

Management of health-care waste in Izmir, Turkey

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Summary. The aim of this study was to evaluate health-care waste in the 18 districts of metropolitan municipality of the third biggest city in Turkey. This cross-sectional study was carried out with 825 health institutions established in the 18 districts of Izmir metropolitan municipality, in 2007. The total amount of health-care waste collected was 4841 tons and 621 kilograms per patient's bed in 2007. Most of the medical wastes were collected from Konak, Karsiyaka and Bornova districts and were 2308, 272 and 1020 tons, respectively. Regarding to overpopulation, the number of health institutions in these districts are more than the number of health institutions in the other administrative districts. There was a statistically significant, positive correlation between the amount of health-care waste collected and population of the 18 districts ($r = 0.79$, $p < 0.001$), and number of beds/patients ($r = 0.83$, $p < 0.001$). To provide a safe health-care waste management metropolitan municipality must provide hazardous waste separation in health institutions, establish sterilization units for infectious waste, and provide the last storage of medical waste in completely different, safe and special areas apart from the municipal waste storage areas.

Key words: health-care waste, waste management.

Riassunto (*Gestione dei rifiuti sanitari in Izmir, Turchia*). Il presente studio prende in considerazione il problema dei rifiuti sanitari in 18 distretti dell'area metropolitana della terza più grande città in Turchia. Questo studio, effettuato nel 2007, è rappresentativo di 825 istituzioni sanitarie in 18 distretti dell'area municipale di Izmir. La quantità di rifiuti sanitari raccolti nel 2007 è stata di 4841 tonnellate e 621 chilogrammi per letto d'ospedale. Molti dei rifiuti sanitari sono stati raccolti nei distretti di Konak, Karsiyaka e Bonova, rispettivamente 3308, 272 e 1020 tonnellate. Il numero delle istituzioni sanitarie nei suddetti distretti rappresenta la maggioranza delle istituzioni sanitarie di tutta l'area metropolitana di Izmir. È risultata una positiva correlazione, statisticamente significativa, tra la quantità di rifiuti sanitari raccolti e la densità della popolazione dei 18 distretti ($r = 0.79$, $p < 0.001$), e il numero di letti d'ospedale ($r = 0.79$, $p < 0.001$). Per ottenere una gestione in sicurezza dei rifiuti sanitari è necessario che la municipalità di Izmir provveda alla separazione dei rifiuti pericolosi nelle stesse istituzioni sanitarie, introducendo reparti di sterilizzazione per i rifiuti potenzialmente infetti e collocando i depositi per i rifiuti ospedalieri in aree separate da quelle per i rifiuti urbani.

Parole chiave: rifiuti sanitari, gestione dei rifiuti.

INTRODUCTION

Health-care waste includes all the waste generated by health-care establishments, research facilities, and laboratories. In addition, it includes the waste produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.) [1]. According to the Turkish Ministry of Environment and Forest declaration (published in the *Official Gazette* 25883-22/07/2005), waste generated by health-care facilities are being classified to the following categories [2]: *communal* waste, including items as packaging materials, paper, plastic, metals and office supplies; *medical* waste, including infectious waste, pathological waste and sharps; *hazardous* waste, including

chemicals, genotoxic waste as cytotoxic medicines, amalgam waste, pharmaceutical waste, heavy metals and pressurized containers; and *radioactive* waste.

The United Nations Conference on the Environment and Development (UNCED) in 1992 recommended a set of measures for waste management [1] as follows: *i*) to prevent and minimize waste production; *ii*) to reuse or recycle the waste to the extent possible; *iii*) to treat waste by safe and environmentally sound methods; and *iv*) to dispose of the final residues by landfill in confined and carefully designed sites.

In several countries, where many health concerns often compete for very limited resources, the management of health-care waste may not get the priority it

deserves [3]. A comprehensive survey is essential for planning an effective waste management programme. It is suggested that a wide-ranging questionnaire be completed for all health-care establishments in order to establish the following: number of hospital beds and bed occupancy rate for each health-care establishment; types and quantities of waste generated; personnel involved in the management of health-care waste; current health-care waste disposal practices, including segregation, collection, transportation, storage, and disposal methods [1].

Every health-care facility should have or develop a waste management plan that includes daily routines for collection, handling, segregation, and packaging of the different categories of waste. Facility managers should ensure that this plan is in place, with adequate budget and personnel to implement it. Implementation of the health-care waste management plan and routine monitoring should be carried out in parallel with the information/training program [3].

All individuals exposed to hazardous health-care waste are potentially at risk, including those within health-care establishments that generate hazardous waste, and those outside these sources who either handle such waste or are exposed to it as a consequence of careless management. The main groups at risk are medical doctors, nurses, health-care auxiliaries, and hospital maintenance personnel; patients in health-care establishments or receiving home care; visitors to health-care establishments; workers in support services allied to health-care establishments; and workers in waste disposal facilities such as landfills or incinerators [1].

The aim of this study was to examine the health-care waste management at 18 districts in the metropolitan area of Municipality of İzmir, the third biggest city in Turkey, and evaluate the solution suggestions.

MATERIAL AND METHODS

Izmir is the third biggest city located in the West Anatolian Region of Turkey. The total population of Izmir is approximately 3.8 million (based on the census 2007) with considerable number of immigrants from the Eastern regions of Turkey. There are 28 administrative districts within the municipal borders of Izmir and 18 of them are in the area of metropolitan municipality. In these 18 districts, the health-care facilities such as collection, transportation, storage, and disposal of health-care waste are in the responsibility of Izmir metropolitan municipality.

This cross-sectional study was carried out with 825 health institutions established in 2007, in the 18 districts of Izmir metropolitan municipality. Data on the population and number of health institutions in these 18 districts in 2007 were provided from the Turkish Statistics Institute [4], Provincial Directorate of Health, and Izmir metropolitan municipality records [5]. The health institutions includ-

ed hospitals, laboratories, medical research centers, polyclinics, private hospitals and surgeries.

According to the medical waste control guide [2] and city waste management plan [5], in health institutions, communal waste was separated by staff of the institution, collected, and transported by district municipality and stored in the metropolitan common waste store area apart from other waste of health-care facilities. Health-care waste was separated by staff in each unit of the health institution, collected by trained workers, and stored temporarily to a maximum of 48 hours at a special area in the institution. Storage was provided according to the "management plan of health-care waste in units in health institutions". An authorized personnel of the institution conceded the temporarily stored health-care waste to metropolitan municipality by signing a formal paper for transportation. The waste was transported to Harmandalı Regular Solid Waste Storage Area to be stored apart from other waste. For transportation of the health-care waste, six registered medical waste collecting vehicles were used. Health-care waste of surgeries was collected daily without temporary storage by the metropolitan municipality.

In our study, we evaluated the data on health-care waste of health-care facilities of 2007 due to the records of Izmir metropolitan municipality and health institutions in Izmir. Applications were also observed at execution areas. Communal waste provided from the health institutions was not evaluated because it was treated by a different management plan. Due to the different way of collecting radioactive waste by the Atomic Energy Institution in Turkey, radioactive waste management was beyond the scope of this study.

All calculations were carried out using SPSS, version 11.0, for Windows. Spearman's ρ test was used for correlation analysis between the sample population and amount of health-care waste and between the sample population and number of beds per patients by year 2007.

RESULTS AND DISCUSSION

The total amount of health-care waste collected from the 825 health institutions by the metropolitan municipality was 4841 tons and 621 kg per each patient's bed in 2007. Most of the medical waste was collected from Konak, Karsiyaka and Bornova districts and was 2308, 272 and 1020 tons, respectively. Regarding to overpopulation, the number of health institutions in these districts are more than the number of health institutions in other administrative districts (*Table 1*). There was a statistically significant, strong and positive correlation between the amount of health-care waste generated and population of the 18 districts ($r = 0.79$, $p < 0.001$), and between the amount of health-care waste generated and number of beds/patients in these districts ($r = 0.83$, $p < 0.001$), respectively.

Table 1 | Population, number of health institutions and beds for patients in the 18 districts with the amount of health-care waste in Izmir, in 2007

Administrative district	Population	Health institutions (no.)	Beds for patients (no.)	Health-care waste (tons)	Health-care waste (kg/inhabitant)	Health-care waste (kg/patient's bed)
Balcova	74 837	19	800	599	8.0	2.05
Bornova*	476 153	114	1564	1020	2.1	1.78
Buca	400 930	61	531	204	0.5	1.05
Cigli	144 251	43	30	163	1.1	0.15
Gaziemir	109 291	29	-	31	0.3	-
Guzelbahce	19 255	6	-	1	0.1	-
Karsiyaka*	515 184	125	267	272	0.5	2.79
Konak*	848 226	351	4006	2308	2.7	1.58
Narlıdere	61 455	10	-	34	0.6	-
Aliaga	60 043	7	74	31	0.5	1.15
Bayındır	42 152	5	61	7	0.2	0.32
Foça	30 549	6	30	12	0.4	1.10
Kemalpaşa	81 777	14	-	9	0.1	-
Menderes	64 065	12	-	11	0.2	-
Menemen	126 934	10	122	49	0.4	1.10
Seferihisar	25 830	5	50	12	0.5	0.66
Torbali	119 506	6	100	36	0.3	0.98
Urla	48 058	2	162	42	0.9	0.71
Izmir	3 256 536	825	7 797	4841	1.5	1.70
Turkey	70 586 256		187 788	137 085	1.3	2.00

*: districts with overpopulation in Izmir.

In Turkey, the Ministry of Environment and Forest controls health institutions and municipalities in collection, transportation and storage of medical wastes. Izmir office of the Ministry inspected the 825 health institutions for 58 times in 2007. During these inspections, separation of communal and medical waste, temporary storage areas, training of the staff in waste management were evaluated by the officers.

Metropolitan municipality of Izmir has no special management plan for hazardous waste. In most of the health institutions, hazardous waste including chemicals, genotoxic waste as cytotoxic medicines, amalgam waste, pharmaceutical waste, heavy metals and pressurized containers are treated the same way as other types of medical waste. Only 7 of the health institutions made arrangements with firms for the specific extermination of hazardous wastes. Some of the liquid waste is even expelled by the city sewage network. In Izmir, Harmandalı is the only regular solid waste storage area with specially sealed ground managed by the metropolitan Municipality.

We observed that, neither the metropolitan Municipality nor the health institutions had re-cycling project, and the officers had no formal training in re-cycling management.

Today, there is an increase in the number of health institutions, and change in the quality and amount of waste produced due to the increase in popula-

tion. As health-care waste gives more risk for human health and environment than communal waste, many countries are obliged to have waste management policy and laws [2, 3, 6, 7].

We assessed that, there was a significant, positive and strong correlation between the amount of health-care waste generated and population of the 18 districts in Izmir and between the amount of health-care waste generated and number of beds/patients in these districts.

As in other cities, a large number of the health institutions are located in overcrowded districts in Izmir and produce large amounts of waste compared with small amounts of waste in less crowded districts. The amount of health-care waste per patient's bed in two districts is above the average amount of waste in Izmir. These two districts, Balcova and Bornova, have two university hospitals. Karşıyaka, another overcrowded district in Izmir, has a dozen of private hospitals, polyclinics and a university polyclinic. Although Konak is the largest district in Izmir, and has greater number of health institutions compared with the number of institutions in other districts, the amount of health-care waste was under the average amount of health-care waste of all districts with 1.58 kg/day/patient's bed, by 2007. This was attributed to the source the waste generated. In Konak, 84.1% of the institutions were private surgeries and

the amount of health-care waste was less than the amount of waste in other institutions. The waste produced by health facilities in Konak was mostly of communal waste.

Few studies presented similar results. The average amount of waste per patient's bed in Izmir was 1.70 kg/day and was similar to the average amount of waste in Turkey, by 2007 [2]. In a comprehensive study in Bangladesh, the amount of health-care waste/patient's bed was less than the amount of waste in our study, while studies from Abuja Nigeria, Korea and Bangalore presented similar results with ours [8-11].

In our study, the amount of non-hazardous waste was not considered. In 1995, the Ministry of Environment and Forest declared the amount of non-hazardous waste to be 73.0% of all wastes in Turkey [2]. In Dhaka city, Bangladesh, the ratio was 77.4% and in Nigeria 87.6% [8, 9]. In European countries, 70.5% of solid waste established was communal waste, and the rest was medical, hazardous (2.0%) and radioactive waste and dry batteries [12].

Waste management, as an important part of environmental hygiene, needs to be integrated with environmental planning and policies. Improper collec-

tion, storage, treatment and disposal can lead to serious environmental damages of various kinds [9].

CONCLUSION

The growing number of hospitals, clinics, policlinics and laboratories in Izmir exerts a tremendous impact on public health and environment. Proper management of medical waste by Izmir metropolitan municipality is crucial to minimise health risks. Medical waste requires specialized treatment and management from its source to final disposal. Therefore, medical waste management plan should be adequate, formal training in waste management should be given to all people whom it concerns and coordination between health institutions and waste management officers must be provided.

Conflict of interest statement

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias conduct and findings of this study.

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