily and drains were cleaned twice a week.

5.6 Health Protection of Staff

Hospital waste carries germs. Staffs were found to be at risk because of their inadequate personal protective equipment (PPE) during waste collection and transportation. Staff do not use masks and gloves. The awareness about waste handling was poor among the staff. No monitoring of proper use of PPE was found among the different category of staff.

Clean New-born unit

Wastes are collected in hand trolley

Waste dumping in hospital premise

Cleanliness message in the hospital

Fig.1. 9: General Cleanliness of the hospital

6 GAPS IDENTIFIED IN WASH AND WASTE MANAGEMENT IN THE HOSPITAL

Current Water supply, Sanitation and waste management systems are compared with the standard measures as per 'Essential Environmental Health Standards in Health Care' and gaps are identified for future improvement plan and targeting investment.

6.1 Water supply

The comparison of WASH situation against standard measure with identified gaps is described in Table 1.1.

Table1.1: Comparison of standard measures and existing situation for water supply

Standard Measure	Existing Situation	Gaps
A reliable drinking water point is accessible for staff, patients and patient attendants at all times. Drinking water points should be clearly marked. Reliable water point with soap or suitable alternative is available at all critical points within the HCS (operation theatres, wards, consultation chamber, dressing stations etc.) and in the service areas (sterilization laboratory, toilets). At least two hand washing basins in wards with more than 20 beds. Drinking water supplied should meet national standards and follow WHO guidelines for drinking water quality. Inpatient settings need to have sufficient showers (at least one shower for 40 users and separate showers for both sexes for privacy and safety).	The study hospital has a drinking water system and accessible for staff, patients and patient attendants at all times. There are no such marked drinking water points. Patients and attendants collect drinking water from outside. The operating theatres, consultation chambers, dressing stations, pathological laboratory and blood transfusion centre are equipped with wash basin with soap or alcohol based rubbing. There are two washbasins found near the toilets for 30 beds (The wards are mainly 20 bedded but 10 extra beds are also provided on the floor). In most cases the taps of the washing basins are missing. The water supply is bacteriologically contaminated and hence unsafe for drinking. The FC in the water samples from female ward, male ward and from the doctors' wash room/toilet found to be 100, 68 and 72 cfu/100ml respectively.	The water supply in the hospital is bacteriologically unsafe. No treatment facility is in place for operation theatre and labor ward and pathological laboratory. Hygiene and hand washing practices are compromised because of dysfunctional basins (with missing taps). Maintenance of water supply system such as cleaning of tanks, re-fixing of missing bib cocks and chlorination is weak

	There are two shower facilities in the wards (one for 15) which are sufficient for the in patients. The male and female patients have separate wards which maintain privacy and safety.	

6.2 Sanitation

Adequate, accessible and appropriate toilets for patients, staff and visitors are essential to ensure proper sanitation and hygiene. The standard measures and existing situation for sanitation are compared in Table 1.2:

Table1.2: Comparison of standard measures and existing situation sanitation and gaps identified

Standard Measure	Existing Situation	Gaps
Sufficient toilets are available in HCFs (one toilet per 20 users for inpatient settings and four toilets for outpatients: staff-1, male patient-1, female patient-1 and children-1). Toilets are easily accessible for all users (no more than 30m from all users), lockable by the users and lighting facilities at night. Toilets provide privacy and security (male and female specified). Toilets have convenient hand washing facilities close by. Routine cleaning and maintenance is in operation to ensure that clean and functional toilets	There are two toilets in each ward meaning that one toilet is dedicated for 15 inpatients (there 20 beds in each ward with extra 10 patients bedded on the floor. For the outpatient unit, there are separate toilets for hospital staff, (male and female). No separate toilet facility exists for the children. The patients managed their own soap for hand washing. One two seated public toilet in the hospital premises for out patients. The toilets were attached to each ward therefore accessible to all users of respective wards and lockable. Toilets provide privacy and security as they are male and female specified.	Separate toilets for male and female outpatients and children do not exit. Improved hygiene practice is compromised because of the dysfunctional wash basins. Cleaning activities are routine, it does not ensure that clean, odorless and functional toilets are available at all times. Soap and other cleaning agents are not available which also compromises the hygiene of the users. Locking and lighting facilities are insufficient and not regularly addressed. Regular monitoring or close supervision from the management to maintain a

Standard Measure	Existing Situation	Gaps
are available at all times. Toilets are cleaned whenever they become dirty and at least twice per day (with brush and disinfectant). Toilets are connected to a sewer system or septic tank and drainage system. Toilets are equipped for easy use by people with physical handicaps, heavily pregnant women, and elderly/sick people. Adequate drainage of waste water with cover to avoid the risks of disease vector breeding.	Hand washing basins are there but dysfunctional for missing taps. The toilets are cleaned twice a day but the cleanliness and hygiene are not maintained all the time. There was a support facility for the elderly or sick patients. Some toilet fittings had been broken and repair work was not done by PWD for a long time. Septic tanks usually emptying when they overflowed.	safe and clean environment in the hospital is weak.

6.3 Cleaning and hygiene practice

Floors and the surfaces in the healthcare facility should be kept clean. A routine programme of cleaning, sweeping and wet mopping is to be ensured. The standard measures and existing situation for cleaning and hygiene practice is compared in Table1.3:

Table1.3: Comparison of standard measures and existing situation for cleaning and hygiene practice

Standard Measure	Existing Situation	Gaps
Sweeping daily (office and non-patient areas), wet mopping daily (waiting areas, consultation rooms, wards, pharmacy), cleaning with detergent/disinfectant (operating theatre, delivery rooms, intensive care unit (ICU), casualty departments, laboratory,	Sweeping of the premises floors is done regularly following a cleaning schedule for the sweepers. The waiting areas, consultation rooms, wards are mopped twice in a day. The operating theater, delivery rooms, ICU, casualty department and laboratory	Cleaning activities are routine, it does not ensure that Any area contaminated with blood or body fluids are cleaned and disinfected immediately. The supervision and monitoring of cleaning by the hospital authority is

Standard Measure	Existing Situation	Gaps
kitchen). Any area contaminated with blood or body fluids are cleaned and disinfected immediately, beds/ pillows/linens cleaned between discharged and admitted patients and whenever soiled with body fluid, beds are wiped with disinfectant solution following each hospitalization. Staff are trained and managed in a way that encourages consistent compliance with infection control procedures. Patients and attendants are informed about essential behaviors necessary for limiting disease transmission in HCFs. Posters and other visual information should be used to promote disease control among patients and attendants.	rooms were cleaned with disinfectant. The toilets inside the operating theatre and ICU were cleaned twice daily using detergent. No programme for training of staff to encourage for consistent compliance of infection control procedure. No visual advice or instructions are seen for awareness and practice on cleanliness and infection control.	weak. Promotional programme for essential behaviors necessary for limiting disease transmission in HCFs were absent. There was no committee to monitor the cleaning activities.

6.4 Waste Collection and Disposal

Management of healthcare waste is an integral part of hospital hygiene and infection control. Healthcare waste is a reservoir of pathogenic microorganisms which can cause contamination and infection. If waste is inadequately managed, these microorganisms may be transmitted by direct contact, in the air or by a variety of vectors. Infectious waste contributes to the risk of nosocomial infections, putting the health of hospital personnel

and patients at risk. The standard measures and existing situation for healthcare waste management are compared in Table 1.4:

Table1.4: Comparison of standard measures and existing situation for healthcare waste management

Standard Measure	Existing Situation	Gaps
Healthcare waste must be segregated, collected, transported, treated and disposed of safely. Healthcare waste is segregated at the point of generation according to its type and categories: sharps, non-sharps infectious waste, non-sharps non-infectious waste. Colour coded waste containers or containers bearing clearly understood signs and symbols are provided at convenient locations. They are collected from all healthcare services and stored safely before treatment and/or disposal. Each category of waste is treated and disposed of according to the safest feasible method.	Three types of bins following the colour code are in place but segregation and separate collection and safe disposal are completely absent. All types of wastes were put together. Segregation at source and compliance of color coding is being followed in the pathological laboratory only. In the wards and elsewhere mixed waste, including a syringe with needle was found in the bins. Trolleys were not used for internal transportation of the bins. Needle cutters were not used in all medical units. The bins were labeled with text without pictorial sign. The labeling and position of the bins were mismatched. Most of the bins were seen full and overflowing. The lids of the bins were lost. The bins were taken to the disposal point for unloading and washed openly with water but without using disinfectant. The cleaning of bins was done in open place. The bins with	Hospital Management is not aware of the potential risks of healthcare waste. Overall the waste management system is not safe and has potential for spread of infection. All waste are mixed, thus the handling of mixed waste including sharps thus poses a high risk to the handlers and the surrounding communities. Color coding systems are not understood and being followed. The present process of recovery of recyclable materials through some hospital staff and the scavengers poses a big risk of spreading infectious agent to surrounding community. There is no record of waste generation and disposal to be maintained either by Municipality or the hospital

Standard Measure	Existing Situation	Gaps
	infectious wastes are not disinfected before placement. There was no treatment system of any type of waste and systematic recycling system. The cleaners did not wear protective gear and reluctant to do so.	

7 RECOMMENDATIONS

WASH and waste management are an essential part of the hospital management system for cleanliness, infection prevention and control of spreading diseases. It is found from the assessment above that the hospital has focused too much on clinical interventions to cure diseases and not enough on prevention. Hospitals need to set an example of being a clean and hygienic place in the community. They must demonstrate how to maintain cleanliness by ensuring proper water supply, sanitation and waste management. The overall guiding principles for the improvement of the hospital sanitary environment are as follows:

i) For safe drinking water supply, at least 10 water points with filters (Outpatient Departments-2, Male ward-1, Female ward-1 in (1st floor & 2nd floor), doctors canteen-1, general canteen-1, Neo-natal unit-1, superintendent room-1) need to be installed and clearly marked as safe drinking water points.

ii) Existing toilets must be repaired and maintained along with hand washing facilities to ensure a clean odourless environment all the time.

iii) A health education desk should be created to raise awareness to patients and visitors towards hand washing, use of toilets and waste bins of different category and colour coding system. The desk should explain about the risks of infection from patients, other sources and from certain medical waste. Information by posters and leaflets on hygiene promotion and practice should be displayed in the hospital premises to educate the people.

iv) Regular sweeping, wet mopping and cleaning service should be closely supervised and monitored. For this a written reporting system should be developed and used. It seems that very little happens until clear responsibility is assigned for particular functions. The person in charge (ward master) needs the support of the senior staff of the hospital.

v) Segregation of healthcare waste is essential for infection prevention and control. Colour coding for healthcare waste management should be properly

labeled and strictly followed. Sharps are generally regarded as the most hazardous type of healthcare waste. Sharp wastes must be collected separately and disposed of in an on-site sharp pit (a simple lined pit covered with a slab).

vi) Wastes from the pathological laboratory and isolation wards are regarded as the most infectious wastes and so they could be disinfected by autoclave or by burning through an incinerator before disposal. A technical detailed of Autoclave and Incinerator with regard to operational, regulatory and environmental issues is provided as a guideline for the management in Annex-II.

vii) Recycling of medical wastes may cause infection, so measures should be taken to prevent the recycling of hazardous items or otherwise reduce the risk associated with the items (by disinfection with chlorine) when they are recycled.

viii) The waste bins for general wastes should be bigger in size with proper colour coding (black) and labeling. Ensure that there are covers for all types of bin to reduce risks. For proper segregation the following measures should be taken:

- Bins are placed at the correct assigned place;
- Bins are accessible to patients;
- Adequate numbers of bins are placed;
- Placed bins are according to colour code;
- Bins are closed with lids;
- Bins are properly labeled;
- Surroundings of the bins are kept clean; and
- Placed bins are clean

ix) Separate collection and transportation of different types of medical waste should be ensured. Waste should be transported by designated trolley, through the designated route according to time schedule given by the hospital authority. The trolley or handcart should be easy to clean, load and unload, have a leak proof body and should not be used for anything other than waste transportation. The following procedures are to be in place during waste collection:

- Collection of waste is done according to plan;
- Same colour bin is used for specific type of waste collection;
- Emptying of bins is done properly;
- Record keeping system functioning in relation to waste collection;
- Waste handlers wearing protective equipment during waste handling;
- System of cleaning bins after emptying is in place; and
- Supervision and monitoring of collection of waste are done regularly.

x) Awareness on the importance of sanitation and hygiene be improved, at all levels. The first requirement is that the staff are trained, so that they know

what they should do and are confident that they can do it satisfactorily. Next, follow up and monitoring from the superintendent needs to be strengthening so that they continue to follow the required procedures without fail.

xi) A working Committee on 'Infection Prevention and Control' including cleanliness and waste management should be formed with proper working guidelines. The committee has to supervise and monitor the internal management of medical waste. The committee should implement and maintains the waste management policy and plan. Ward master has the main responsibility to supervise the proper waste storage and collection according to the prescribed rules and guidelines of medical waste handling. He has to communicate directly with the hospital superintendent or Resident Medical Officer and report all matters related to hospital cleanliness and safety measures.

xii) Reward system with clean ward contest should be conducted for encouraging the concern staffs of the hospital.

Below is an estimate for improving the healthcare waste disposal facility in Cox's Bazar Sadar Hospital:

Capital cost: BDT 59,10,000

1. Sharp disposal pit (5 ft ×5 ft) concrete = Tk. 5,00,000
2. Chlorination tank for syringe and other infectious items disinfection = Tk. 2,00,000
3. Shredder = Tk. 2,00,000
4. Burial pit (for body parts) = Tk. 2,00,000
5. Autoclave (125l/hr) including boiler = Tk. 30,00,000
6. Facility construction = Tk. 7,50,000
7. Cost of small Effluent Treatment Plant (ETP) for the waste water discharge = Tk. 50,000
8. Stand by generator (50kw) = Tk.10,00,000
9. Safety gear (mask, gloves etc.) = Tk. 10,000

Recurrent cost: BDT 5,40,000 (Monthly)

1. Staff wage (2) =Tk. 3,00,000
2. Fuel cost (kerosene/diesel) for steam boiler = Tk. 70,000
3. Electricity cost = Tk. 40,000-Tk. 50,000
4. Maintenance cost = Tk. 70,000
5. Water cost = Tk. 5,000
6. Training cost = Tk. 15,000
7. Cost for routine test and test prescribed by Department of Environment (DOE) = Tk. 20,000

REFERENCES

1.0 Medical Waste (Management and Processing) Rule 2008

2.0 Safe Management of wastes from health-care activities, A Pruss, E. Giroult and P. Rushbrook, World Health Organization, Geneva 1999

3.0 How are we managing our healthcare wastes? By Adrian Coad and Jurg Christen, March 1999, SKAT

4.0 Situation Assessment and analysis of hospital waste management, A K M Saidur Rahman, DGHS, Dhaka 2000

5.0 Essential environmental health standards in health care, Edited by John Adams, Jamie Bartram, Yves Chartier, World Health Organization 2008

ANNEX I

Micro-biological water quality testing.

Site : Sadar Hospital, Coxbazar.
Date of Testing: 03/9/2015
Time : 11 am
Field Kit Use : Millipore
Tested by : Md. Monower Hossain

Sample NO	Source Name	FC	
		1ml	100ml
01	Doctor station	3	72
02	Female Ward	5	>100
03	Male Ward	0	68
04	Tube well	0	2

ANNEX II

Assessment of technical, operational, regulatory and environmental issues related to incinerator and autoclave as a guideline

Parameter	Incinerator	Autoclave
Process and control parameter	Incinerator is a combustion process which reduces weight and volume of the wastes by 90%-95% producing flue gases and non-combustible residue (ash). Management of flue gases and ash requires careful consideration. Temperature is a controlling parameter of incinerator.	Autoclave is a sterilization process where temperature & pressure, steam penetration in the waste material, contact time are the influencing factors for controlling proper disinfection.
Capital and recurrent costs	Incinerator needs high capital and operating costs. For 20 Kg/hr capacity double chamber pyrolitic combustion incinerator costs around 40 to 50 lac. taka with air pollution control device dry scrubber 10 lac /wet scrubber 15 lac taka. For Incinerator i) Cost of Incinerator (20kg/hr) (Pyrolitic two combustion chambers) = Tk. 40,00,000 ii) Cost of Air pollution control unit (Dry scrubber)= Tk. 10,00,000 or Cost of Air pollution control unit (Wet scrubber) = Tk. 15,00,000 iii) Facility construction = Tk.7,50,000 iv) Installation (5% of the capital cost) =Tk. 2,50,000 v) Ash pit = Tk. 1,00,000 vi) Cost for safety gears = Tk.10,000 Recurrent cost: i) Staff wage (2) = Tk. 3,00,000 ii) Fuel cost (Kerosene/diesel) = Tk. 70,000 iii) Electricity cost = Tk. 40,000 iv) Maintenance cost=Tk. 1,00,000 v) Training cost= Tk. 15,000 vi) Cost for test prescribed by DOE= Tk. 50,000 vii) Cost test for dioxin, furan ,ash content etc. as per EPA guideline = US$10,000	Relatively low capital and operating costs. The capital cost of 125 liter capacity autoclave is around 25 -30 lac taka including the boiler. For size reduction of autoclaved wastes, it needs additional cost of shredder of about 2 lac taka. For Autoclave: i) Cost of Autoclave (125liter/hr)including boiler: Tk 30,00,000 ii) Facility construction = Tk. 7,50,000 iii) Cost of Shredder=Tk. 2,00,000 iv) Installation (5% of the capital cost) : Tk. 1,50,000 v) Cost for separate disposal cell of disinfected waste = Tk. 1,00,000 vi) Cost for a sharp pit=Tk. 5,00,000 vii) Cost of small ETP=Tk. 50,000 viii) Cost for safety gears = Tk. 10,000 Recurrent cost: i) Staff wage (2)=Tk. 3,00,000 ii) Fuel cost

Parameter	Incinerator	Autoclave
		(kerosene/diesel) for steam boiler = Tk. 70,000 iii) Electricity cost = Tk. 40000-Tk. 50,000 iv) Maintenance cost = Tk. 70,000 v) Water cost = Tk. 5000 vi) Training cost = Tk. 15,000 ix) Cost for routine test and test prescribed by DOE: Tk. 30,000
Potential environmental impacts and their feasibility of mitigation	Potential pollution risks and concerns associated with incineration process (Dioxin, Furan and their carcinogenicity). No burning of chlorinated plastic, maintaining temperature of around 850^0C, increasing combustion efficiency and using emission control equipment such as dry scrubber/bag filter or wet scrubber etc. can mitigate potential risks. Air pollution control equipment has to be used to control emission of particulate matter and toxic substances from the flue gases. The ash need to be disposed of in a pit.	Autoclave has a low environmental impact from emission. However, it has inability to change waste appearance, inability to change waste volume and production of pungent odor and uncharacterized air emission. The odor will not create any public nuisance if it will be operated in the landfill in a closed room. The volume and appearance of wastes can be changed by shredding and disposal will be done in a separate cell of landfill.
Standards need to be maintained according to Medical Waste Management Handing Rules 2008	a. Operating Standards: i) Combustion efficiency shall be at-least 99% ii) The temperature of the primary chamber shall be 800 ± 50^0C iii) The secondary chamber gas residence time shall be at-least 1 second at 1050 ± 50^0C with minimum 3% oxygen in the stack gas. b. Emission standard s: i) Particulate matter 150	When operating a gravity flow autoclave, medical waste shall be subjected to: (i) A temperature of not less than 121^0C and pressure of 15 psi for an autoclave residence time of not less than 60 mins; or (ii) A temperature of not less than 135^0C and pressure of 31 psi for an

Parameter	Incinerator	Autoclave
	mg/Nm^3, Nitrogen Oxide 450 mg/Nm^3, HCL 50 mg/Nm^3 ii) Minimum stack height shall be 30m above ground, iii) Volatile organic compounds in ash shall not be more than 0.01%.	autoclave residence time of not less than 45 mins; or (iii) A temperature of not less than 149^{0}C and pressure of 52 psi for an autoclave residence time of not less than 30 mins. Hazardous Medical waste shall not be considered properly treated unless the time, temperature and pressure indicators indicate that the required time, temperature, and pressure are reached during the autoclave process.
Air Quality monitoring as per medical waste management rules 2008	In Bangladesh, the operating and emission standards of Incinerator are: i) The combustion efficiency shall be at least 99%. ii) Particulate matter 150 mg/Nm^3, Nitrogen Oxide 450 mg/Nm^3, HCL 50 mg/Nm^3 iii) Minimum stack height shall be 30m above ground, iv) Volatile organic compounds in ash shall not be more than0.01%. Emission from the stake of the incinerator has to be done twice a year or sometimes four times in a year when the facility is installed in a town. For stake test, it has to pay Tk. 3000 each time. According to EPA guideline for incinerator operation, dioxin, furan, SOx, HCL, NOx etc. has to be tested. Ash has to be tested to find out heavy metal content etc. which is normally not tested in Bangladesh and expensive as well.	Hazardous medical waste shall not be considered properly treated unless the time, temperature and pressure indicators indicate that the required time, temperature and pressure are reached during the autoclave process. When operating a gravity flow autoclave, medical waste shall be subjected to: (i) A temperature of not less than 121^{0}C and pressure of 15 psi for an autoclave residence time of not less than 60 mins; or (ii) A temperature of not less than 135^{0}C and pressure of 31 psi for an autoclave residence time of not less than 45 mins; or (iii) A temperature of not less than 149^{0}C and pressure of 52

Parameter	Incinerator	Autoclave
		psi for an autoclave residence time of not less than 30 mins. Each autoclave shall have graphic or computer recording devices, which will automatically and continuously monitor and records dates, time of day, load identification number and operating parameters throughout the entire length of the autoclave cycle. Spore test: Biological indicator for autoclave shall be Bacillus stearothermophilus spores using vials or spore strips with at least 1×10^4 spores per milliliter. Routine test: A chemical indicator strip/tape that changes colour when a certain temperature is reached can be used to verify that a specific temperature has been achieved. It may be necessary to use more than one strip over the waste package at different location to ensure that the inner content of the package has been adequately autoclave.
Institutional training and monitoring requirement	With a basic understanding of incinerator technology and air pollution control mechanism is needed. Well trained operator can monitor and control combustion.	Needs a basic training to monitor temperature, pressure and residence time for the sterilization effectively done.

ANNEX III

CHECK LIST FOR WASH

Area	Indicators / Variables / Activities	Status		Remarks
		Yes	No	
Water quality (water for drinking, cooking, personal hygiene, medical activities, cleaning and laundry services)	Water source safe			
	Microbiological quality of the water supplied tested/monitored			
	Water storage tanks are cleaned and how often			
	Water is safe for drinking			
	Water is suitable for medical purpose			
Water quantity (Sufficient water is available at all times for drinking, food preparation, personal hygiene, medical activities, cleaning & laundry)	Sufficient water available at all times for all needs			
Water facilities and access to water (Sufficient water collection points and water use facilities are available in HCS for drinking, medical activities, personal hygiene, food preparation, laundry & cleaning)	Reliable drinking water points are accessible for staff, patients and careers at all times			
	Drinking water points are sufficient and clearly marked			
	Reliable water point with soap or suitable alternative is available at all critical points (Operation theatre, wards, consulting rooms, dressing stations, laboratory, kitchen etc.) [At least two hand washing basins in wards with more than 20 beds]			
	Inpatient settings have sufficient showers (At least one shower is available for 40 users and separate showers for both sexes for privacy and safety)			
	Alcohol based hand rub facilities exist			
Excreta Disposal (Adequate, accessible and appropriate toilets for patients, staff and careers)	Sufficient toilets are available in HCS (one per 20 users for inpatient settings, four toilets per outpatients)			
	Toilets easily accessible for all users (No more than 30m from all users)			
	Toilets provide privacy and security (Male and Female specified)			
	Clearly sign posted to help users finding them			
	Toilets maintained and repaired			
	Toilets hygienic to use and easy to clean			
	Hand washing facilities close by the toilets			
	Toilets connected to septic tank and soak pit			
	Equipped to make easy to use by people with special need			
	Lockable by users and lighting facility at night			

Area	Indicators / Variables / Activities	Status		Remarks
		Yes	No	
	Cleaning and maintenance routine in operation			
	Clean at least twice per day			
Waste water disposal	Waste water is disposed of rapidly and safely			
	All open waste water drainage covered to avoid the risks of disease vector breeding			
	On-site disposal in soak away/pits			
Cleaning and laundry (Floors and surfaces, laundry are kept clean)	Sweeping daily (office and non-patient areas)			
	Wet mopping daily (waiting areas, consulting rooms, wards, pharmacy)			
	Cleaning with detergent/disinfectant (OT, delivery rooms, ICU, casualty depts., laboratory, kitchen etc.) daily			
	Any areas contaminated with blood or body fluids cleaned and disinfected immediately			
	Beds/Pillows/linens are cleaned between patients and whenever soiled with body fluid			
	Beds are wiped with disinfectant solution following each hospitalization			
	Food kept covered to protect from flies and dust			
	Refuge kept in covered bins			
Information and Hygiene Promotion	Staff trained in infection control procedures			
	Patients and careers informed about limiting disease transmission			
	Posters and other visual information used to promote disease control among patients and careers			

ANNEX IV

CHECK LIST OF IN-HOUSE HEALTHCARE WASTE MANAGEMENT

Area	Indicators / Variables / Activities	Status		Remarks
		Yes	No	
Placement of Bin	Bins are placed at the right site (accessible for patients)			
	Placed bins are correct in number according to need(All places) OT, emergency, Casualty, OPD, Gynae, dressing etc. (one set of waste container per 20 beds in a ward)			
	Placed bins are correct in colour according to type of service delivery and also labeled			
	Bins are closed with lid and are clean			
	Surroundings cleanliness of the bins are maintained			
Segregation of waste according to classification	General waste segregated properly and placed in black colour bin			
	Infectious waste segregated properly and placed in yellow colour bin			
	Sharp waste are needle crushed and placed in red colour bin			
	General waste but recyclable segregated properly and placed in green colour bin			
	Liquid waste disposed properly (with treatment/without treatment)			
Collection of waste	Emptying of bins is done properly			
	Waste handlers are wearing protective materials during waste handling			
	System of cleaning bins after emptying are in place			
	Supervision and monitoring of collection of waste are done regularly			
Temporary waste storage room management	Dedicated temporary waste storage room			
	Concrete floor with good drainage			
	water supply for cleaning purpose			
	Inaccessible for unauthorized person, animals and insects			
	Easy access for the waste transportation trolley			
	Proper light, Passive ventilation			
	Situation of the room not near to the food preparation area			
Infection control and Safety measure	Wearing protective material like Service gloves, Apron, Boot, Mask			
	Doctors, nurses including waste handlers developed capacity on safety measures			
	Training received by designated staff on HCWM			
	Aware of HCWM rules or guidelines			
	Proper hand washing is practicing by doctors, nurses especially for the waste handlers after waste handling			

Area	Indicators / Variables / Activities	Status		Remarks
		Yes	No	
	Incidence reporting system is in place, especially for needle prick			
	Waste management and supervision committee is in place and sit at a regular interval			
	Safety measure discussed in the monthly waste management implementation coordination committee meeting			
	Responsibilities are distributed among the supervisor and staff for effective waste management			
Logistic management	Supply plastic bowls are adequate and properly used			
	Supply of protective material are sufficient in number			
	Supply of needle crushers are sufficient in number			
	Reserve stocks are available in the store for above mentioned material			
	Soap/hand washing materials are sufficient in quantity			
	Budgetary allocation available for logistic			
	Proper inventory system for waste management logistic			
Waste transfer and disposal and treatment Facility	Field Observation			