

A Case Study of Hospital Waste Management in Balochistan and Its Impact on Health and Environment

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Abstract: Hospital waste is a mixture of general refuse, biomedical laboratory and pathological wastes. Between 75-90% of the waste produced by the health care providers is non-risk health care waste whereas, the remaining 10-25% consist of infectious pathological waste and is of great health concern, if not segregated from general hospital waste. Various studies have reported the waste generation in urban centers of Pakistan, however, no data has been reported previously for Balochistan. Current study surveyed public sector hospitals in Balochistan (Quetta City) and hospital waste was segregated based on their specification and categorized into: general, bio-medical and hazardous wastes. The amount of waste produced in Surgical departments/Operation Theatres was approximately: general (1.75 kg/bed/day), medical (0.30 kg/bed day) and hazardous (0.013 kg/bed/day). Similarly, the average daily waste produced for General/Non-surgical Wards was: general (0.350 kg/bed/day), medical (0.050 kg/bed/day) and hazardous (0.002 kg/bed/day). Amount of biomedical waste from all hospitals consisted of needles (0.45 kg/bed/day), gloves (0.480 kg/bed/day), drain tubes (0.30 kg/bed/day), cottons and gauze (0.40kg/bed/day), napkins (0.02 kg/bed/day), plastic syringes (0.30 kg/bed/day), swap (0.005 kg/bed/day) and body parts (0.40 kg/bed/day). As a whole, 8-10% of total waste was hazardous, 10% was biomedical of the total waste. Although the data is comparable with other cities of Pakistan, more studies are warranted to enumerate other private medical facilities in order to find their generation and means of disposal.

Keywords: Disposal techniques, hazardous biomedical waste, infectious diseases, pollution, waste segregation

INTRODUCTION

Hospital wastes are heterogeneous mixtures of general refuse, laboratory and pharmaceutical chemicals, plastic or metal containers and pathological wastes (WHO, 1999). General refuse from hospitals is similar to generic waste from residence and institutions. However, It is the laboratory and pathological infectious waste that may contain potentially infectious wastes (Sharma and Chauhan, 2008). It includes isolation wastes from isolation patients, cultures and stocks of infectious agents and associated biological (human blood and blood products), pathological wastes, contaminated sharps, body parts and organs, that represents the major problem in hazardous waste management (WHO, 1999; WHO, 2000). The waste that originates from operation theatres and laboratories is more hazardous for those who come into contact with it, especially, the doctors, para-medical staff and waste handlers (Rutala *et al.*, 1998).

It has been estimated that between 75-90% of the waste produced by the health care providers is non-risk general healthcare waste, comparable to domestic waste. It comes mostly from the administrative and housekeeping functions of healthcare establishments and

may also include waste generated during maintenance of health care premises. The remaining 10-25% of health care waste is regarded as hazardous, if not segregated from general waste and may create a variety of health risks (Rutala *et al.*, 1998; Shagufta, 1995). In Pakistan, however, all hospital waste including hazardous waste is considered to be a part of municipal solid waste. An estimated hospital waste generation has been reported at the rate of 0.7 kg/bed/day in Pakistan (WHO, 2000). Previous studies have reported that about 80 tones of hospital waste is generated everyday in Karachi city alone, that includes 20% of infectious waste (EPA-Sindh, 2001). Similarly, a total of 15-20 tons of hospital and clinical waste is generated daily in the province of NWFP, with hospitals in Peshawar account for 20% of total waste (WHO, 2000). In Punjab the total amount of waste produced was found more than 50 tons/day (EPA-Punjab, 1994). Where, Rawalpindi alone produced 2,350 kg of hospital waste everyday with a 1200 kg contributed by private clinics and hospitals and 750 kg by three public hospitals (Fig. 1) (Zafar, 2002). However, no hospital waste data has been reported for hospitals in Balochistan. Furthermore, the practice of mixing and collecting hazardous waste with municipal waste has aggravated the problem by not only exposing

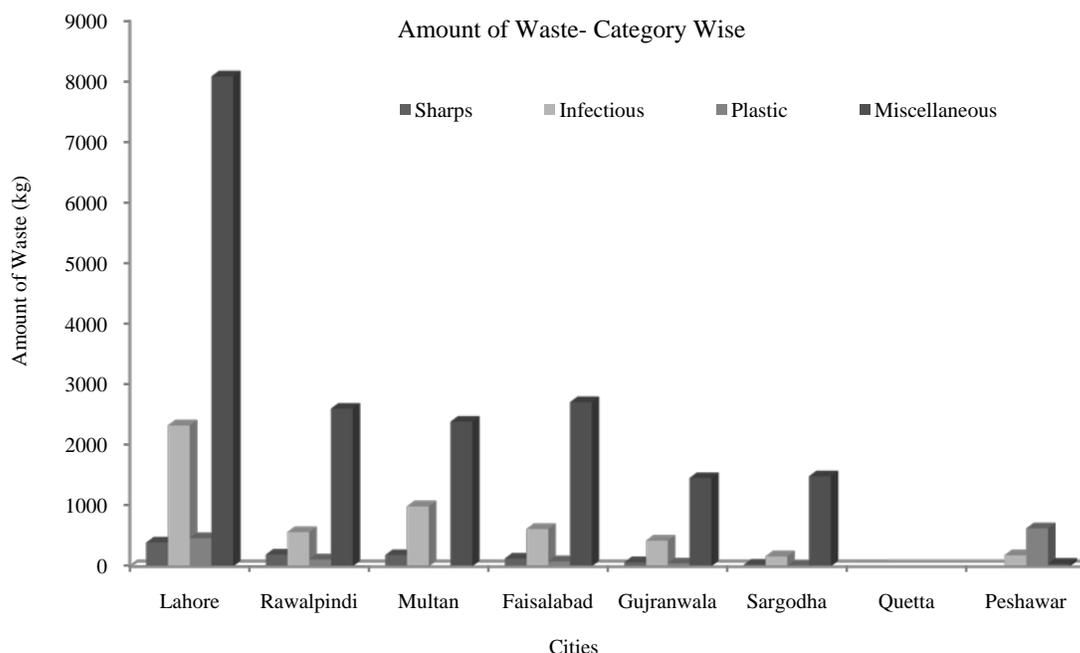


Fig. 1: Waste generation of various cities of Pakistan

the municipal workers to contaminated waste but has also increased the volume of hazardous waste manifold (Glenn and Garwal, 1999; Prawitasari *et al.*, 1996). The risk of injury and infections resulting from the improper management of waste is very high in developing countries (Gehad, 1998; Glenn and Garwal, 1999). In particular, the dangers of the spread of the disease from the misuse of discarded syringes and bloodied equipment such as tubes, bags and plastic bottles are the cause of diseases such as Hepatitis and HIV (Birungi, 1998; Gehad, 1998; Khan *et al.*, 2000; Luby *et al.*, 1997; Zuberi and Lodi, 1978). Similar health effects and diseases have been reported in other countries (Gehad, 1998; Gumodoka *et al.*, 1996; Mujeeb and Mehmood, 1996; Baron *et al.*, 1983). Hospitals and other health care establishments have a “duty of care” for the environment and for public health and have particular responsibilities in relation to the waste they produce (WHO, 2000).

The objectives of current study were: to survey the waste generation from public sector hospitals in Quetta City and their management. For the purpose of achieving this goal, segregation of hospital waste was carried out in order to enumerate the figures of each one of the category. A few major private-sector hospitals were also included in the study to compare the waste generation and its management practices. The data and the results were compared with private sector hospitals and with the hospitals in other cities of Pakistan.

MATERIAL AND METHODS

Study area: Study area for the research purpose was the public sector hospitals of Quetta City (Fig. 1), however, few big private hospitals of Zarghoon Road were also visited to include in the survey. This area was chosen because of the maximum healthcare facilities in Balochistan are located in Quetta city. The study included Civil Hospital (Sandeman Provincial Hospital), Bolan Medical College Hospital Complex (BMC), Fatima Jinnah Tuberculosis Sanatorium (FJ Sanatorium), Children Hospital Quetta (CHQ) and Lady Dufferin Women Hospital (LDH). Other private Hospitals selected as reference included Akram Hospital, Pakistan General Hospital (PGH), major private specialists clinics and pathology laboratories.

Survey of the study area: Survey of the hospitals was done in order to assess the type of facilities present in the hospitals. The survey included: to gather information about current disposal practices and to understand the present situation of hospital waste management by personal observation. After these observations, a plan was made for data collection by segregating the produced waste according to the wards or departments and facilities according to the method reported by Keilmann *et al.* (1992). An adapted questionnaire was also developed to gather information according to the observation as reported previously (Zafar, 2002).

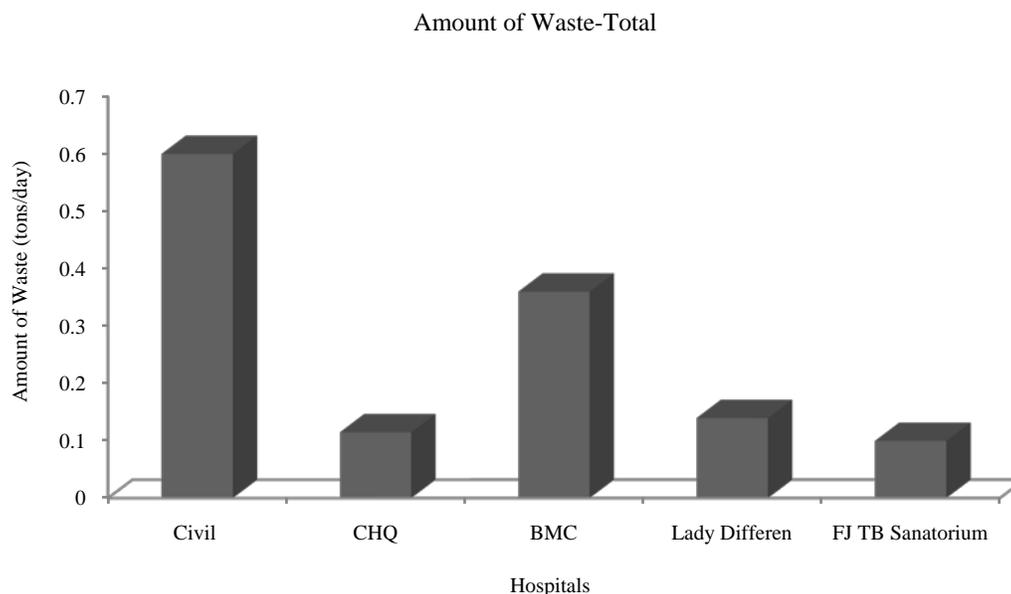


Fig. 2: Amount of waste generation/hospital (tons/day)

Developing a questionnaire and pretesting: To achieve the objectives of the research questionnaire was developed. The questionnaire will be developed in such a way that it provides all the information regarding Hospital Waste Management. Pretest of a questionnaire was done to filter or test the questionnaire according to the procedure reported by Zafar (2002). Questionnaire was finalized by removing the irrelevant questions and was distributed among all the healthcare facilities. 3-day time was given to fill in the questionnaires keeping in view the busy routine of the health care providers (Keilmann *et al.*, 1992).

Waste segregation study: Trash bins with coloring bags were in placed in hospital wards for 24 h in selected wards, surgical units, emergency wards, operation theaters (where not available). The waste was collected after an interval of 12 h as the shift of nursing and paramedical staff switched. Waste Generation Data was calculated based on weighing the waste on a manual scale (Shagufta, 1995; Zafar, 2002).

Data entry and processing: The questionnaire was collected back in the same sequence as it was distributed and was processed. Data Cleaning was done in order to remove errors and omissions from the forms. Data Coding of the questions was done at the data entry stage after sorting out all the required information as reported by Keilmann *et al.* (1992). Data entry was done after checking all the forms. Database was developed in computer software Program Access and was statistically analyzed in Excel.

RESULTS AND DISCUSSION

Similar to the situation in other cities of Pakistan (Fig. 1), In Quetta, hospital waste and other hazardous waste is considered to be a part of municipal solid waste. It was earlier estimated by WHO (1999), that 75-80% of the waste produced by the health care providers is general health care waste, whereas, 20-25% is infectious waste.

Survey of total waste generation: The data was collected from public-sector hospitals in Quetta City by collecting the data from Municipal Sanitary Department. According to the survey of (5) major public sector hospitals located in metropolitan area, i.e., Sandeman Provincial Hospital (Civil hospital) and BMC Medical complex were found to be the leading producer of hospital waste (Fig. 2).

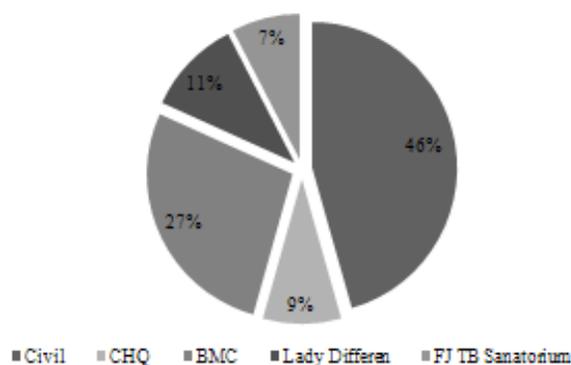


Fig. 3: Total hospital waste (%) contribution hospital

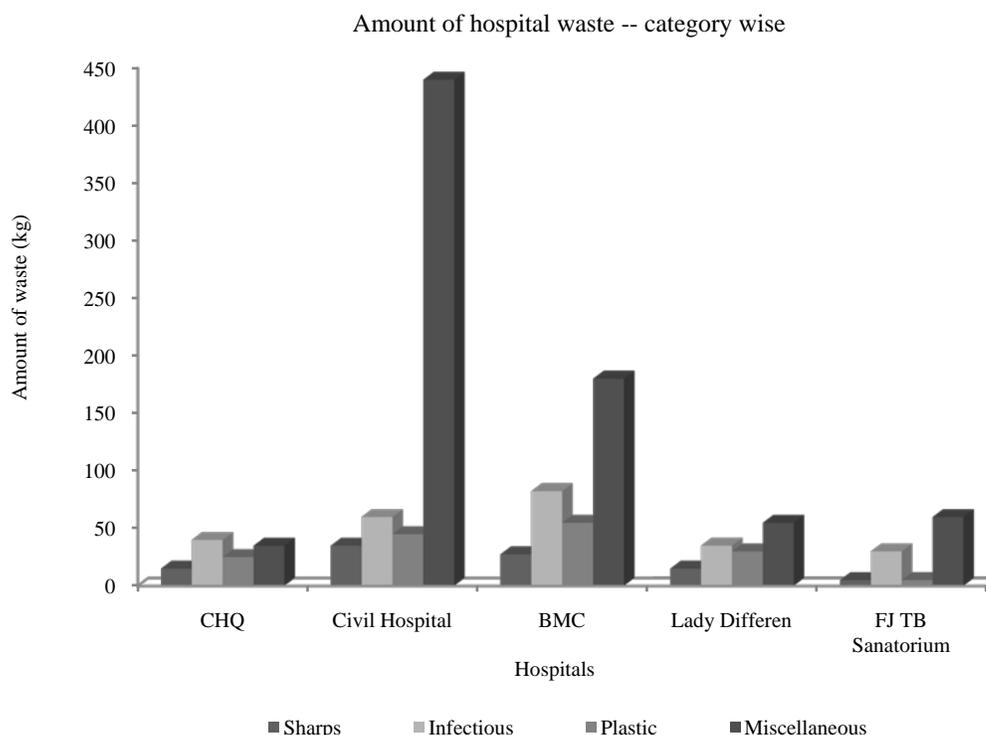


Fig. 4: Amount of waste after segregation by categories

Table 1: Segregated total hospital waste with hospital contribution (%)

Hospital	Sharps (%)	Infectious Agents (%)	Plastic (%)	Miscellaneous Waste (%)	Total (%)
Children Hospital (CHQ)	13	35	22	30	100
Civil Hospital(Sandeman Provincial Hospital)	6	10	8	76	100
Bolan Medical College Hospital Complex (BMC)	8	24	16	52	100
Lady Dufferin Women Hospital (LDH)	11	26	22	41	100

It is due to their capacity to handle the out-patient and in-patient facilities. Amount of Total waste (tons/day) produced was highest by Civil Hospital followed by Bolan Medical Complex (Fig. 2) since both are the major public sector hospitals in the provincial capital. Being the major hospital having the in-patient and out-patient facility, the percentage contribution of Civil hospital is also highest due to surgical facilities. When most of the facilities are provided at one place, the number of patients will increase and so does the waste per patient (Fig. 3). Although, separate data is not reported for private hospitals, i.e., Railway hospital, Akram public hospital, the waste was sent to BMC complex or Civil hospital (Sandeman provincial hospital) or CHQ for disposal.

Segregation of hospital waste: It is important that general refuse is segregated from hazardous waste. To further verify this estimated amount the data was collected after segregation of waste to find out the exact amount of waste category wise as well. For the purpose of separating general waste from hazardous waste and other glass and plastic related material, bins were

placed with a color coding system. Staff was asked to dispose off waste accordingly. The waste is produced more in those facilities where there is in-patient facility. According to data generated after segregation of waste, It was found that hazardous waste produced was highest at BMC Medical Complex, followed by Civil Hospital (Fig. 4).

To further verify this estimated amount the data was collected after segregation of waste to find out the exact amount of waste category wise as well as total hospital waste produced in Quetta The segregation was carried out at all 5-public sector hospitals and reported (Table 1). However, the data collected from FJ Tuberculosis Sanitarium was inconclusive to report.

According to the survey, CHQ was found to produce more infectious waste than other hospitals (Table 1). It is common that Children hospitals produce more infectious waste due to higher amounts of injuries, infections and other health related problems among infants and children. At CHQ, an Indigenous Incinerator Facility (IIF) was established by support of German Government and most of the infectious waste is properly segregated and incinerated, accordingly. However, incineration process entails with production

of Dioxins (McKay, 2002) and other by-products of dioxins and furans (Cains *et al.*, 1997). Dioxins and furans are formed as a result of combustion processes and persist in the environment for many years and degrade slowly (US-EPA, 1990). The most common health effect in people exposed to large amounts of dioxin is chloracne, skin rashes, skin discoloration, excessive body hair and possibly mild liver damage (Cains *et al.*, 1997; Singh *et al.*, 1999).

As compared to Civil Hospital, a more newly established BMC Medical Complex houses major surgical units and therefore, most of the surgeries are conducted at BMC complex hospital. It produces a large amount of hazardous waste (24%) when compared with Civil Hospital (10%) (Table 1). An incinerator was installed but was not found functional and hence, most of the waste was dumped in municipal waste bins and transported to landfill site in suburb of Quetta City along with other municipal waste. On the other hand, Lady Dufferin Women Hospital (LDH) produced the largest amount of infectious waste (26%). It could be due to being a Women hospital and higher number of surgeries related to pregnancies among women and other gynecological and obstetrics related medical cases. Segregation and collection of waste was found regular at hospital level, but no proper disposal method other than municipal dumping was found. The largest amount of miscellaneous waste, i.e., regular non-risk waste was produced at Civil hospital (76%) followed by Civil hospital (52%), LDH (41%) and CHQ (30%). Whereas, the largest amount of plastic waste, i.e., syringes, bottles, etc were found at CHQ and LDH (22%). On the other hand disposable sharps were properly segregated at CHQ and LDH and accounted for approximately 12% of total waste produced (by wt).

Although, It has been reported by WHO that 75-80% of the waste produced by the health care providers is general health care waste whereas, 20-25% is infectious waste, globally (WHO, 2000). The current study reports more hazardous waste (~25%) produced in public sector hospitals of Quetta City. It could be due to inadequate surgical facilities in other areas of Balochistan. Beside that transportation of more patients that require surgeries from war-torn border areas of Afghanistan, is another additional factor to consider.

CONCLUSION AND RECOMMENDATIONS

Health-care waste management is strongly influenced by cultural, social and economic circumstances and a well designed waste management policy, legislative framework and disposal plans are essential (US-EPA, 2000). Although some good basic groundwork has been carried out in an attempt to bring out improvements, the situation remains deplorable and represents grave health risk, not only to medical and hospital staff but also to municipal authority staff and general public, in Pakistan. The management at most of the hospital exhibited a careless attitude and the collection, handling, transfer and transport to the final

disposal site is being conducted in the most hazardous manner. The staff responsible for the handling of hospital waste is not trained and equipped and don't realize the potential danger associated with this wastes. The containers used for the transportation of hazardous wastes are usually old and corroded and without lids.

Due to poor management of hospital waste in Balochistan, it was observed that no proper segregation plan is being followed for either incineration or proper dumping at a lone landfill site in the suburb of Quetta City. This study surveyed the waste from public sector hospitals in Balochistan (Quetta City). Hospital waste data was generated by segregating the total waste based on their specification and categorized into: general, bio-medical and hazardous wastes, is being reported. As a whole, 8-10% of total waste was hazardous, 10% was biomedical of the total waste. Although the data is comparable with other cities of Pakistan, more studies are warranted to enumerate other private medical facilities in order to find their generation and means of disposal. The study will provide the basis to formulate recommendations and provide baseline data related to public sector hospitals in Balochistan. Based on the current reported data, health and environment protection department could make plan and introduce necessary enactment for the proper and safe disposal of the clinical waste. The safe management of biomedical and health care wastes is essential for community and environmental health. It is important that, irrespective of technologies used for it's treatment the disposal ensures a more viable, safe and efficient solution.

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REFERENCES

- Baron, R., J.B. McCormick and O. Zubair, 1983. Ebola virus disease in Southern Sudan. Hospital dissemination and intra-familial spread. Bull. WHO, 61: 997-1003.
- Birungi, H., 1998. Injections and self-help: Risk and trust in Ugandan health care. Soc. Sci. Med., 47: 1455-1462.
- Cains, P., L. McCausland, A. Fernandes and D. Patric, 1997. Polychlorinated dibenzo-p-dioxins and dibenzofurans formation in incineration: Effects of fly ash and carbon source. Environ. Sci. Technol., 31: 776-785.

- EPA-Punjab, 1994. Report on health care facilities in central Punjab: EPA Report.
- EPA-Sindh, 2001. Report on hospital waste: In solid waste generation in urban areas of Sindh. EPA Report.
- Gehad, A., 1998. Hospital Waste Management. Ministry of Health Hospitals. Oxford Printing Press, UK, Cairo, Egypt.
- Glenn, M.R. and R. Garwal, 1999. Clinical waste in developing countries. An analysis with a Case Study of India and a critique of the Basle TWG guidelines. Govt. of India, Ministry of Environment and Forests, Delhi, India.
- Gumodoka, B., J. Vos and Z.A. Berege, 1996. Injection practices in Mwanza Region, Tanzania: prescriptions, patient demand and sterility. *Trop. Med. Int. Health*, 1: 874-880.
- Keilmann, A.A., K. Janovsky and H. Annet, 1992. Protocols for Rapid Data Collection and Analysis: Assessing District Health Needs Services and System. John Wiley and Sons Inc., New York, USA.
- Khan, A.J., S.C. Luby and F.F. Fikree, 2000. Unsafe injections and the transmission of hepatitis B and C in a periurban community in Pakistan. *Bull. World Health Organ.*, 78(8): 956-963.
- Luby, S., C. Qamruddin and A. Shah, 1997. The relationship between therapeutic injections and high prevalence of hepatitis C infection in Hafizabad, Pakistan. *Epidemiol. Infect.*, 119: 349-356.
- McKay, G., 2002. Dioxin characterisation, formation and minimisation during municipal solid waste (MSW) incineration: A review. *Chem. Eng. J.*, 86: 343-368.
- Mujeeb, S. and K. Mehmood, 1996. Prevalence of HBV, HCV and HIV infections among family blood donors. *Ann. Saudi Med.*, 16: 702-703.
- Prawitasari, H.J., S. Suryatwati and S. Danu, 1996. Inter-actional group discussion: Results of a controlled trial using a behavioral intervention to reduce the use of injections in public health facilities. *Soc. Sci. Med.*, 42: 1177-1183.
- Rutala, A.W., R.L. Odetta and G.P. Samsa, 1998. Management of infectious waste by US hospitals. *JAMA*, 262(12): 1635-1640.
- Shagufta, S., 1995. Hospital waste management in Punjab. *Pak. J. Health*, 32(3): 34-41.
- Sharma, S. and S.V.S. Chauhan, 2008. Assessment of bio-medical waste management in three apex Government hospitals of Agra. *J. Environ. Biol.*, 29(2): 159-162.
- Singh, V.P., G. Biswas and J.J. Sharma, 1999. Biomedical waste management - an emerging concern in Indian hospitals. *Indian J. Forensic Med. Toxicol.*, 1(1): 7-12.
- US-EPA, 2000. Federal plan requirements for hospital/medical/infectious waste incinerators constructed on or before June 20, 1996. Proposed Rules, 64 FR 36426, July 6, Washington D.C., USA.
- US-EPA, 1990. Medical waste management in the United States: First interim report to congress. US EPA Office of Solid Waste, EPA/530-SW-90-051a, Washington D.C., USA.
- WHO, 2000. Hazardous Waste from Health Care Facilities. World Health Organization, Rome, Italy.
- WHO, 1999. Safe Management of Waste from Health Care Activities, World Health Organization (WHO), Rome, Italy.
- Zafar, R.A., 2002. Implementation of GIS (Geographical information system) on hospital waste management of Saidpur Road: A pilot project on rawalpindi public and private sector hospitals. M.A. Thesis, Department of Environmental Science, Fatima Jinnah Women University, Rawalpindi.
- Zuberi, S.J. and T.Z. Lodi, 1978. Prevalence of hepatitis b surface antigen and anti body in healthy subject and patients with liver disease. *J. Pak. Med. Assoc.*, 28: 1-8.