HOSPITAL WASTE MANAGEMENT STATUS IN LEBANON

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ABSTRACT

The existing management of hospital waste in Lebanon currently poses both an environmental hazard as well as a public health risk. This is due mainly to lack of legislation, information and modern treatment and disposal facilities designed for this purpose. A nation-wide questionnaire survey was conducted to assess the status of hospital waste management. The study started from October 1997 till August 1998. We found that 75% of the surveyed hospitals completely ignore their total waste quantity; 73% of hospitals surveyed practice segregation at source of infectious, pathological, sharps and pharmaceuticals; more than 40% dispose of their hospital risk wastes through the municipality waste disposal, 24 % by burning in open fires, 14% by on-site hospital incinerators, 11% in on-site dumping, 8% handled by a private contractor and 1% in uncontrolled landfill. We conclude that with some exceptions, the hospital waste management situation in Lebanon is very far from being satisfactory and therefore needs to be reconsidered.

Keywords: hospital waste management, hospital risk waste, infectious waste, pathological waste, pharmaceutical waste

INTRODUCTION

Environmental deterioration has become among the most pressing public and official concerns worldwide, both in developing and developed countries. In Lebanon, the environmental problems especially the disposal of hazardous hospital waste is acute due to the effects of the long war and the lack of adequate environmental policies and services (Halbwacks, 1994).

There is a growing awareness, on a world-wide scale, of the need to impose stricter controls on the disposal of waste generated by hospitals and other healthcare

services. Hospital waste poses a serious public health problem (Bencko *and al*., 1993; Culikova *and al.,* 1995). As the volume and complexity of hospital waste increase so does the risk of transmitting disease through unsatisfactory handling and disposal practices. The rise in the incidence of diseases such as AIDS and hepatitis B open up the possibility of infection of personnel handling the waste, and the widespread illicit use of drugs makes the need for proper disposal of used syringes and sharps imperative. The results of a nation-wide survey, which was conducted in order to assess the present situation, to advise hospital directors on an environmentally safe policy and to facilitate a strategy suitable for Lebanon, are reported herein.

MATERIALS AND METHODS

The total area of Lebanon is 10 452 km^2, divided into five administrative areas. More than 90% of the hospitals in Lebanon are operated by the private sector of which the Ministry of Health finances 70% of the patient treatments. The remaining 30% of patient treatment are financed through private insurance or by individual. Therefore, the Ministry of Health is the largest client of the private sector. The survey was conducted by a questionnaire prepared in Arabic, English and French and was comprised of five parts. This survey questionnaire inquires about the hospital type, size, number of beds and number of admissions per year. It studied segregation, collection, storage, treatment and disposal of hospital waste, i.e. all stages from the production until final treatment. The focus of this particular survey is on hospital risk waste according to the World Health Organisation (WHO) classification (Table I) generated by private general hospitals, since the non-risk waste may be collected, transported and disposed in a similar way as municipal waste. Other non-general hospitals (e.g. rehabilitation, chronic long term, etc), that normally produce much less hospital risk waste per occupied bed were excluded from this study. Statistical analyses were carried out using SPSS for windows 6.0. This questionnaire was sent to all general hospitals of the private sector located in the five regions of Lebanon. These hospitals are of varying sizes; all belonged to the Syndicate of Private hospitals. Seventy-three hospitals providing approximately 6811 available beds collaborated and answered the questionnaire. They represent 67% of those currently involved in the study and a rate of 80% of occupied beds (Table II).

The data provided by hospitals about their waste generation was an estimation done, for some hospitals, by manually counting the number of waste bags, sharps bins, from one or more collection rounds and projecting this to daily numbers. For other establishments, estimation was done by measuring bags and container capacities. The data of this survey are presented in the order of the items of the questionnaire; this order corresponds to the chronology of the different phases of waste elimination.

Table I. Typical categories of healthcare risk wastes (World Health Organisation, CEHA. 1997).

Risk waste category	Description	Examples
Infectious waste	Waste suspected to contain pathogens	laboratory cultures; waste from isolation wards, tissues; materials or equipment in contact with infectious patients
Pathological waste	Human tissue or fluids	body parts; blood and other bodily fluids; human foetuses
Sharps	Sharp waste	needles; infusion sets; scalpels; knives; blades; broken glass
Pharmaceutical waste -including genotoxic waste	substances with genotoxic properties	expired or redundant pharmaceuticals; items contaminated or containing pharmaceuticals (bottles, boxes) waste containing cytotoxic drugs; waste containing genotoxic chemicals
Chemical waste	discarded chemical substances	laboratory reagents; film developer; expired or redundant disinfectants/solvents
Pressurised containers	empty/damaged gas cylinders, cartridges and aerosol cans	
Radioactive waste	waste containing radioactive substances	unused radiotherapy/lab research liquids; contaminated glassware, packages or absorbent paper; urine and excreta from patient treatment/testing with unsealed radionucleides sealed sources

Table II: Number and rates of surveyed hospitals and available beds.

Region	Hospital	Surveyed hospitals	%	Total beds	Occupied beds	%
Beirut	22	15	68%	2420	2046	85%
Mont-lebanon	33	22	66%	2415	1938	80%
North	18	15	83%	1247	1171	94%
South	20	13	65%	1454	1024	70%
Bekaa	16	8	50%	954	632	66%
Total	**109**	**73**	**67%**	**8490**	**6811**	**80%**

RESULTS

Seventy five percent of hospitals surveyed did not know their waste quantity. Only 18% give some inaccurate figures about the quantity of their risk waste. The average of total hospital waste generation obtained was 5.44 kg/occupied bed/day whereas the average of risk waste was 1.04 kg/occupied bed/day. Accordingly, the hospital risk waste estimates in this study represent approximately 19.2 % of the total waste stream from hospitals (Table III). The surveyed hospitals proved to have respectively the following numbers of occupied beds:

- 67% ———— 1<number of occupied bed>100.
- 22% ———— 101<number of occupied bed>200.
- 11% ———— 201<number of occupied bed>450.

Seventy three percent of hospitals surveyed practice segregation of infectious, pathological, sharps and pharmaceuticals. Only a few hospitals segregate chemical, radioactive and pressurised containers. We found that some hospitals that have on-site disposal facilities actively segregate risk wastes from non-risk wastes.
However, full segregation is not practiced for all risk wastes; pharmaceutical products and containers, which if not returned to the manufacturers, are disposed through the municipal waste system. Where no-risk waste disposal facilities exist, segregation is not practiced and risk waste is disposed of with non-risk waste.

Some hospitals with on-site disposal facilities segregate waste using appropriate yellow color-coded plastic bags. Where no segregation occurs, risk waste is disposed in black plastic bags for non-risk waste and disposal occurs through the municipal waste management system. In the majority of hospitals, it was noted that thebags were held in open bins; however, a small number of hospitals

occasionally used small pedal bins. Disposal of sharps occurs either in proprietary sharps containers, or more commonly in reused plastic or metal containers such as water bottles. Generally, there was no international biohazard labeling on risk waste bags, containers and bag holders. It was also noted that there was minimal labeling of the waste to allow identification of its source.
More than 40 % of hospital surveyed hospitals disposed their risk waste at municipal dumps, 24 % by burning in open fire, 14 % treated by on-site incinerators. Many hospitals do not mention the characteristics of their incinerator or the temperature of burning, nor the air pollution control equipment. Finally, 11% dispose of their risk waste in on-site dumping, 8% handled by a private contractor and 1% in uncontrolled landfill (Figure 1).

Table III. Estimated hospital waste generation.

Region	Number of hospitals	Number of beds	Risk waste (kg/occupied bed/day)	Total waste* (kg/occupied bed/day)	Proportion of risk waste (%)
Beirut	15	2046	0.78	6.0	13
Mount Lebanon	22	1938	1.28	5.8	22
North	15	1171	1.17	5.3	22
Bekaa	8	632	1.25	5.8	21.5
South	13	1024	0.75	4.3	17.4
Total	**73**	**6811**	**1.046**	**5.44**	**19.2**

* Total waste designated mixed risk and non-risk waste.

We note that Lebanon currently disposes of hospital risk waste using one of the following methods:

1. General hospital risk waste is mainly disposed at municipal dumps. The hospital risk waste is typically mixed with non-risk waste produced at the hospitals either during collection or storage and transport. Once at the municipal dump, the hospital risk waste is disposed of in the same manner as non-risk waste and domestic waste from the local community, using the same sorting and dumping facilities. It should be noted that all known and unknown municipal waste dumps are potentially contaminated with risk waste from hospitals. Therefore there is a risk of cross-infection to workers handling the waste on-site, members of the public who may be involved in materials scavenging and to wildlife.

Additionally, there is a potential for soil and groundwater contamination resulting in the migration of hazardous materials away from the sites.

2. Burning of hospital risk and non-risk waste in open fires occurs both on hospital sites and at municipal dumps. This can result in inadequate combustion of risk waste creating a greater potential for distributing the hazardous materials both into the air

and onto the local land, thus spreading the risk of exposure and environmental contamination.

3. Some hospitals burn hospital risk waste in basic, small-scale incinerators on the hospital site. The incinerators are generally used for the more hazardous hospital risk wastes, such as body parts or waste from highly infectious patients. The incinerators are 5 to 30 years old, and do not have provisions for any cleaning of stack emissions beyond rudimentary particulate removal systems. The incinerators are the subjects of significant public concern and complaints concerning smoke emissions; they are often operated at night to avoid the stack emissions visible in those hospitals.

4. Where hospitals have sufficient land, on-site dumping of hospital risk waste occurs either above ground or in large pits, which are then covered over with soil.
During the hospital surveys, we invited comments from hospital staff regarding their concerns and issues for the development of the hospital waste collection and treatment system. The main comments provided by the hospital are presented in Table IV.

Table IV. Comments provided by hospital staff regarding hospital waste collection and treatment system

Comments	N°of hospitals (out of 73)

Short term waste treatment and disposal	
Requires short term waste treatment solution	20
Future waste collection, treatment and disposal service	
Alternative disposal costs to a price per ton should be investigated (e.g. price per bed)	2
Hospital taxes should be discontinued to accommodate disposal costs	3
Government should fund disposal costs	5
Government should manage hospital waste collection and disposal	5
Future waste treatment and disposal technologies	
Investigate and assess the use of alternative treatment technologies	3
Incinerators preferred since they can treat all wastes	7
Segregation/recycling/composting of hospital waste where acceptable should be considered	5
Legislative requirements	
Hospitals should be forced to comply with waste segregation through legislation	10
National waste management guidance /regulations should be provided	13

Fifty percent of hospitals do not have a specific unit to deal with hospital waste management. More than 90% do not train their staff. None of the hospitals surveyed had adequate information about the physical and chemical composition of their wastes.

DISCUSSION

The survey shows that the waste management situation in Lebanon is not famous at all. In fact, only few hospitals surveyed practice a good segregation at source. The majority of hospitals have their own system for collect and segregation of hospital waste. Almost all hospital surveyed in the country do not pre-treat hospital waste before disposal. Majority are still practicing open dumping or inadequate landfill and finally very few hospitals are seriously considering developing programs and plans of action for adequate healthcare waste management: Handling, storage, transportation, treatment, disposal and training.
The total hospital waste stream can be broadly categorized into two waste types: non-risk waste and risk waste.

It has been reported by the World Health Organisation (WHO) that 75-88% of waste from hospitals falls into the non-risk waste category (comparable to domestic garbage) which can be disposed of in the municipal waste management system. The remaining 12-25% of hospital waste is comprised of those components, which are potentially contaminated with material, which has infectious, chemical or radioactive properties (World Health Organisation, Copenhagen 1983). These waste types are defined as risk waste and must be handled and disposed in such a manner as to minimise the potential for human exposure and cross-contamination. This data provided by hospitals about their waste generation may be inaccurate, which may affect the real value of hospital waste generation. Estimates of the generation of hospital risk waste should be based on bed numbers, bed occupancy, segregation and waste factors. These factors can be obtained from pre-published sources using data

collected in international studies and surveys (World Health Organisation, Copenhagen 1985) (Table V).

We notice that, risk waste generation in Lebanon meets the countries with a high income levels whereas the generation of mixed risk and non-risk waste meets those of the middle and high income levels countries.

Table V: Healthcare waste generation according to income levels (World Health Organisation, Copenhagen 1985)

Category	Waste factor(Kg/occupied bed/day)	
	Risk waste	Mixed risk and non-risk waste
Income area	Low <0.3 Middle 0.3-0.4 High 0.4-5.5	0.5-3 0.8-6 1.1-12

Accurate estimates of hospital waste generation are essential to the development of the system of collection and treatment of hospital waste since they determine transportation requirements and the number, capacity and size of treatment facilities.

The effective implementation of a risk-management strategy places a number of requirements on the hospitals generating the risk waste. We suggest that segregation at source, at the point of generation, is the only effective method of ensuring that risk and non-risk waste are kept separate and are appropriately handled and disposed. Segregation at source may reduce volume and cost (Fay *et al,.*1990; Cox *et al*,.1997).

Packaging and labeling must be carried out at the point of origin; safe disposal and handling of sharps is more important than ever especially with the risk of disease transmission (Gwyther, 1990). It is an essential element of any infection control program (Palenick *et al.,*1993). Good sharp disposal practice is essential in preventing accidental inoculation with blood or body fluids (Legge, 1996; Kopfer *et al.,*1993).

Each package must be labeled to allow the type of waste to be readily identified. Manual handling at all stages of the collection and transport process must be minimized as much as possible, to avoid direct contact between staff and the public and waste materials.

Procedures for in-house waste packaging, labeling and handling should be provided and such procedures should be regulated across the entire country.

One of today's major dilemmas in healthcare is the disposal of hospital waste (Crow,

1996). None of the existing disposal practices in Lebanon adequately meet the necessary standards for the safe disposal of hospital waste and protection of the environment and public health.

Therefore, it is recommended that these practices be discontinued as soon as possible.

In recent years, techniques have been developed to reduce human exposure to the toxic and infectious components of hospital waste.

There are many options available to replace the disposal methods currently in use in the country. The most commonly used techniques include internal segregation, containment and incineration (Phillips, 1999). The options included technologies such as gasification, steam sterilisation or heat disinfection which can be used to process certain categories of clinical waste prior to landfill-all, have advantages and disadvantages (World Health Organisation, Geneva 1992).

The World Health Organisation outlines the main advantages and disadvantages of the treatment and disposal options (Table VI). To select the most efficient treatment method of hospital waste, composition analysis is generally considered to be the fundamental information needed (Li, *et al.,*1993).

Table VI. Main advantages and disadvantages of some treatment and disposal option.

Treatment/disposal method	Advantages	Disadvantages
High temperature incineration	Very high disinfection efficiency; Adequate for all infectious waste, and most of pharmaceutical and chemical waste.	Incineration temperature of 800?C; Destruction of cytotoxics; Relatively high costs of investment and operation.
Steam sterilisation	Environmentally friendly;	Shredding is subject to

(Autoclaving)	Relatively low investment and operation costs.	many breakdowns and bad functioning; Operation requires qualified technicians; Inadequate for anatomic waste, pharmaceutical and chemical waste or waste not easily penetrable by steam.
Microwaving and Irradiation	Environmentally friendly. Good disinfection efficiency under appropriate operational conditions;	High investment and operation costs; Potential operation and maintenance problems.
Chemical sterilisation	Highly efficient disinfection; Good operating conditions; Costly if the chemical disinfectants are expensive.	Requirements of highly qualified technicians for operation of the process; Use of hazardous substances which require comprehensive safety measures; Inadequate for pharmaceutical, chemical and some types of infectious waste.

A study regarding the characteristics of hospital waste should also be done. To realize a sustainable development within hospitals, it is necessary that the need to maintain a balance between effective infection control and a good ecological environment is recognized and supported by healthcare workers and the hospital management (Daschner *and al*., 1997). Adequate training for all staff involved in the waste management chain is fundamental for the safe operation of a risk waste management system within a hospital. If staff is alerted to the correct procedures and protective clothing and equipment is provided, potentially dangerous accidents can be prevented (Burns, 1991). Responsible persons for all aspects of the waste management system must be clearly identified and appropriately trained. Finally, individual hospitals should prepare their own written policies and measures for waste handling, appropriate to their requirements.

We agree with all requirements of hospital staff regarding hospital waste collection and treatment system and propose the elaboration of a national program of sound healthcare waste management achievable through an action plan. Before implementing of this action plan, the country has to commit itself to developing a national policy, and designate responsibility to the appropriate government authority. The Ministry of Health or the Ministry of Environment will usually serve

as the principal authority, and should work closely with other relevant ministries. Policy commitment should be reflected in appropriate budgetary allocations at different government levels.

The proper management of hospital waste is largely dependent on good administration and organization inside hospital. These should be supported by adequate legislation and financing, as well as active participation of trained and informed staff.

CONCLUSION

Lebanon has not yet developed comprehensive hospital waste management regulations. In general, hospital activities in Lebanon are based on several provisions of laws and presidential orders, with only a number of decrees related to waste management. At this stage, a national policy document and technical guidelines should be framed on the basis of this national survey. We believe that safe and effective waste management will only be undertaken if enforced through legislation. We suggest that good waste management practice should be included, as part of the hospital rating system, and that national waste management guidance and a Code of Practice should be provided.

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