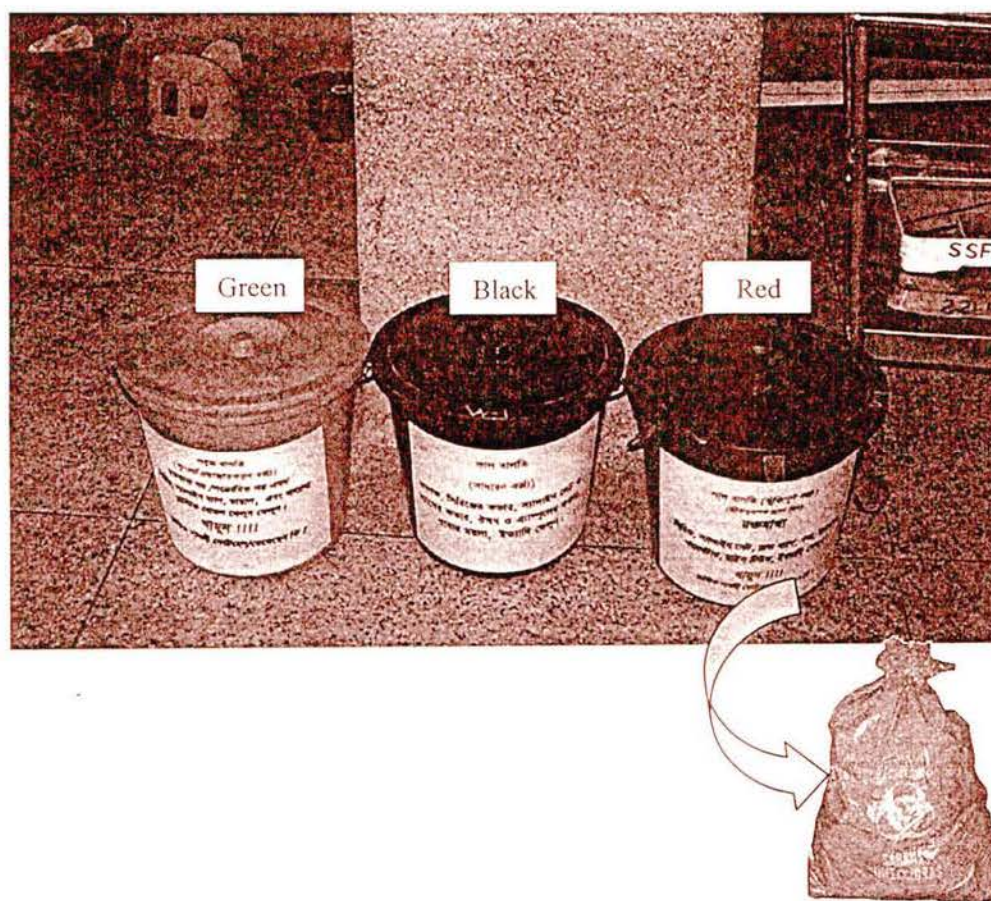


Improving in-house medical waste management: A pilot research

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Abstract

BRAC has undertaken a pilot project on improving in-house medical waste management in collaboration with three selected hospitals (Dhaka Shishu Hospital, Institute of Child Health and Shishu Shasthya Foundation, and one BRAC upgraded *Shushasthya*). As an outcome of this project, a manual on in-house medical waste management has been prepared. The pilot programme was designed to build awareness/consciousness among hospital staff and initiate some action programs with the hospital staff to streamline the existing waste management systems. To make the pilot programme successful the following steps were selected: i) baseline survey, ii) manual development and training, iii) implementation and follow up, and iv) finalize the manual on in-house medical waste management. The eight-month long project was implemented during January-August 2004. Baseline survey found that, a number of hospital staff specifically nurses and cleaners had been suffering from various kinds of infectious diseases, such as hepatitis B/C, skin disease/allergy, infection, diarrhoea, fever, headache, cough, asthma, and typhoid. Nurses were mostly injured during needle breaking (42%) and ampoule breaking (34%), and cleaners were injured during handling and cleaning waste. It was found that, 60% of sold items were plastics collected by unauthorized waste pickers such as used syringes, saline bags, water bottles, etc. from hospitals. After introducing the in-house management system in three hospitals, the amount of infectious waste became around 2%, recyclable 4-6% and above 90% were general waste that could be dumped to the municipal bin without treatment. Nevertheless, it should be kept in mind that the amount and quality of waste depends on proper segregation, hospital size, services, diseases type, waste category, and seasonality. To improve the medical waste management in Bangladesh, we recommend the following: i) raising awareness, training, and capacity building of hospital staff, ii) responsibilities inside hospital (designated personnel), iii) monitoring mechanism and committee, iv) role of City Corporation (transportation and central treatment system), v) hospital initiatives for proper medical waste management (cost, return), and vi) private sector and NGOs involvement.

List of Abbreviations:

| | |
|-------|----------------------------------------------------------|
| BHC | BRAC Health Center (BRAC Shushastho) |
| DCC | Dhaka City Corporation |
| DGH | Directorate General of Health |
| DOE | Department of Environment |
| DSH | Dhaka Shishu Hospital |
| GO | Government Organization |
| HBV | Hepatitis B Virus |
| HCV | Hepatitis C Virus |
| HIV | Human Immune Deficiency Virus |
| HW | Hazardous Waste |
| ICH | Institute of Child Health and Shishu Shasthya Foundation |
| IW | Infectious Waste |
| MOEF | Ministry of Environment and Forestry |
| MOHFP | Ministry of Health and Family Planning |
| MWM | Medical Waste Management |
| NGO | Non-Government Organization |
| PVC | Poly Vinyl Chloride |
| RCC | Rajshahi City Corporation |
| WHO | World Health Organization |

Introduction and Statement of the Problem

Medical waste is such a public health issues that attracts the government of both industrialized and developing countries. Certain categories of medical waste are potentially more dangerous over other waste (Air Waste, 1994). Medical waste is generated in different treatment process, which includes diagnosis, monitoring and preventive, curative or palliative activities in field of the veterinary and human medicine include infectious, hazardous and benign materials (Akter and Tränkler, 2003). Improper management and disposal of hospital wastes pose direct and indirect health impacts on hospital professionals, surrounding communities and the environment as well (Akter and Tränkler, 2003; Johnson, 1999). Some toxic effects are reported from the use of discarded medicine, which was collected from rubbish of hospital waste and use without any concern of physicians (Halbwachs, 1994). Waste from radioactive isotopes and genotoxic treatment may cause health risks and severe injury (WHO, 1999). It is evident from World Bank report (2000), that HBV, HCV, and even HIV can spread through hospital waste.

In developing countries where there is a lack of resources, training and awareness, needle injuries are common to the hospital professionals especially to nurses and cleaners. Moreover most of the cases the hospital professionals may not use proper personal protective devises as per necessary, which may led them to cause several injury.

As hospital waste contain infectious microbial agents, radioactive materials, sharps and others, which have potentiality to cause sever microbial infection, radiation burns or other injuries to the hospital staffs, patients and general people. Throughout the world every year an estimated 12 000 million injections are administered. It was also estimated (Hutin *et al*, 2003) that in transitional and developing countries the average number of health care injections per person to be 3.7 per year (this includes all heath care injections, including those given to diabetics for administrating insulin). And not all needles and syringes are properly disposed of, generating a considerable risk for injury and infection and opportunities for re-use. It is found that worldwide, 8-16 or 20 million hepatitis B, 2.3 to 4.7 million hepatitis C and 80,000 to 160,000 up to 250,000 HIV infections are estimated to occur yearly from re-use of infected needles. These chronic infections lead to a high burden of morbidity and mortality (WHO, 2000; Hutin *et al*, 2003). Another study (Hauri, Armstrong and Hutin, 2004) also showed that in developing and transitional countries, persons receive an average of 3.4 injections per year of which 39.3% are administered with reused equipment.

In June 2000, six children were diagnosed with a mild form of smallpox, affected from the waste of small pox vaccine at Vladivostok in Russia. Due to improper management of waste of radiotherapy, sever radiation burn was recorded at Goiânia, Brazil in 1988 in which four people died from acute radiation syndrome and 28 suffered serious radiation burns. Similar accidents happened in Mexico City in 1962, Algeria in 1978, Morocco in 1983 and Ciudad Juárez in Mexico in 1983 (WHO report). Several occupation injury and infectious diseases were also reported from Bangladesh related to hospital waste handling and disposal (Akter, *et al*, 2000, Akter and Tränkler 2003).

While hospitals and other health facilities in developing countries have developed certain safety standards in order to minimize the risk resulting from medical waste, the situation in developing countries is worrying. In developing countries, where many health concerns often

compete for very limited resources, the management of medical waste may not get the priority it deserves. Currently available information on medical waste management in developing countries shows lack of adequate or appropriate management structures/options, lack of funding, trained personnel, technical equipment and awareness is often the reason for improper waste management practices. Most of the developing countries use incinerator as the only options for treating medical waste. Even in some countries there is no existence of treatment facility or any kind of medical waste management practices (Akter, 2003). From the literature it is also found that, this technology is not always viable or appropriate for all developing countries considering the quality of incinerator, cost-effectiveness, acceptability, proper handling and maintenance. Regulatory or legal accepts of medical waste management in developing countries also an issue that has a role on proper handling and management of medical waste.

To date no low-cost, environmentally friendly and safe disposal options for health-care waste are available. Low-cost options are often polluting and are therefore indirectly potentially harmful to human health. The absence of management however also puts human health at risk. Significant improvements can however be achieved by management options such as introduce policies, guidelines, and segregation and proper treatment of significant portion of the waste.

Hospital authority and staff play an important role on the overall medical waste management system. Since different studies showed inadequate awareness among the hospital staff about waste management, an intensive training and/or awareness raising programme should be carried out before going for any intervention. Therefore, this pilot was designed to build awareness/ consciousness among hospital staff and initiate some action programs with the hospital staff to streamline the existing waste management systems.

Objectives

The aim of this pilot was to develop and introduce an appropriate waste management system in hospitals and clinics. The specific objectives of this project were:

- ♣ Initiate a pilot on in-house waste management in two children hospitals and one BRAC health center
- ♣ Develop guideline for proper waste management system and prepare background documentation to initiate discussion on formulating rules and regulation at government level
- ♣ Sensitize hospital management, policy makers, and building awareness among hospital staff (including doctor, nurses, cleaners etc.)
- ♣ Introduce environment friendly, healthy and economically viable in-house management systems for hospital

Methodology

Activities of pilot project

With a view to make a successful pilot project, following steps were undertaken:

1. Baseline survey
2. Manual development and training
3. Implementation and follow up
4. Finalize the manual on in-house medical waste management.

This is an action-oriented piloting. Above mentioned activities were further detailed out to the following activities:

1. Discussion meeting with hospital management and Initial waste inventory
2. Overview of selected hospitals and job description (staff, services, patients etc.)
3. Group discussion for situation improvement (participatory method)
4. Review of ongoing activities and identify the problems to be solved in a priority basis
5. Select the target group for training. Prepare a training manual on hospital waste management
6. Drafting a training manual/ guideline
7. Conduct training, workshop, awareness campaign (common awareness campaign for hospital officials, patients and visitors)
8. Finalize the manual/guideline
9. Bi-monthly meeting with the operational committee

A thirteen member operational committee (Appendix 1) was formed comprising relevant personnel from different organizations and government agencies. Periodic meetings were arranged with this committee to review the progress of this project activity and get the feedback.

Description of selected hospital

Two children hospitals and one BRAC Upgraded Shushastho (BRAC Health Center =BHC) was selected for this pilot. Those are Dhaka Shishu Hospital (DSH), Institute of Child Health and Shishu Shasthya Foundation (ICH), and BRAC Upgraded Shushastho, Mymensingh. As children are the most vulnerable group in the society children hospital were selected to provide better environment for child patient in those hospital. Size, distance and accessibility were also factor to select those hospitals. Dhaka Shishu Hospital is an autonomous public hospital, Institute of Child Health and Shishu Sastho Foundation is a private hospital and BRAC upgraded Shushastho is BRAC operated hospital in district level. These three hospitals were selected to get an idea about different type of administration and management as well.

Information on Dhaka Shishu Hospital, Agargoan, Dhaka

- 349 bedded hospital sometimes overloaded with more than the capacity
- 170 doctors (including consultants and medical officers)
- 162 nurses
- 150 other staff (Administrative 40 and MLSS 110)
- Services (name of the units): Pediatric medicine, Neonatology, Cardiology, Child Development, Pulmonology, Endocrinology, Hematology, Community pediatric, General Surgery, Burn and reconstruction, Urology, Nephrology.
- Microbiology laboratory and pathology

Information on Institute of Child Health and Shishu Sastho Foundation, Mirpur, Dhaka

- 98 bedded (one third of this is free of cost)
- 175 doctors (including consultants and medical officer)
- 46 nurses
- 42 other staff (MLSS, administrative),
- Services: all kind of child diseases
- Pathology

BRAC Upgraded Shushastho (BHC), Mymensingh Sadar

- 10 bedded
- two doctors
- 5 nurses
- one lab technician
- cleaners/ health workers
- Services: general for all and operation (scissor) for pregnant women
- Pathology for minimum lab analysis

Targeted audience and owner of findings

First level audiences are doctors, nurses, and hospital staff related to waste generation and handling. Second level audiences are hospital authority, health care services provider as well as all the relevant institutes and organizations involved in health care services. The Government and public implementing agencies such as Ministry of Health and Family Planning (MOHFP), Directorate General of Health (DGH), Ministry of Environment and Forestry (MOEF), Department of Environment (DOE), Dhaka City Corporation (DCC), other City Corporation is also be a part of it. The ultimate beneficiary of this project is the people and the environment of Bangladesh.

Time period

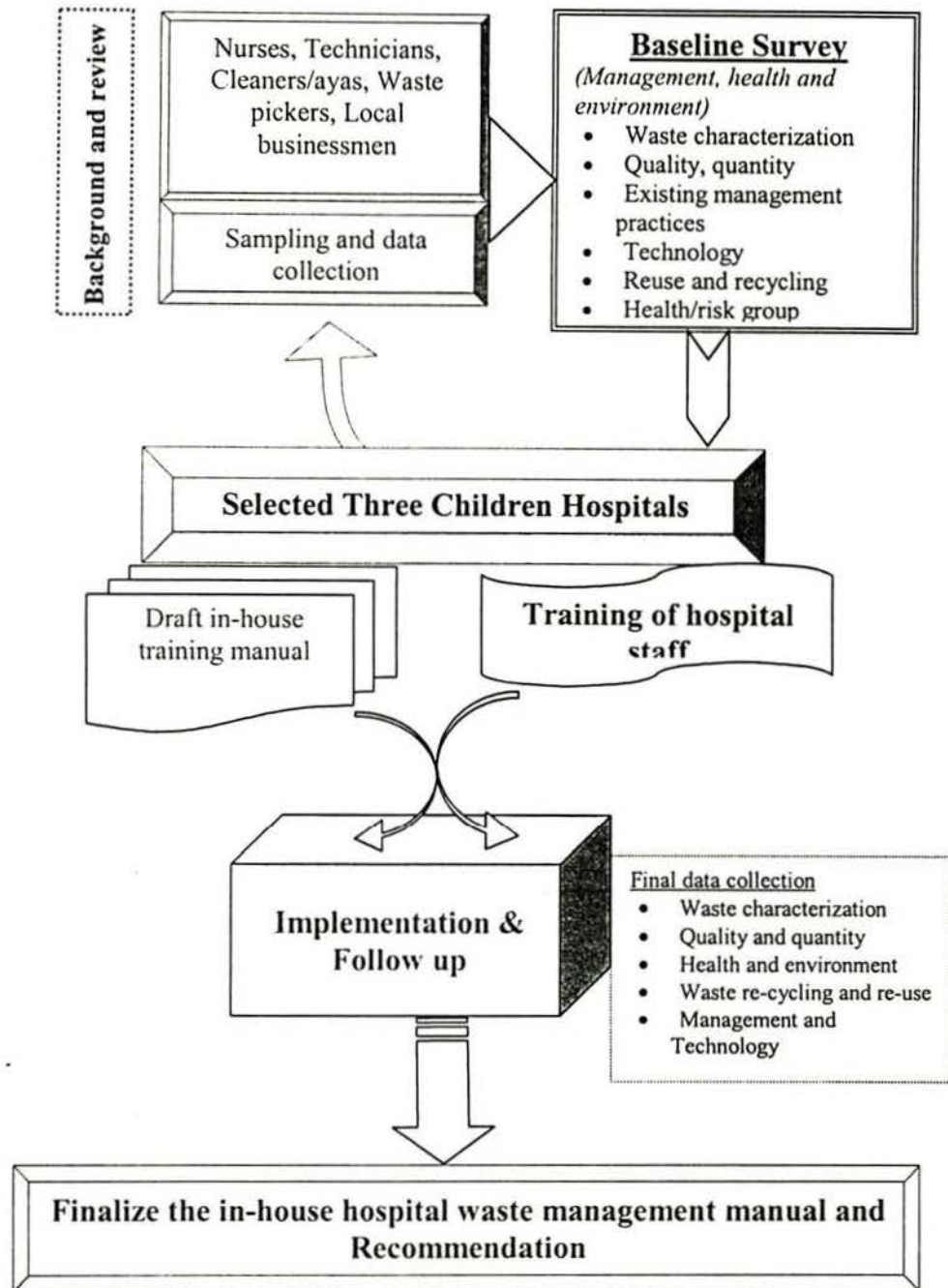
Six-month pilot initiated in January 2004. It was completed in August 2004 with one month extension. The in-house management practice is still going on at studied hospital after completion of the project.

Baseline survey

A baseline survey was conducted among the nurses, cleaners, ward boys and laboratory technicians of two child hospitals named Dhaka Shishu Hospital and Institute of Child Health and Shishu Sasthya Foundation Hospital. Small businessman and waste picker/ scavengers near by two hospitals were also selected. The survey was conducted to identify the professional injuries, disease incidences among different professionals, existing practice of waste management, provision of waste recycling and reuse. A questionnaire was developed for collecting information from selected groups. There were few in depth interviews were carried out to understand the system in side hospitals. Total 201 persons were interviewed among them 90 from Dhaka shishu hospital and it's area and 111 from Shishu Sastya Foundation Hospital and it's area. Among 201 participants, 147 were female and 54 were male.

Study Design

Following flow diagram explained the study design for this pilot.



Respondents categories

There were 39 nurses from ICH and 66 nurses from DSH interviewed. All of them are female. Either sex is found in the profession of Aya/ward boy/cleaner, Lab technicians and waste pickers (Table 1). Most of cleaners/ayas are female where the most lab technicians are

male. Almost all waste pickers are male except one at DSH and all businessmen are male. This might be due to the nature of job and cultural issues in Bangladesh.

Table 1 respondent for baseline survey at two children hospitals

| Profession | ICH | | | DSH | | |
|------------------------|-----------|-----------|-----------|------------|-----------|-----------|
| | Total | Female | Male | Total | Female | Male |
| Nurse | 39 | 39 | 0 | 66 | 66 | 0 |
| Aya/ ward boy/ cleaner | 27 | 18 | 9 | 25 | 19 | 6 |
| Waste picker | 7 | 0 | 7 | 11 | 1 | 10 |
| Lab technician | 10 | 3 | 7 | 6 | 1 | 5 |
| Local business | 7 | 0 | 7 | 3 | 0 | 3 |
| Total | 90 | 60 | 30 | 111 | 87 | 24 |

Training

A training manual was drafted based on baseline survey and background study. This manual was also been consulted with the operational committee formulated for this pilot study (appendix 1). One-day orientation training was organized at two hospitals after consulting the operational committee and hospital personnel. Participants came from all three hospitals according to the schedule. Information on *occupational injury and feedback* from participants were collected after each session. Those were compiled and analyzed to finalize the report.

Implementation and follow up

Getting feedback from participants and discussing with the operational committee a half-day workshop was organized to refine the in-house hospital waste manual. All concerned stakeholders were invited to participate the workshop. That manual was then implemented at three hospitals. Following the guideline a focal person in each hospital was selected to follow up the activities.

After implementing the manual final set data were collected from those three hospitals particularly on *waste generation, characterization, recycling, and onsite treatment*.

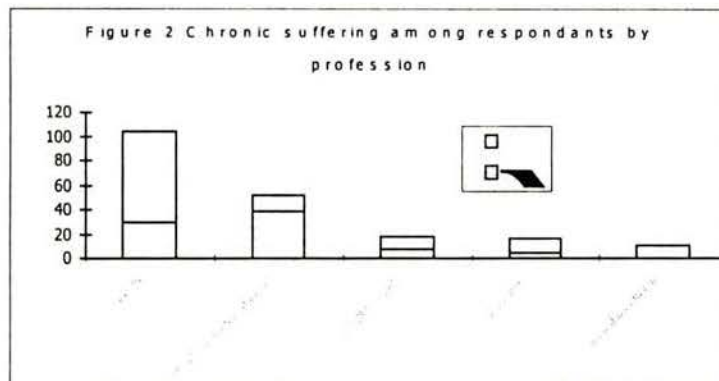
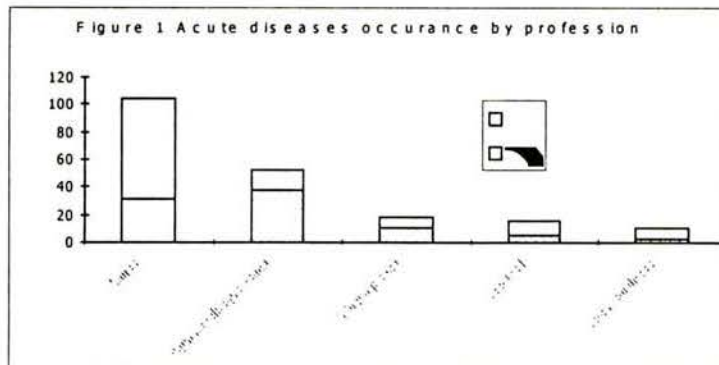
Finalizing the manual

The final workshop to finalize the manual and final treatment options another workshop was organized. Participants from all concerned stakeholders such as DCC, RCC, DGH, MOPH, MOEF, DOE, hospital authority, medical professional, nurse, NGOs, Treatment Company and experts participated in the workshop. All feedback and suggestions were incorporated to finalize the manual.

Result of Baseline Survey

Diseases incidents among respondents

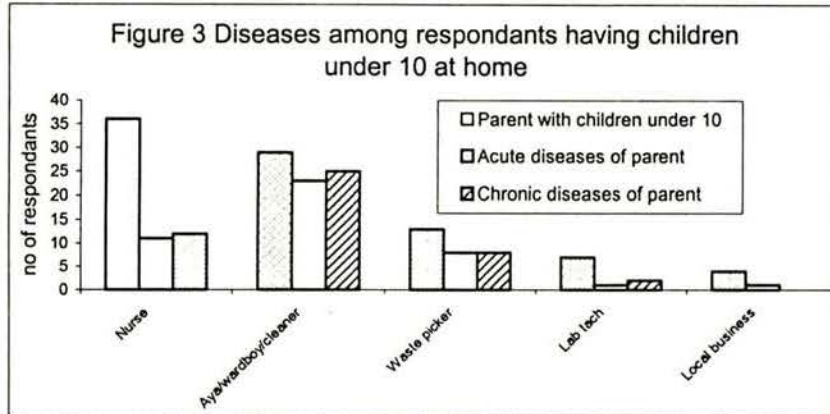
Respondents were asked if they had any diseases within 15 days of interview and long time disease. It was found that acute and chronic diseases among different professions in the hospital might have some positive relation between profession and disease occurrences (Figure 1 and 2). Figure 1 and 2 showed that the nurses and aya/ward boy/cleaner are most affected group. They are suffering from both acute and chronic diseases. Almost all groups have some kind of disease occurrence. Nevertheless, no chronic disease was observed to the people engaged in business at that locality. As the cleaners and the waste pickers are always exposed to the waste and they do not use any personal protective devices, the incidence of disease occurrence among these two groups (within group) is higher than other groups.



Respondent's diseases with children under 10 years

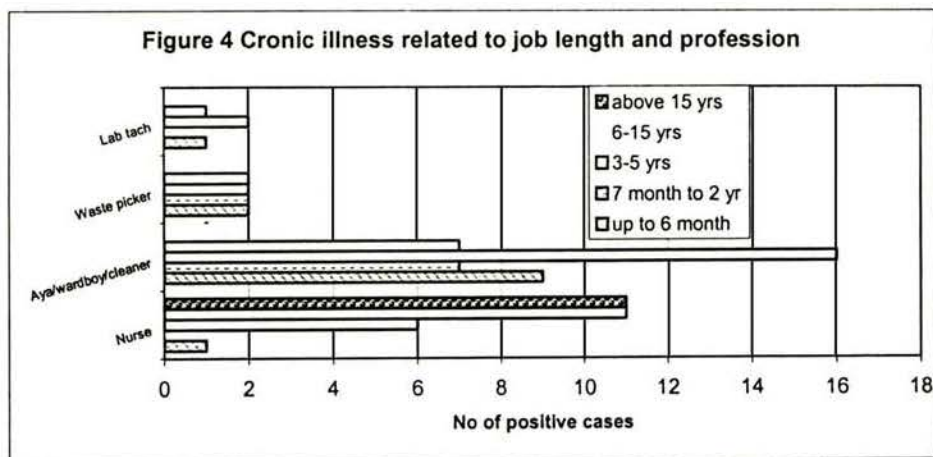
It is evident children are more susceptible to any kind of diseases. Information were collected to see if any parent had any diseases who has children under 10 years at home. Results are shown in figure 3. It is found that disease incidence in the mother in Aya/ward boy/cleaner professions are higher than others groups. Waste pickers are the second most susceptible to both acute and chronic disease. Disease incidence among nurses and lab technicians are relatively less than other two groups.

The most common diseases (both in acute and chronic) found among respondents are *Hepatitis B/ C, skin disease/ allergy, infection, diarrhea, fever, headache, cough, asthma, typhoid, other noninfectious*. Similar results were found in the year 2000 from hospitals at Dhaka city (Akter *et al*, 2002; Akter & Tränkler, 2003).



Service length and disease incidence

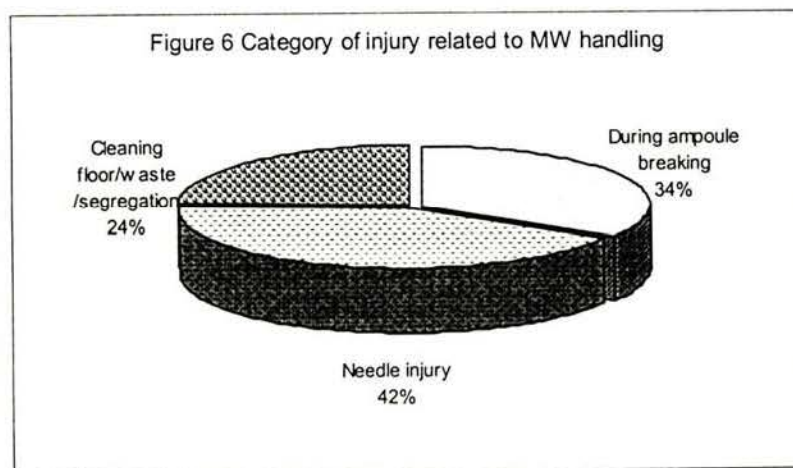
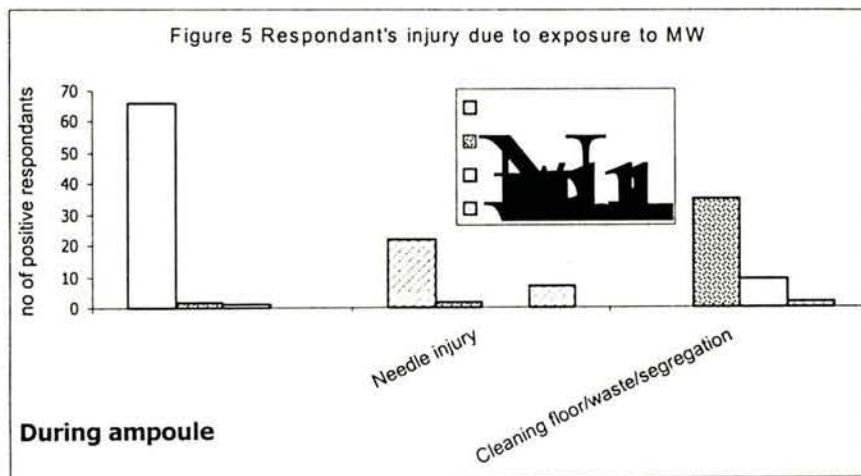
To observe the impacts of long-term exposure of the clinical waste on human health, a component was added in the questionnaire to see the service length of the target people and their sufferings from chronic diseases. This information was collected from the people of all professions. It is found that less people are involved in these professions for more than 15 years. From this survey it was found that except nurses most of the people are involved in these professions around 3 to 15 years. It was observed (Figure 4) that except local businessman (not is figure) and lab technicians all other professions have positive relation between service length and chronic disease. The reason of less chronic disease among local businessman and lab technicians is that, local businessmen are not involved in waste management directly and the lab technicians are quite aware about their personal protective devises. It was also observed that professions with waste handling and patient management are equally vulnerable to diseases such as nurses and aya/cleaners.



Professional injuries

From this study it is found that every profession has some risk of injury due to exposure to medical waste (Figure 5). Nurses are the most vulnerable group in case of professional injuries especially for sharp injury (Ampoule and needle). Cleaners/ayas, waste pickers and lab technicians are also at great risk. Needle and ampoule injury is higher in nurses than others and in almost every needle injury happened during pushing injection. Cleaner/aya usually got sharp injury during doing cleaning activities, waste collection and segregation.

Waste pickers are normally injured during collection of saleable materials from the dustbin. It was found that among total professional injuries 42% was needle injury caused during pushing injection or blood drawing from patients at the laboratory, 24% was sharp injury during cleaning and rest 34% was injury during ampoule breaking (Figure 6).



From this result it is assumed that there is potential risk of various infectious diseases are associated with injury and accident.

Waste reuse and recycling

Respondents were asked about the kind of waste are being reused or recycled from hospital and/or dustbin. Information was gathered on items they collect and sell from inside hospital and dustbin. Waste pickers and cleaners/aya collect recyclable item from the roadside, dustbin, hospital ward, operation theatre, ICU and pathology unit. These items were water bottle, iron/tin paper/carton/box, ampoule/vial, polybag/plastics, saline bag/set, blood bag/set, canola/catheter, suction tube/rice tube, syringes, glass/broken glass, and surgery blade. Waste pickers sold those items. It was noticed that aya/cleaners also collect and sell few items informally without informing hospital authority. Nevertheless, all respondents stated above-mentioned items as those are sold informally. Figure 7 showed items sold from hospital waste. It can be seen that most of the items are plastic items except paper, glass and iron

(Figure 7). It was found that quite a good proportion of saline bag and syringes are sold. Therefore, there is a risk of illegal re-use of syringe and saline bag.

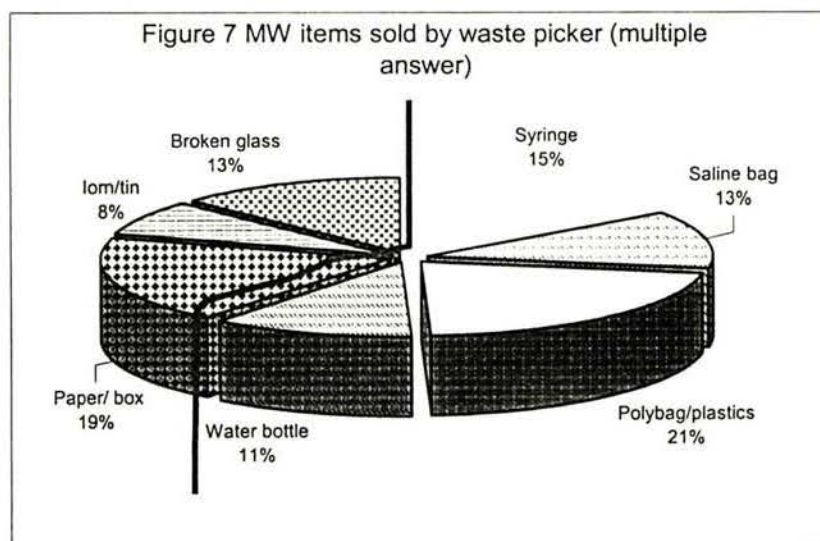


Table 2 Price (tk/kg) of item sold by waste picker

| Item | Price (tk/kg) | Common price |
|---------------------|---------------|--------------|
| Syringe | 10-20 | 20 |
| Saline bag | 10-24 | 20 |
| Water bottle | 7-10 | 10 |
| Paper | 2-5 | 2 |
| Other plastic items | 10-20 | 10 |
| Broken glass | 1.5-5 | 2 |
| Metal container | 4-10 | |

Table 3 Daily incomes from waste selling

| Waste selling (Taka/day) | (%) of responses |
|--------------------------|------------------|
| 125 | 6.7 |
| 80 | 13.3 |
| 60 | 13.3 |
| 50 | 20.0 |
| 45 | 6.7 |
| 40 | 33.3 |
| 20 | 6.7 |

Waste picker usually sell collected items at following rate (Table 2). Waste pickers earn 20 taka to 125 taka daily by selling those hospital waste (table 3). Income depends on type of items they collect from hospital waste. Syringes and saline bags are most expensive item. This also reveals that there is a risk of re-pack and re-use of those items by unscrupulous manufacturer. This information can insist or help to think of profitable business for the hospital in safer way. Nevertheless, waste should be properly segregated, and safely disposed.

Any possibilities of re-use of syringes and saline bag should be prohibited before selling those items. All kind of potential contamination and professional hazard should be taken into account before going for selling those items from hospital.

According to Hauri, Armstrong and Hutin (2004), in absolute numbers of infections caused from reuse of injection indicated that globally, in 2000, contaminated injections may have caused 20.6 million new HBV infections, 2.0 million HCV infections and 260,000 HIV infections. This study also said that, in the year 2000, four decades after the widespread availability of single-use injection equipment and two decades into the HIV pandemic, contaminated injections account for close to a third of new HBV infections, 40% of new HCV infections and 5% of new HIV infections. They found HBV is the most prevalent and the one most easily transmitted through injections. This transmission and contamination may come from injury and/or reuse of injections as well. Therefore, the possibilities of potential re-use of syringes should be carefully protected and monitored.

Manual development and training

Based on field experience and literature review a manual for in-house hospital waste management was drafted in the context of Bangladesh socio-economic condition, awareness level, and resource availability. Resources considered are health facilities, health personnel, instruments, skilled staff, and financial matters. Before launching the training several workshops and meeting were organized with the operational committee and hospital personnel (including administrative authority) to sensitize them on this issue.

As a part of this action oriented pilot, a one-day training was organized for six batches. For each of the batches participants were from Dhaka Shishu Hospital, Institute of Child Health and Shishu Sasthya Foundation Hospital, Mirpur and Shu-Sayasthya of BRAC (Mymanshing). Heterogeneous participant (Doctor, Nurses, Cleaners, Aya, Laboratory Technicians and Attendants) were selected for all of the trainings. Around 20 participants were participated in each batch and the total numbers of participants were 125. Training venue was supported by DSH and ICH. Both lecture and participatory method were applied for conducting the training.

Brief description on training is given below.

Objectives of the training: Training programme was undertaken with the following objectives:

After completion of this training participants will be able to understand-

- ♣ Environment friendly, healthy and economically viable in-house management systems for medical waste
- ♣ Environment, Health and Safety for hospital, healthcare service provider, health worker and people related with waste generation and handling

Contents of the training module: Training was designed in such a way that participants can easily understand the hazardous effects of medical waste to the health care professionals, general peoples, ecosystems and environment. They also get some conception regarding the importance of personal protective devises and proper in-house management of hospital waste as designed by pilot project. Area covered in this training were as follows:

- ♣ Definition of waste and medical waste
- ♣ Classification of the medical waste
- ♣ Health impacts of improper management of medical waste
- ♣ Proposed in-house management system
- ♣ Management of sharp items (special emphasis)
- ♣ Safe transportation and final disposal options
- ♣ Importance of personal protective devises

Training manual prepared in Bengali and training was conducted in Bengali as well.

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Immediate impacts of training

Though the participant were heterogeneous, response and participation of all levels were quite good. It was found that the professionals are usually not aware about the injury *i.e.* few respondents did not consider needle stick as injury. It was reflected in their responses before and after training. Information regarding professional needle injury varied before and after awareness training. Among nurses needle injury was recorded 15% before training but after training it was 37% (Figure 8). Almost similar scenario was observed among the lab technicians. Response to needle injury was 26% before training and it became 30% after training (Figure 9). Information on professional injuries was collected using viv-card. Therefore, cleaners/ayas could not respond due to their illiteracy. Nevertheless, participants seemed to be more aware about injury and any kind of health hazards related to hazardous waste (infectious, non infectious, and sharp) after training. It was also observed during hospital visit after training and implementation of guideline in hospitals. It was possible because of the hospital authority's willingness and motivation as well.

Figure 8 Change in nurse's perception on injury after training

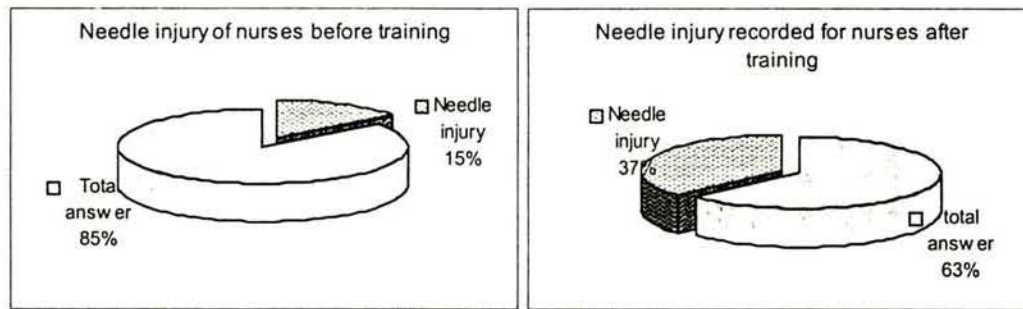
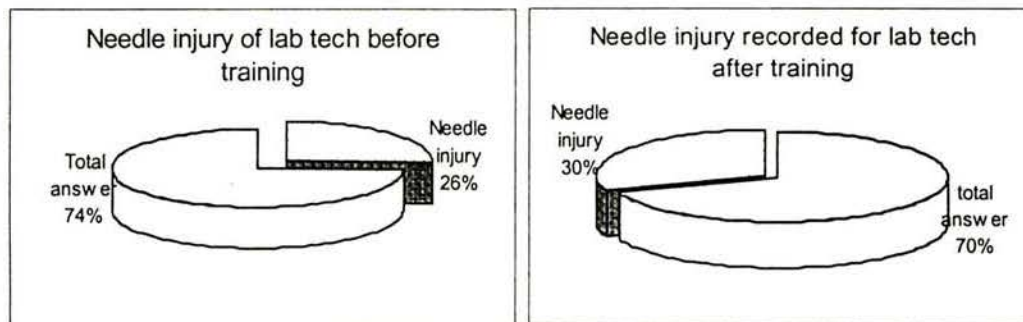
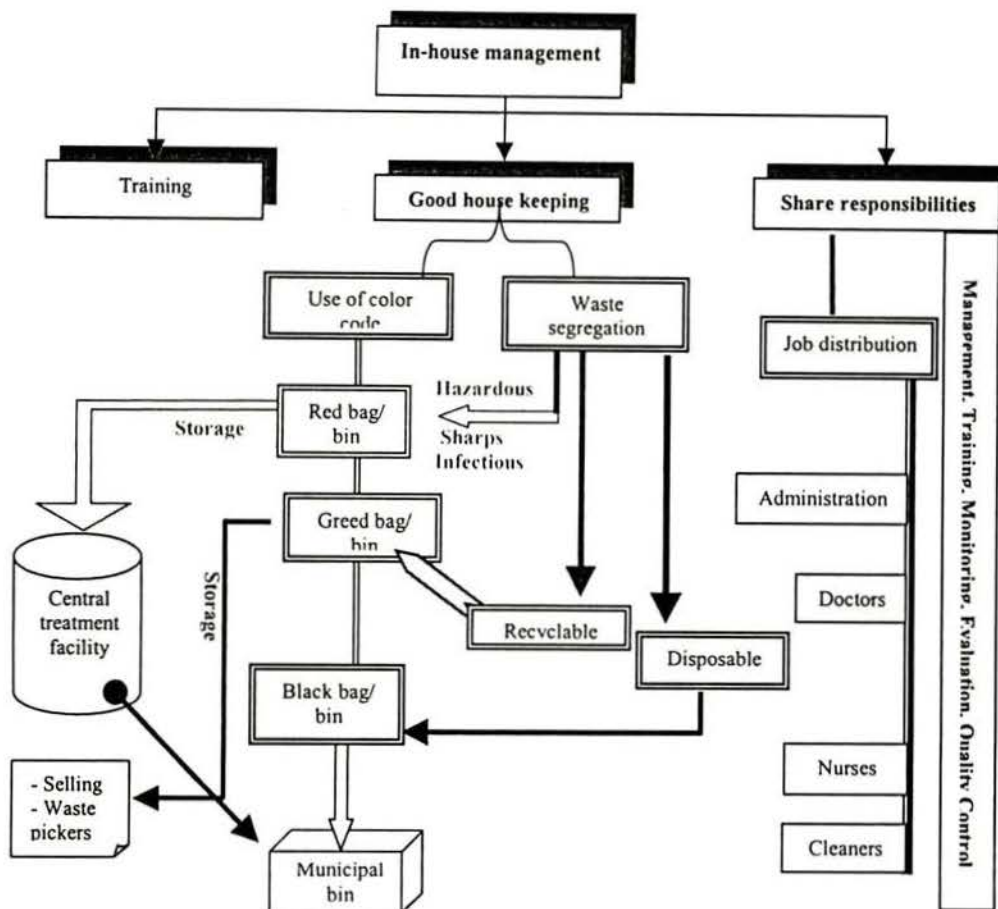


Figure 9 Change in laboratory technician's perception on injury after training



Seminar/discussion meeting

Two half-day discussion meeting (with operational committee and all possible stakeholders) were organized to discuss the progress, strategy and future possible activities/steps to make the project successful. First seminar was organized to make an initial discussion among the operational committee and hospital authority. Second discussion seminar was held with operational committee and participants from government agencies, NGOs, private and public hospital personnel, health professionals, doctors and nurses. Both of the seminars were half-day long. Experience, problems and possible solutions were discussed in the meeting. All seemed agree with the in-house management system followed by this pilot. However, all were concerned about the final treatment and disposal of 'red bag waste' *i.e.* hazardous waste. Meeting also suggested few immediate possible steps for low cost medical waste management and treatment technologies such as laboratory waste (microbial culture) disinfected by boiling, use of low cost disinfectant in 'red bag' waste, cutting or destroying syringes and saline bag to prohibit re-use, burning of non-pvc waste, etc. Those were added in the in-house medical waste management guideline/manual. The proposed guideline for in-house management system in said hospitals is outlined in the following page.



Implementation of guideline based on manual and follow-up

The proposed method for in-house management of medical waste has already been implemented in three hospitals (BHC, DSH, ICH). To follow-up and monitor this process a person was designated in each hospital. This person monitors each and every component of the in-house waste management activities. After implementing this management system BRAC research team also monitored and follow up the activities and collected data on waste generation by category. Results of waste generation are given in table 4 below.

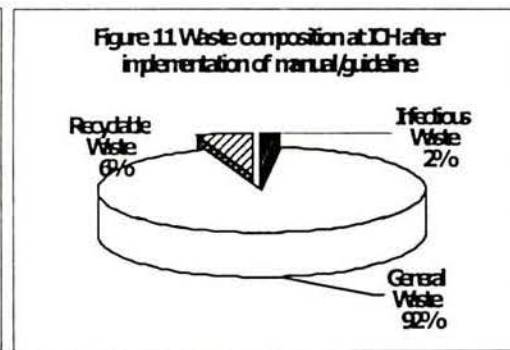
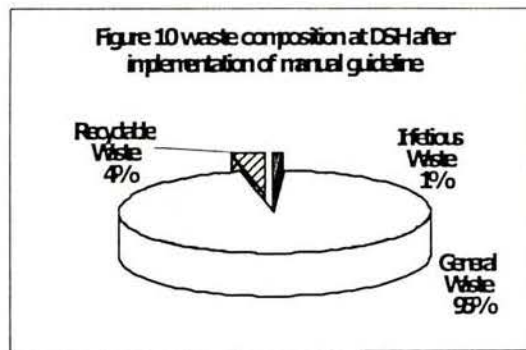
It is noted that all sharps, infectious and other hazardous waste were considered as 'infectious waste' here. This category is kept in red bin packed with a red bag made for this purpose. All needles are kept in hard plastic bottle with disinfectant, that bottle is than discarded in red bag along with other infectious waste. Infectious waste in red bag also disinfect using low cost disinfectant e.g. chlorine solution. It is noted that these hospitals did not generate hazardous waste like radioactive waste. Though some chemical waste generated in the laboratory was advised to dilute (10 times) and pour in sewerage drain. Therefore, that was not included in the data. From the data it can be seen that general waste are the major portion of hospital waste in the studied hospital. That is kept in black bin and disposed to municipal dustbin

afterward. Infectious/hazardous waste was only 1-2% and recyclables was 4-6% only (Figure 10 & 11). This small proportion of waste such as saline bag and uncontaminated syringes (as recyclable waste) are sold from the studied hospitals. Green bin is being used to keep this category of waste. Those recyclables are destroyed before sending to the recyclable bin to protect any kind of re-use. A simple metal made cutter is being used to cut syringes and saline bag before disposal.

Compare to WHO data or other studies conducted in different countries, this percentage is quite small. This is because the hospital size, service and nature of diseases treated in these hospitals. Amount of general waste was higher compare to other study as this included food waste also. Moreover, as these are children hospital all patients were attended with at least one or more attendant that also contributed to general waste quantity. This also is mentioned that if waste could be segregated properly, the amount of infectious waste reduced drastically. Similar result also found in a study at Bangkok where the infectious waste dropped down to 7% after proper segregation (Akter, 2003).

Table 4 Waste generation by category at three hospitals after implementation of manual/guideline (average within bracket)

| Waste category | Amount of generated waste (Kg/day) | | |
|---------------------------------|------------------------------------|------------------|------------------|
| | DSH 349 bedded | ICH 98 bedded | BHC 10 bedded |
| General (non-infectious + food) | 205-221 | 50-56 | 5-6 |
| Infectious/ Hazardous | 1-3.5 | 0.5-2 | >1 |
| Recyclable | 4.4-11.5 | 2-3.8 | ~1 |



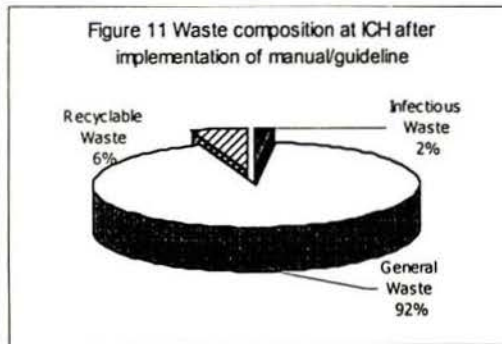
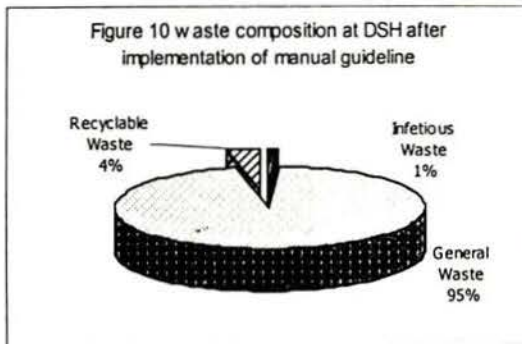
Variation in waste quantity and quality also depend on proper segregation, hospital size, services, diseases type, waste category, and seasonality. Therefore, the quality and quantity of waste differs country to country, region to region and also season to season. Nevertheless, when the segregation is not done properly, the whole amount of waste including general waste become contaminated. It would be easy to handle and/or treat one or 4 kg of infectious waste for every hospital if it was segregated properly. Rest general waste could be sent to the municipal bin.

afterward. Infectious/hazardous waste was only 1-2% and recyclables was 4-6% only (Figure 10 & 11). This small proportion of waste such as saline bag and uncontaminated syringes (as recyclable waste) are sold from the studied hospitals. Green bin is being used to keep this category of waste. Those recyclables are destroyed before sending to the recyclable bin to protect any kind of re-use. A simple metal made cutter is being used to cut syringes and saline bag before disposal.

Compare to WHO data or other studies conducted in different countries, this percentage is quite small. This is because the hospital size, service and nature of diseases treated in these hospitals. Amount of general waste was higher compare to other study as this included food waste also. Moreover, as these are children hospital all patients were attended with at least one or more attendant that also contributed to general waste quantity. This also is mentioned that if waste could be segregated properly, the amount of infectious waste reduced drastically. Similar result also found in a study at Bangkok where the infectious waste dropped down to 7% after proper segregation (Akter, 2003).

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Finalizing the manual for in-house medical waste management

There have been several manuals prepared for in-house medical waste management in Bangladesh. None of these are effectively implemented at hospital level. Considering those experience and current practices in hospitals this manual was formulated to streamline the ongoing practices in appropriate manner. Before finalize the manual practical obstacles and field experiences were discussed and corrective measures were incorporated in the manual. As the manual was finalized, a workshop was organized to launch this manual among all possible stakeholders (GO, NGO and private organizations/institutes, professionals, experts).

Final treatment and disposal

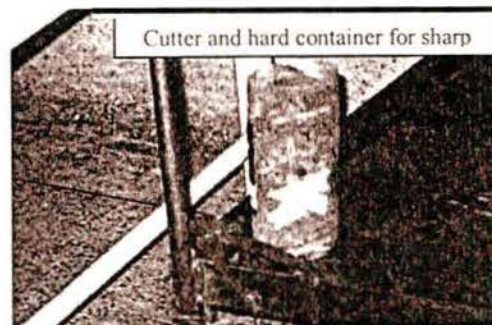
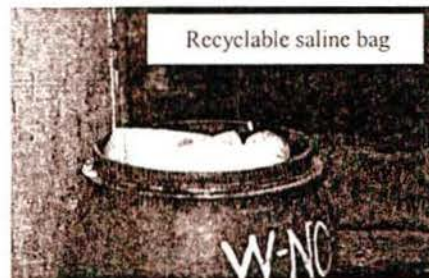
Most concerned medical waste is infectious and hazardous waste. If there was no option or facility for final treatment and disposal of those segregated waste, this initiative of in-house management would not be worthwhile. There are several options for final treatment and disposal being discussed in the workshop and meeting. Those are as follows

- Ø Use of disinfectants
- Ø Autoclave
- Ø Incinerator
- Ø Sanitary landfill

Technology, maintenance, cost and effectiveness as well as environmental aspects of all these options were discussed. Decision on final treatment and disposal is yet to be decided by the government. Therefore, considering the socio-economic condition, status of legal aspects in Bangladesh and availability of resources few solutions are recommended for hospitals. It is noted that, these are simply immediate options before going for any sophisticated system or option prescribed by the government authority.

Immediate options are

1. Introduce 3R (Reduce, Recycle and Reuse), it will reduce 50% volume of HW/IW. But any kind of re-uses of plastics is discouraged here.
 - a. Segregate recyclables and cut or destroy at source to prohibit re-use. These are sold centrally by hospital authority
 - b. Recycle plastic petridish from laboratory after autoclaving (sell as plastic mould)
2. Treatment and disposal inside hospital
 - a. Autoclave of laboratory waste (microbial culture) using pressure cooker (boil at 60-100^oC for 60 minutes) and drain in sewerage (latrine)
 - b. Sufficient dilution of chemical waste with water and drain to sewerage

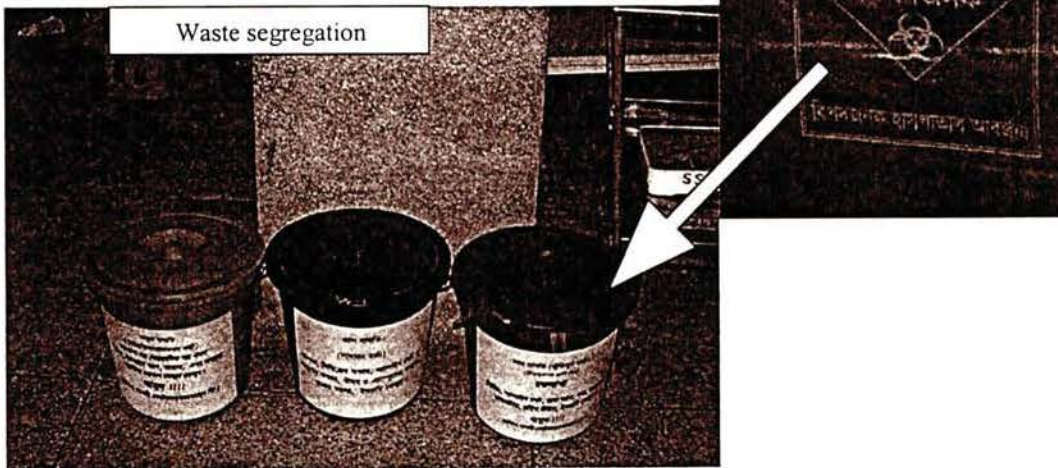


- c. Sharp management: hard box for needle with disinfectant and use cutter to separate needle from syringe
- d. Use of disinfectants (Chlorine oxidation/Bleaching powder 0.5% solution; Cydex 0.05% solution) for segregated infectious/hazardous waste in red bag
- e. Incineration of non-PVC infectious/hazardous waste



All these treated waste can go to municipal bin. Since these are kept in closed red bag with “dangerous” sign waste picker do not open it pick those items. The red bag also designed after discussing with cleaners and waste picker at hospital site (as shown in the picture).

Three-colored dustbins are placed at each nurse station in the ward. These bins are labeled with instruction on what to do before put waste in the bin (as picture below).



Conclusion and Recommendations

The public perceived hospital waste, as being the waste stream creating the greatest risk to public health. This is a matter that is exacerbated by the adverse publicity that these incidents have caused. It's importance therefore, is well established and whilst in terms of waste production, in any country, the amount to be dealt with is small in comparison with the total amount of waste produced, the overall effect if it is mishandled is proportionately greater.

The piloting of in-house medical waste management found to be an effective way of reducing the amount of infectious and/or hazardous waste and also the risk of health hazard for exposed population at different level.

Following this guideline and manual hospitals will have an opportunity to comply with the upcoming government rules and regulation. This will also improve the quality of services in hospital, which in turn will be profitable for hospital authority in different ways. Nevertheless, following things are to be considered to make an effective implementation of in-house medical waste management system.

Things to be considered

- Raising awareness, training, capacity building of hospital staff
- Responsibilities inside hospital (designated personnel)
- Monitoring mechanism and committee
- Role of City Corporation should be clear (transportation and central treatment system)
- Hospitals initiatives for proper MWM (cost, return)
- Private sector and NGOs involvement

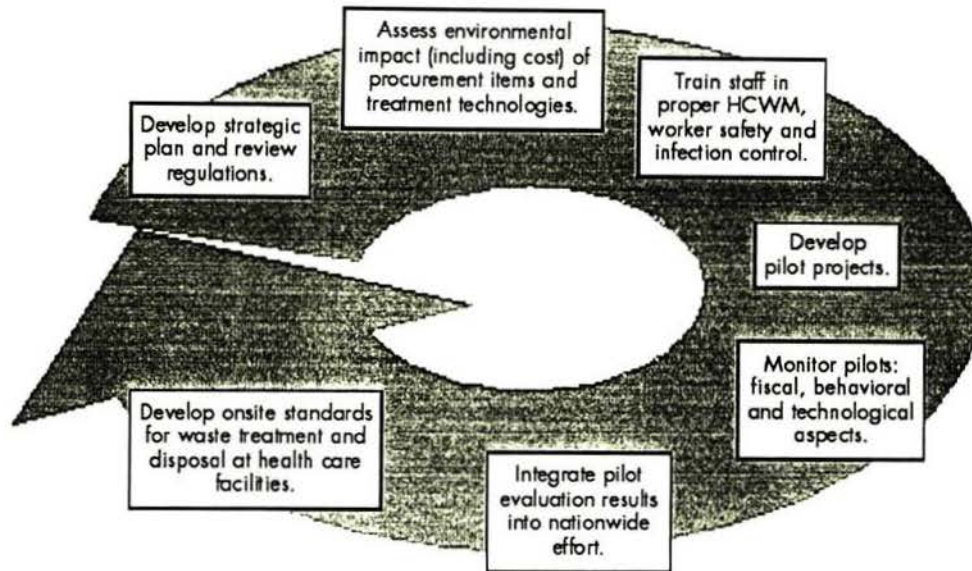
Some of the recommendations came from the participants in workshop. These are:

- ToT for key person in the hospital on manual (nurse, lab tech and ward master)
- Introduce service charge, should not be free of cost
- Ownership of the authority
- User friendly instrument/technology
- Working group manual
- Manual for responsibilities
- Awareness, training
- Routing group meeting and Responsibilities inside hospital

Following diagram explained the healthcare waste management project cycle outlined by WHO, 2003.

Health care waste management project cycle

(According to WHO, 2003)



Reference:

- Air Waste (1994). Medical waste committee, air and waste management association. Medical waste disposal: report of the medical waste committee (Wt-3), Technical council. *Air Waste*, 1994, 44:1176-9
- Akter N., & J. Tränkler (2003). An analysis of possible scenarios of medical waste management in Bangladesh, *Management of Environmental Quality: An International Journal*, Vol. 14 No.2
- Akter, N (2003). Appropriate Management Options for Developing Countries (the case of Bangladesh and Thailand). Doctoral Dissertation. Asian Institute of Technology, Thailand.
- Akter, N., Hussain, Z. Tränkler, J. and Parkpian, P. (2002). "Hospital Waste management and it's probable health effect: a lesson learned from Bangladesh", *Indian Journal of Environmental Health*, National Environmental Engineering Institute. Nehru Marg, Nagpur 440020. India. Vol. 44, No 2.
- Halbwachs H. (1994). Solid waste disposal in district health facilities, *World health forum*, 85:583-9.
- Hauri, A., Armstrong, G., and Hutin, Y. (2004). The global burden of disease attributable to contaminated injections given in health care settings. *International Journal of STD & AIDS* 2004; 15: 7-16.
- Hutin, Y., Hauri, A., Chiarello, L., Catlin, M., Stilwell, B., Chebrehiwet, T., Garner, J., and the members of the injection safety best practices development group (2003). Best infection control practices for intradermal, subcutaneous, and intramuscular needle injections. *Bulletin of the World health Organization* 2003, 81 (7).
- Johnson B. (1999). Impact of hazardous waste on human health. Washington DC, Lewis Publishers.

- WHO. (1999). *Safe Management of Wastes from Health-Care Activities*. edited by *A Prüss. E Giroult and P Rushbrook*. 1999. XIV + 230 pages + 4 colour plates (available in English; French and Spanish in preparation). ISBN 92 4 154525 9. CH-1 21 1 Geneva 27 Switzerland. WHO. (2000a), *WASTES FROM HEALTH-CARE ACTIVITIES*. WHO information, Fact Sheet N° 253, October 2000. <http://www.who.int/inf-fs/en/fact253.html> (downloaded in March, 2002).
- WHO. (2000). *Policy analysis Management of Health-care wastes*. (Intended to provide a quick overview of the topic at policy-maker level, in particular at national level). Downloaded in April 2002.
- WHO. (2003). *Health Care Waste Management: At a glance*.
- World Bank. (2000), *Healthcare waste management guidance note*. Urban Development Division, Infrastructure Group, Environment Department and Health, Nutrition and Population Team. The World Bank.

Appendix 1

Operational committee for medical waste management pilot research:

1. Salehuddin Ahmed, PhD, Deputy Executive Director, BRAC – Chairperson
2. Director, Hospital and clinics, DG health, MHFW (representative: Dr. AKM Saidur Rahman)
3. Md. Reazuddin, Director (Technical), DoE
4. Chief Health Officer, DCC (representative: Dr. Md Latifur Rahman, medical officer Mirpur zone)
5. Dr. Shahid Hassan, Deputy Director Administration, Dhaka Shishu Hospital, Sher-e-Bangla Nagar, Dhaka
6. Prof. Samir K Saha, PhD, Department of Microbiology, Dhaka Shishu Hospital, Sher-e-Bangla Nagar, Dhaka
7. Dr. AKM Shamsuzzaman, Deputy Director, Institute of Child Health and Shishu Hospital, Mirpur
8. Imran Matin, PhD, Director Research, BRAC
9. Faruque Ahmed, Director, BHP, BRAC
10. Dr. Shamsher Ali Khan, Programme coordinator, BHP, BRAC
11. Mr. Milan Kanti Borua, Programme coordinator, BHP, BRAC
12. Mr. Fazlul Hoque, Programme coordinator, Training Division, BRAC
13. Nasima Akter, PhD, Environmental Research Unit, BRAC – Lead researcher and member secretary