



HOSPITAL WASTE MANAGEMENT AWARENESS, ATTITUDE AND PRACTICES IN TWIN CITIES OF PAKISTAN

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ABSTRACT

In developing countries like Pakistan hospital waste management is one of the ignored areas that have further augmented the poor hygiene conditions. This study was undertaken to highlight the medical waste management condition in the capital city Islamabad and its twin city Rawalpindi. Seventeen hospitals located in Rawalpindi and Islamabad were visited; doctors, paramedical staff and sanitary workers were interviewed. Hospital waste generated per patient per bed was weighed randomly; twice a week for four months and average waste production was calculated. Results of this study bring to light the unawareness and ill practices mainly of medical waste handling personnel of the hospitals. Lacks of proper training, noncompliance of protective measures, inappropriate catchment sites, intermixing of infectious waste with general waste were frequently observed. Our studies strongly recommend a robust and regular training of medical staff including sanitary workers and a vigilant system for waste management policy implementation.

KEYWORDS: Waste management, infectious waste, healthcare waste, waste disposal



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INTRODUCTION

Hospital waste is a special type of waste that is generated in relatively smaller quantities as compared to other wastes. World health organization (WHO) and US environmental protection agency (EPA) advocated that hospital wastes are hazardous and therefore should be treated as special wastes¹. Major portion of the hospital waste (75-90%) cause no potential risk and are classified as household wastes; while the minor portion (10-25%) waste is really hazardous if it is not disposed properly and is a source of potential threat to patients, healthcare workers, the general population and even the whole environment². Thus, generally one-fourth of the medical waste is regarded as hazardous that can pose serious threats³. The poor management exposes the workers, waste handlers and the community to toxic effects, infections and injuries. It also creates the opportunities for the collection, re-sale and re-use of disposable medical equipment without sterilization causing significant disease burden in the whole world⁴. Proper management is a serious concern to community health and environment as the hospitals waste possess great potential to spread various kinds of infections⁵. About 16,000 million injections are administered annually in Himachal Pradesh, India and all of them are not disposed properly⁶. Hospital waste is the major source of various viral diseases like AIDS, HBV, and HCV etc. and, is also a source of major nosocomial infections as it contains a wide variety of pathogenic bacterial strains like *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Escherichia coli*, *Staphylococcus aureus* etc⁷. Therefore, special treatment procedures are essential for their safe disposal⁸. Different countries have made recommendations and codes of practices to handle and dispose of the medical wastes properly. Different forms of waste i.e. solid, liquid, etc., should be treated accordingly, in order to safeguard public health and the environment. In developed countries, the overall condition of hygiene is quite satisfactory due to huge consumption of budget is consumed in this sector. Most of the aspects of

routine hygiene, disinfection and waste management are reported to be quite adequate in Europe⁹. In addition, wastes are mainly recycled, reducing the main burden of waste production in the developed countries¹⁰. Eliminating wastes and improving the facilities are largely done in order to have a better management system¹¹. But in developing countries, like other issues, disposal of medical waste is still a neglected area. This problem remains persistent as the methods of disposal are quite expensive and larger than the budget range of small sized municipalities¹². They are disposing this hazardous waste along with their domestic waste and it is polluting their environment. Most of the time, these wastes are handled by poor, low income, uneducated labors, who are doing this at the expense of their health. Hospitals in Pakistan produce about 250,000 tons of waste per year. This waste is not managed according to rules and regulations. The health-care waste management systems are not well-defined and are not according to the WHO standards or Pakistan bio-safety rules 2005 standards. Very few studies have been conducted on this issue in Pakistan and it was established that hospitals did not have proper arrangements for managing their wastes⁶. There is no official data documentation regarding waste management in the hospitals. Despite of the hazardous nature of the medical waste, it is not properly handled by the respective establishment. Incineration is mainly used for treatment of hospital wastes, this treatment is now not much appreciated because burning of medical wastes resulting in air pollution and the toxic metals associated with the incinerator ash¹³. Despite hazardous effects of this treatment, it is still being used in Pakistan. Thus, there is a great need to enforce the health policy and laws regarding this issue. Regular training systems and activities are to be applied to governmental and private staff as well. Training of the respective authorities is very important in improving the conditions of the present management¹⁴. Detail research is obligatory to assess the waste sources, collection, transportation and final disposal

imperfections in the present condition. The objectives of this study were to conduct a survey of hospital waste production, its segregation, storage, transportation and treatment. In addition to assess the knowledge among the healthcare personnel and training level provided to the workers dealing with the waste and to see the existing rules and policy implement situation in this field. This study will enable us to plan, design and implement the health policy in order to manage hospital waste appropriately.

Study area description

This study was performed in the twin cities of Pakistan; Rawalpindi and Islamabad (Figure 1). These cities are located in the northern part of Pakistan and the hospitals that are studied are indicated in the figure 1. Rawalpindi is more densely populated as compared to the capital city, Islamabad. The health care facilities are serving approximately 4.5 million inhabitants and are providing a broad range of medical facilities.

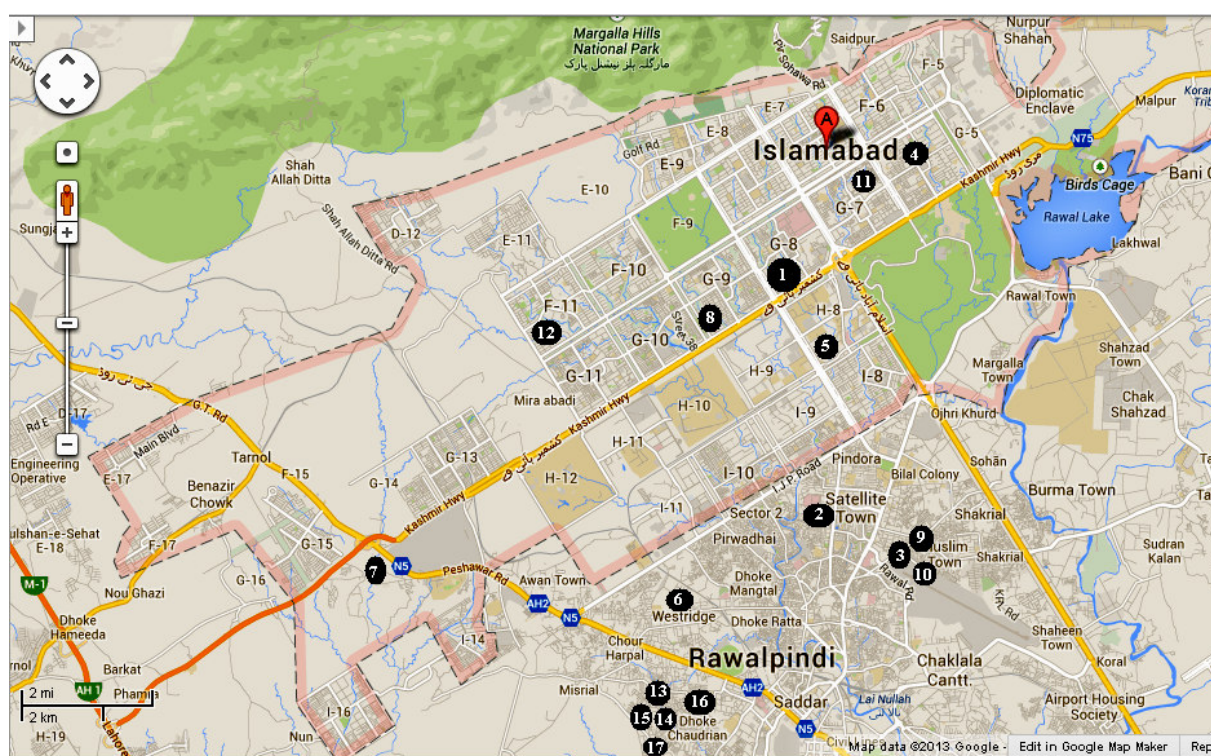


Figure 1
Map of sampling area, Rawalpindi and Islamabad, showing the location of 17 hospitals included in this study.

MATERIALS AND METHODS

This study was approved by Institutional Review board (IRB) Atta-Ur-Rahman School of applied Biosciences, National University of Science and Technology and was conducted with the consent of the participant hospital management. This study comprises detailed survey of 17 main hospitals located in Rawalpindi and Islamabad. All wastes generated from different departments were

weighted randomly; twice a week for four months and average waste production was calculated. During the study the main emphasis was on the infectious waste management as this waste is well recognized public health concerns⁶. Personnel in charge of waste management department, environmental health department and people related to waste management were interviewed. A questionnaire was developed for medical waste management based on the recommendations of World Health

Organization¹⁵. After taking into considerations the specific Pakistani differences and suggestions of environmental health specialists, some modifications were made to the questionnaire. In each hospital the interviews of directors, managing employees and other related staff were conducted and observation of the process of collection and disposal of waste were recorded. Interviews and site visits were helpful in obtaining information about common practices for managing hospital wastes. The data was recorded in specific data forms and questionnaires were completed and stored for further analysis.

RESULTS AND DISCUSSION

1. Attitude and knowledge among healthcare personnel

This study highlights that in all hospitals sanitary staff was almost unaware of the mandatory safety measures required for the job. Knowledge regarding transmission of disease and color coding was more among nurses and doctors. Disinfection and segregation of waste was carried out mainly by sanitary workers who have least knowledge about the safety measures (Table 1). When practices related to biomedical waste was

analyzed it was concluded that sanitary staff were much ignorant of the routine practices like disposal of sharp objects in puncture proof containers and appropriate segregation according to color coding system. Doctors were more aware of the hazards so they act accordingly but unfortunately sanitary staff were totally unaware of the hazards associated with waste management and rarely or never report any injuries from infected sharp objects during waste handling (Table 2). Thus among workers the chances of catching a contagious disease are very high on account of these inappropriate measures. Lack of education and proper training are the key factors behind this mismanagement among healthcare personnel.

2. Hospitals and their capacity

Most of the well developed hospitals of the area are located in Rawalpindi and Islamabad. These two twin cities have generally moderate climate and serves as a main center for health services to not only its own residents but also to the people living in the vicinity areas like northern part of Pakistan. The total numbers of beds in these hospitals are 5567 and the average bed occupancy during the study period was 78%.

Table 1
Data showing percentage awareness of biomedical waste management among healthcare personnel (n= 280)

Knowledge about biomedical waste	Doctors (n= 65)	Nurses (n= 80)	Laboratory Technicians (n= 55)	Sanitary staff (n= 80)
Transmission of diseases through biomedical waste	63 (96.92)	70 (87.5)	47 (85.45)	16 (20)
Color coding for waste containers	61 (93.84)	75 (93.75)	49 (89.09)	43 (53.75)
Disinfection of hospital waste before disposal	54 (83.07)	25 (31.25)	35 (63.63)	18 (22.5)
Segregation of waste at sources	59 (90.76)	68 (85)	50 (90.90)	27 (33.75)
Biomedical waste management rules	58 (89.23)	72 (90)	47 (85.45)	35 (43.75)

Table 2
Data showing percentage compliance of biomedical waste management Practices by healthcare personnel (n= 280)

Knowledge about practices of biomedical waste	Doctors (n= 65)	Nurses (n= 80)	Laboratory Technicians (n= 55)	Sanitary staff (n= 80)
Disposal of sharps in puncture proof containers	50 (76.92)	57 (71.25)	37 (67.27)	21 (26.25)
Disposal in specified color coding containers	65 (75.38)	65 (81.25)	48 (87.27)	25 (31.25)
Reporting of injuries due to improperly disposed sharps	46 (70.76)	22 (27.5)	9 (16.36)	2 (2.5)

3. Rates of waste generation

Waste is produced from different activities carried out in the hospital. General waste produced is related to administrative department, food preparation and construction. This type of waste is not considered dangerous and is similar to household waste. In the hospitals different treatments produce infectious waste including radioactive treatment, surgery, dialysis, delivery, biopsy, autopsy, injections and other therapies like chemotherapy and cobalt therapy etc. Waste generation rates in different hospitals vary from 0.34 to 8.87 kg/bed/day. The data in the Table 3 shows different amounts of waste generated in kg/day and kg/bed/day according to the occupancy rates of the hospitals. Amount of waste produced in different hospitals depends on the number of beds, occupancy rates, and types of services provided, social, economical and cultural conditions of the patient and the general condition of the area where hospital is located. High income countries generate approximately 0.5 kg of hazardous waste per bed per day while low income countries generate 0.2 kg of hazardous waste per bed per day. However in

developing and under developed countries waste segregation is not proper which makes the real quantity of hazardous waste much higher¹⁵. According to WHO facts infectious and anatomical waste constitute majority of the hazardous waste i.e. up to 15% of total hospital waste, sharps constitute 1% of the total waste and pharmaceutical wastes account for 3% of the total waste¹⁵. This is the first report regarding hospital waste management; no such study has been performed earlier in this area and we propose a further comprehensive study of daily waste for appropriate risk assessments.

4. Waste segregation

In all hospitals, waste segregation at the site of production was not according to standards. All of the hospitals were aware of the WHO medical waste categories. Infectious and sharps waste was segregated from the general waste via color coding system. Anatomical parts (waste) were either handed over to patient's guardians or were disposed by the hospital administration itself by deep burial in a nearby graveyard or in a ground reserved for this purpose in large hospitals.

Table 3
Data showing generation of various categories of hospital waste in 17 different hospitals.

Hospital	Capacity	Occupancy	Waste generation rates (kg/bed/day)				Waste generation rates (kg/day)			
			General	Infectious	Sharps	Total	General	Infectious	Sharps	Total
1	1300	100%	1.54	0.19	0.15	1.88	2000	250	200	2450
2	1000	100%	0.14	0.11	0.10	0.35	137.5	105	100	342
3	680	90%	2.22	1.31	0.26	3.79	1360	800	160	2320
4	545	98%	2.03	1.37	0.20	3.60	1086	733.05	109	1928
5	500	80%	6.86	1.75	0.25	8.88	2750	700	100	3550
6	400	70%	3.57	1.43	0.14	5.14	1000	400	40	1440
7	400	20%	0.94	0.31	0.04	1.29	75	25	3.5	103.5
8	200	100%	1.03	0.50	0.01	1.54	205	100	2	307
9	200	80%	1.00	0.59	0.01	1.60	200	94	2	296
10	110	95%	1.14	0.38	0.04	1.56	120	40	4	164
11	50	60%	1.00	0.23	0.03	1.26	30	7	1	38
12	45	33.33%	1.07	0.67	0.06	1.80	16	10	1	27
13	40	70%	1.25	0.07	0.04	1.36	35	2	1	38
14	40	95%	3.89	2.92	0.79	7.60	148	111	3	262
15	30	30%	0.78	0.22	0.11	1.11	7	2	1	10
16	17	50%	0.82	0.24	0.12	1.18	7	2	1	10
17	10	80%	1.25	1.25	0.25	2.75	10	10	2	22

Five of the studied hospitals (33.3%) were disposing their pharmaceutical waste by incineration. Other six hospitals (40%) were disposing pharmaceutical waste along with municipal waste. Seven (46.6%) of these hospitals used to return outdated and expired

drugs back to company. Four private sector hospitals (26%) were not practicing needle cutter method properly due to resource constraints. 13 (86.6%) of the hospitals were incinerating sharp needles with or without cutting them by needle cutter. The ash from incineration was buried in

wells having concrete walls in only 1 (6%) hospitals, rest of them were disposing ash along with municipal waste. In some hospitals syringes were being destroyed together in free time but not as a sole responsibility by the medical staff. Thus large portion of syringes were not incinerated; this practice when further explored and investigated revealed that it led to pilferage of used syringes and sharps objects to the black market. 2 (13.3%) hospitals were disposing sharps in general waste. This practice is highly perilous; due to improper disposal of these syringes they are a hazard to scavengers which manually sort hazardous waste in order to find recyclable items. Moreover scavenging of this waste by drug addicts to find syringes is a major issue. WHO estimated that in 2000, injections with contaminated syringes caused 21 million hepatitis B virus infections, two million hepatitis C virus infections and 260000 HIV infections worldwide⁶. All hospitals have proper waste collecting plastic containers with plastic bags. This color coding of baskets was in accordance of WHO proposal¹⁵. Suitable and adequate numbers of bins were provided in most of the hospitals but the plastic bags used within these bins were colored only in 4 hospitals (26%). Rest of the hospitals used black or white bags for all kinds of bins. Among the hospitals included in this survey 6 (40%) of them choose red and 5 (33.3%) of them choose yellow for infectious waste. If the intermingling of the waste occurred it was due to the negligence and unawareness of patients, their guardians, visitors and insufficient training of waste handlers and to a lesser extent due to lack of facilities.

5. Medical staff

In all of the hospitals, medical superintendents were accountable for hospital waste management and housekeeping department manager/head was responsible for treatment and proper disposal of the waste. In 9 (60%) of hospitals heads of the house keeping departments were doctors and in 7 (46.4%) of hospitals they were qualified persons but not doctors. Such personnel had attended some

workshops on waste management. 8 (53.3%) of hospitals included in this survey conducted training workshops on frequent basis. However, 7 (46.6%) hospitals arranged such workshops infrequently. Unexpectedly 2 (13.3%) hospitals didn't conduct training classes at all. Lack of the adequate training of these personnel poses a serious threat to health of these personnel as well as to the society because of mishandling of the medical waste. In 9 (60%) hospitals the cleaning staff was not vaccinated against hepatitis B and tetanus. 4 (26%) hospitals vaccinated the waste handlers for tetanus only and 1 (6%) hospitals vaccinated against hepatitis B and tetanus. Municipality workers who are responsible for offsite transport were not cautioned of the hazards associated with the waste they were carrying. They even hadn't any training comparable to sanitation staff in hospital. Thus in developing countries like Pakistan there is a huge gap in implementation of health policy contrary to developed countries where proper laws are made and steps are taken for implementation⁵.

6. On-Site transport of waste

Hospital waste was collected by waste handlers from waste bins daily before or after every shift and transported to catchments area. The capacity of the temporary storage bins in 5 (33%) of hospitals was 5-8 kg, 10-13kg in 6 (40%) hospitals and 15-20kg in 5 (33%) hospitals. Only 6 (40%) hospitals provided proper trolleys to the workers for waste transport in both public and private sector hospitals. In rest of the hospitals workers were either carrying plastic bags or bins to the catchment area. For self protection of waste handlers special boots, apron and masks were provided in 5 (29%), 7 (41%), 10 (59%) hospitals respectively (Figure 2). Some hospitals organized proper training workshops to teach the waste handling personnel the rules and precautionary measures to be taken for shipment to avoid direct contact with hazardous waste. The lack of sufficient and suitable protective Kit and unawareness put these waste handlers in high risk to infectious agents.

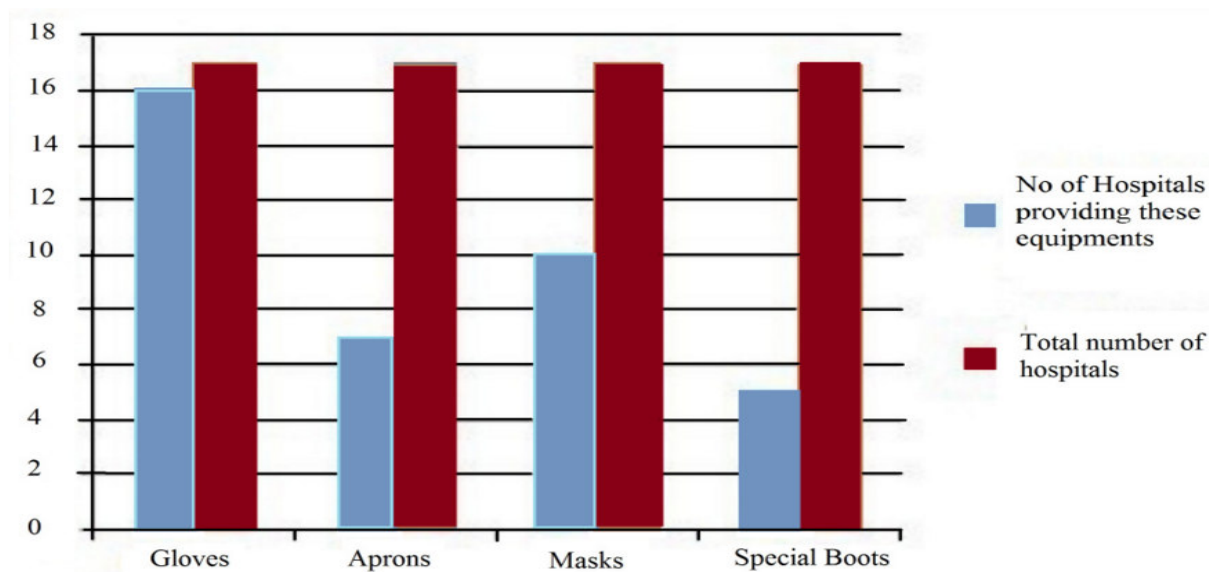


Figure 2
Graphical presentation of Data showing use of safety items provided by hospital to sanitary workers

In more than half of the hospitals needle stick injury wasn't reported merely due to lack of knowledge, eventually the personnel are not offered post exposure prophylaxis. This can have drastic effects because needle stick injuries are a major cause of transmission of blood borne diseases¹⁶. Furthermore the overturning or tearing of the waste containers during onsite or offsite transport of waste was not reported.

7. Catchments area

The place where the hospital waste is kept before taking to final disposal and treatment area is termed as temporary storage or catchments area in any hospital. This area should be well sanitized and sealed. No unauthorized person should be allowed to go there. Most of the hospitals which used incinerators for the final disposal of their waste used the same room as storage area where incinerator was located. Such storage areas contained infectious waste only which was destined to be incinerated. These places were usually located away from other sections of the hospitals. Only 10 (66.6%) of the hospitals had a separate temporary storage area. Sanitization of storage area in all hospitals was poor. Startlingly 40% of the studied hospitals do not

have proper catchments area. In 12 (80%) hospitals although the rooms were not sealed, but unauthorized access was restricted. Serious situation was observed in one of the hospitals (6%) where an empty plot was used as temporary storage areas at the back of the building. The storage area constituted an undersized boundary and the sanitation staff was dumping the waste from all over the hospital in that open plot. The waste separated at the site of production was mixed at that place. This practice was highly unsafe and risky as it gave an open feast to many vector insects and animals. The hospital was located in densely populated areas of Rawalpindi city. Another hospital was using gallery opposite to washrooms as waste storage area.

8. Hospital waste treatment

Waste treatment not only decreases volume of the waste produced, it consequently reduces risk of infectivity instigating from the waste. In most of the hospitals, general waste was disposed along with municipal waste which was later taken care by city's municipality. The only system used in most of the hospitals to dispose of the sharp object and infectious waste was incineration. However only 5 (33.3%) of hospitals were equipped with incinerators; in

addition 2 hospitals had their incinerators out of order due to lack of skilled workers and unavailability of spare parts in Pakistan. They were sending their waste to other sites for incineration like Attock Oil Refinery. In 2009 an incinerator was installed in a tertiary care hospital which was provided by WHO and later it was named as combined treatment facility (CTF). 10 other allied hospitals used this hospital for their waste disposal. 12 (80%) of hospitals don't have their own incinerators due to lack of financial resources; they were sending their waste to CTF for incineration. The condition of functional incinerators was objectionable. Height of the smokestack and rate of smoke production was not suitable as per international standards.

9. Off-Site Transport of hospital waste

In most of the hospitals municipality was responsible for deporting and disposal of the general waste. In 2 of the studied hospitals this responsibility was taken by the hospital administration itself. In all of the hospitals general waste was transported on a daily basis. In 3 (20%) of allied hospitals transportation of waste was performed thrice a week. In 4 (26.6%) allied hospitals transportation of the hospital waste was done twice a week. The waste was transported in general trucks uncovered. Hence the time of storage of waste in the temporary storage area exceeds the recommended standard (24 h during the hot season and 48 h in cooler seasons) in most of the hospital during the hot season.

10. Final Disposal of Hospital Waste

All hospitals included in this survey disposed their domestic (general) waste at the same sites as civic waste by municipality. As intermixing of hazardous and general waste to certain extent occurs due to above mentioned reasons, the domestic waste of the hospitals cannot be compared with domestic waste of the community. Therefore, due to the intermingling of hazardous waste, these wastes should be considered infectious (New York State Department of Health, 1995). Alarmingly, one of the hospitals had their incinerator out of order

and was burning their waste in an open space within the hospital boundary.

11. Hospital waste management regulations

In many hospitals there was no policy for purchasing the necessary machinery and equipment for correct management of hospital waste. In number of hospitals, which were newly inaugurated the medical superintendent was well interested in proper disposal of hospital waste by setting policies. In 2005 rules for medical waste management were made by ministry of environment of government of Pakistan¹⁷. Only 5 hospitals were ISO certified. More than half of the hospitals kept a record of the daily waste produced. Few hospitals placed a proper check and balance on waste generation rate and its proper disposal.

12. Sewage system

In 5 hospitals (33.3%) liquid waste was discharged in drains. 10 hospitals (66.6%) disinfected their liquid waste with chemicals before disposal in general waste. None of the hospitals performed sewage treatment prior to disposal. All of the hospitals drained their sewage into the regular city sewage system.

CONCLUSION

Hospital staff, especially the sanitary staff was much ignorant of the proper disposal of medical waste as they were not well trained. Sufficient or suitable protective equipment and kits were also unavailable in most of the hospitals, posing serious health risks not only to these personnel but to others as well. The segregation of hazardous and non infectious waste is not done properly according to recommended rules. Owing to high risk of mixing all waste produced by these hospitals is bio-hazardous. The foremost problem identified in this study is the non compliance of guidelines as prescribed by the Pakistan biosafety rules laid down by government of Pakistan or WHO medical waste management guidelines. Lacks of proper training, noncompliance of protective measures, inappropriate catchments sites, intermixing of infectious waste with general waste were frequently seen.

Recommendations

This study suggests an urgent need of mandatory training for all health care personnel including nurses, paramedical staff and sanitary workers from accredited training centers. These training sessions should not be a onetime activity, but a continuous process. There should be a continuous supervision and monitoring mechanism for the strict implementation of the existing rules regarding biomedical waste management. Special emphasis should be given to the sanitary workers; in case of

accidental injury during waste handling, there should be an immediate reporting system and protective treatment available.

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