

Improvement to the quality of the healthcare system – safe healthcare waste management

Dr VERICA JOVANOVIĆ¹, SCOTT CROSSETT¹,
dr ELIZABET PAUNOVIĆ², RADMILA ŠEROVIĆ³,
JAN GERD KUHLING¹, CRAIG CHANDLER¹,
MILORAD STANAREVIĆ¹, VIKTOR HRISTOV¹,
KATARINA BOGOJEVIĆ¹

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The issue of healthcare waste management in Serbia has been continuously raised, but up until now, action has been confined to a series of foreign donation supported studies. Healthcare waste is produced in healthcare facilities in uneven quantities, depending on the type of facility, number of beds, diseases treated and types of medical services provided. Healthcare waste in Serbia is inadequately disposed of. It is estimated that approximately 48,000 tons of total waste is produced in all healthcare institutions in Serbia every year. About 9,600 tons of this waste could be considered hazardous.

The National Waste Management Strategy was adopted by the Government of Serbia in 2003, however, its implementation, in the field of medical waste management, is in its infancy.

Project "Technical Assistance for Healthcare Waste Management" is the first phase in organized activities of Ministry of Health and Ministry of Environmental Protection, and the Veterinary Directorate to solve this problem.

Key words: *Healthcare, healthcare waste management, infectious healthcare waste*

1. INTRODUCTION

The main objective of the "Technical Assistance for Healthcare Waste Management" project of the Ministry of Health of the Republic of Serbia, funded by the European Union through the European Agency for Reconstruction, is the development of an efficient system for collection, storage, treatment and disposal of infectious healthcare waste, pursuant to the national legislation, as well as corresponding directives applied in the countries within the European Union, which can be adapted to the national legislation.

This includes:

- Equipping healthcare institutions with the necessary infectious healthcare waste sterilization systems, according to a previously completed assessment of needs and amounts of infectious healthcare waste produced in each of the healthcare institutions.

Address authors: Project of the Ministry of Health/
European Agency for Reconstruction¹, Ministry of
Health of the Republic of Serbia², Ministry of
Environmental Protection of the Republic of Serbia³

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- Supervision of the installation of infectious healthcare waste sterilization equipment and auxiliary procedures.
- Adoption of bylaws, which will define infectious healthcare waste pathways, as well as collection and treatment technology, in greater detail.
- Development of a National Strategy for Infectious Healthcare Waste in the healthcare sector in Serbia.
- Adoption of a National Good Practice Guideline for Infectious Healthcare Waste Handling.
- Defining financial viability of the proposed model of infectious healthcare waste handling.
- Building necessary human resources base and staff training.
- Taking part in the campaign for raising awareness of the professionals working in this field, as well as within the general public, on the advantages of appropriate handling procedures for infectious healthcare waste in Serbia.
- Activities within the scope of this project are currently under way in 25 administrative districts in Serbia. The largest producers of healthcare

waste in Serbia are currently in the process of acquiring equipment and undergoing preparations necessary for the introduction of a new system of healthcare waste management.

- 78 processing plants for the treatment of infectious healthcare waste have been distributed to healthcare institutions in 25 administrative districts in Serbia. The main criterion used to determine which institutions should receive the autoclaves and shredders was the amount of infectious healthcare waste produced in the given healthcare institution.
- Ministry of health of the Republic of Serbia has decided to propose and select the district model for the territory of the Republic of Serbia, as a sustainable model that solves the problems of the largest producers of infectious healthcare waste on a given district's territory and which provides the most adequate geographical distribution of the necessary equipment.
- The equipment that is now in use in demonstration districts comprises autoclaves for infectious healthcare waste sterilization (with the capacity of 165 kg/8h) and a shredder for the minimization of the sterile, i.e. newly formed municipal waste. One infectious healthcare waste treatment system, according to this model, comprises one autoclave and one shredder unit.
- The Ministry of Health has decided to form central treatment sites (CMT) and local treatment sites (LMT) for the treatment of infectious healthcare waste.
- A total of 54 institutions have been equipped with the capacities for treatment of infectious healthcare waste generated in these institutions. In addition, 15 institutes for public health have been equipped with a shredder unit for waste minimization, with the obligation to use the existing capacities for the pretreatment of the said waste.
- 2 healthcare institutions that will receive a transporting vehicle will be the CMTs, while the other institutions receiving the equipment will serve as LMTs and will handle mostly their own waste.
- CMT/LMTs will be charged with collecting healthcare waste from other institutions in the given district.
- CMT/LMT will also be entitled to provide services to the infectious healthcare waste producers from the private sector (private practices, laboratories etc).

In Serbia, waste is classified according to the European Waste Catalogue, used by all member states of the EU. This document contains 20 chapters

and over 960 codes. Section 18 refers to the waste produced while providing healthcare services, both medical (category 01) and veterinary (category 02). Category designated 18 01 03 refers to infectious healthcare waste.

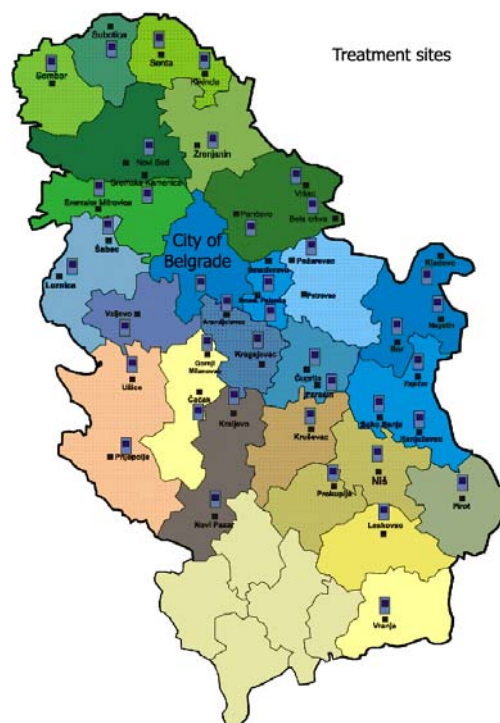


Figure 1: District model for handling infectious healthcare waste

2. MAIN ACTIVITIES AND EXPECTED RESULTS

The main objective in improving infectious healthcare waste management is to introduce a uniform healthcare waste management system (most importantly, for infectious healthcare waste) on the territory of the Republic of Serbia.

The final result expected from the ongoing activities is that, starting from June 2009, there will be no more infectious healthcare waste leaving the healthcare institutions without previously having been sterilized, i.e. rendered non-infective.

An important achievement, which will trace the route of generally accepted procedures in defining the handling and treatment of healthcare waste, is the Good Practice Guideline for Healthcare Waste Management and Handling. It is expected that the recommendations contained in this guideline will be included in a sublegal act ensuring uniform procedures for separation and treatment of infectious waste in healthcare institutions.

Activities of the inspections of Ministry of Environmental Protection and Ministry of Health will accompany the management processes for infectious healthcare waste in all districts in Serbia and will represent an important instrument of quality control and implementation of infectious healthcare waste handling procedures in healthcare institutions. All necessary preparations for the initiation of these activities are now almost completed.

In addition to these activities, each healthcare institution will be motivated further to control the realization of newly adopted procedures through its own committees, Hospital Infection Prevention Committee and Healthcare Waste Management Committee.

In the Republic of Serbia, the **district model** will be applied to infectious healthcare waste management. In each district, at least **one general hospital**, typically one which is in the central town of the said administrative district, will be equipped with adequate capacities - autoclave and shredder, for waste sterilization and grinding, both for its own waste and the waste produced in other healthcare institutions in that same district. This hospital will be designated **Central Waste Treatment Site (CMT)**. In towns with a tertiary level of healthcare services, primary healthcare centers will play the part of CMTs. It is estimated that in any district, the total amount of infectious waste generated by the primary healthcare institutions (on average, 7 primary healthcare centers per district) amounts to 30% of the amount of infectious healthcare waste generated by the largest general hospital in the district.

3. HEALTHCARE SERVICES QUALITY AND TREATMENT OF INFECTIOUS HEALTHCARE WASTE

Procedures that improve the quality of the healthcare system regulate the process of handling, storage and final disposal of infectious healthcare waste.

Infectious healthcare waste flow in each of the healthcare institutions is shown in a simplified diagram below (figure 2, infectious healthcare waste flow in a healthcare institution).

Categorization of the generated healthcare waste at its place of origin, labeling, packing, internal transport, temporary storage and delivery and/or treatment in autoclaves present the processes of handling and managing this particular class of healthcare waste in any healthcare institution, whether it is a primary, secondary or tertiary healthcare institution. Commonly referred to as the flow of infectious waste, it allows for each of the said procedures to be defined, to ensure a higher quality of work conditions in

healthcare institutions and reduce health risks for the employees, as well as the risk of environmental pollution.

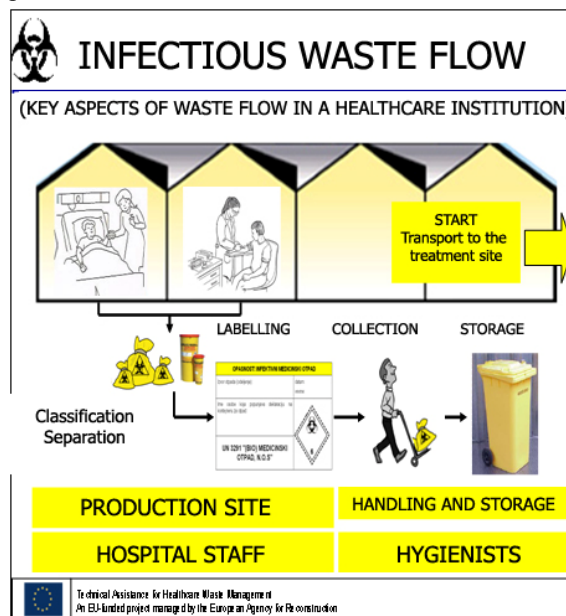


Figure 2 - Infectious healthcare waste flow

Infectious healthcare waste generated in the healthcare sector in the Republic of Serbia will be labeled by yellow color, pursuant to the recommendations of the World Health Organization and in accordance with the principles agreed upon by domestic professionals in this field.

The objective of introducing separation procedures of this type of waste from any other types of waste, at the site where the healthcare services are provided, as described herein, is to reduce the amounts of this type of waste arriving to the disposal sites by 50%, to achieve the daily average of infectious waste produced of 0.35 kg per bed in the hospitals of Serbia, which is a basic indicator of the quality of performance in the healthcare sector in all developed countries in the world [1].

The ultimate goal of these activities is to eliminate the risk of spreading infections outside healthcare institutions and to prevent the infectious healthcare waste to leave the institutions in which it was produced without previously having been decontaminated.

Transport of small amounts of infectious waste from primary healthcare centers and appended healthcare stations and practices to the CMT will be organized for each of the districts, according to the plan and schedule prescribed by the healthcare waste manager of each of the CMTs.

Plans for disposal of infectious healthcare waste of each healthcare institution will include collection schedules, deliveries, treatments, and responsibilities of the employees. These plans are an important instrument in improving the quality of work conditions in healthcare institutions [2].

Management of each healthcare institution will be improved by the introduction of a quality infectious healthcare waste management.

In the institutions that have introduced the ISO standard (ISO 9000), the procedures described as important herein have already been introduced, and will be defined in greater detail in the new operating rules [3].

4. TREATMENT IN AUTOCLAVES AND SHREDDERS ELIMINATES THE RISK OF SPREADING DISEASES

Treatment of infectious healthcare waste by sterilization through the application of steam is based on the principles of sterilization and disinfection of medical instruments and equipment.



Figure 3 - Autoclaves for the treatment of infectious healthcare waste

This process takes place under high pressure (2.05 bars) and temperature (121°C - 134°C) in a chamber filled with saturated steam to almost 100%. Saturated steam, at high temperature and high pressure, destroys organic matter and thus eliminates fungi, spores and bacteria. Steam transfers thermal energy, destroying pathogens and, in vacuum, disrupts the structure of pathogenic microorganisms right at the start of the cycle. General characteristics of the process of infectious healthcare waste sterilization through the use of autoclaves (manufactured by Getinge) are the possibility of automatic process control, constant monitoring of the sterilization cycle, logs of all processes and parameters used to monitor the treatment, monitoring of daily cycles, simplification of

record keeping, high level of safety during operation, evidence that the treated waste has been sterilized, as well as an option to verify the quality of each sterilization performed (Figure 4).



Figure 4 - Overview of the infectious healthcare waste treatment process

Waste generated in the healthcare services sector is a potential reservoir of microorganisms, representing a risk of infection in healthcare institutions. All persons exposed to the waste are at risk, both employees in healthcare institutions and those outside of healthcare institutions charged with handling of healthcare waste.

The following categories are at risk:

- doctors, nurses and other staff employed in the given healthcare institution,
- patients of the healthcare institution as well as those receiving treatment in their homes,
- visitors in healthcare institutions,
- personnel providing supporting services for the hospitals (laundries, employees handling and transporting waste),
- persons not employed in the healthcare sector charged with handling waste [4, 5].

Infectious healthcare waste contains a myriad of microorganisms (bacteria, viruses, parasites and fungi) in sufficient concentrations to cause a disease. If the waste is inadequately treated, microorganisms contained in the waste could be transferred by: puncture wounds, abrasions or cuts to the skin, or through mucous membranes, by air (inhalation) or ingestion [6, 12]. Existence of bacteria resistant to antibiotics and disinfectants can also contribute to the hazards of inadequate healthcare waste handling [7].

A special aspect of this problem is the transfer of the HIV virus, as well as Hepatitis B and C viruses,

which are proven to be transferred through healthcare waste. This issue is dealt with separately. These viruses are typically transferred by injury caused by sharp objects (most frequently, needles) contaminated by blood. This form of healthcare waste represents the greatest potential health hazard. Injuries involving used sharps represent a double risk - the injury itself and the subsequent infection of the wound. Most injuries occur because the used needles are not disposed into safe containers (boxes) or because these containers are overloaded.

5. INTRAHOSPITAL INFECTION CONTROL

A distinct aspect of infectious healthcare waste management, especially in hospitals, is the prevention of nosocomial infections. Nosocomial infections (hospital infections) are infections that were not present at the time of the patients' admission into the hospital, but have arisen during their hospitalization (at least 48 hours following admission) and can also occur in healthcare workers and visitors [8, 9].

There are two types of such infections: endogenous (autoinfections) and exogenous (caused by cross contamination) [8, 10, 11, 12].

In endogenous infections, microorganisms are present in the patient's body at the time of admission into the healthcare institution, but there are no visible signs of the infection. Infection develops during hospitalization as a consequence of the patient's reduced resistance.

Cross-infections develop during the hospitalization of the patient, once the patient comes into contact with new infectious agents.

Healthcare personnel, patients, visitors and the non-living hospital environment, including working surfaces and healthcare waste, can all be **the source** of nosocomial infections.

Proper disposal of infectious healthcare waste and its appropriate treatment reduces and eliminates the risk of transferring such infectious microorganisms [12, 13, 14].

Standards and requests pertaining to the quality of healthcare services provided by healthcare institutions (healthcare service providers) are defined in the relevant legislation. Hospital infections prevention committees are obliged to monitor, among other procedures, the disposal of infectious healthcare waste, as well as potential risk for development of nosocomial infections.

6. CONCLUSION

Introduction of an infectious healthcare waste management system is a process that has begun in June 2007, through the activities encompassed by the project entitled "Technical Assistance for Healthcare

Waste Management". In 2009, the activities from this project will be transformed into regular activities of all healthcare institutions within the public healthcare system.

Being that these activities are realized in cooperation with the Ministry for Environmental Protection, realization of the project objectives will represent an improvement in environmental protection on the territory of the entire Republic.

Veterinary Directorate will accept the recommendations applied in the healthcare sector, being that the general principles of handling infectious waste in the veterinary sector are the same as in the human healthcare sector, in the in all developed countries in the world, especially in the countries in the European Union.

Development of mandatory infectious healthcare waste management plans in all healthcare institutions in Serbia will allow the application of uniform procedures in the said field.

Management improvements in this segment of the healthcare system will allow for an improvement in the healthcare services, both in the public and in the private healthcare sector.

Good Practice Guideline, which will be published by the Expert Committee of the Republic of Serbia for the Development and Implementation of a Guideline, will contain professional recommendations pertaining to handling and management of the infectious healthcare waste.

A Guideline with the same principles will be published in the field of veterinary medicine as well.

Quality of services provided in the healthcare sector, pertaining to separation, labeling, packing, transport and treatment of infectious healthcare waste will be defined through indicators which will be monitored both in each healthcare institution separately, as well as within each of the 25 administrative districts.

Special training for the employees in the healthcare sector will help refresh the knowledge and skills of all employees and strengthen the possibilities of prevention of potential infections. District model will be applied to this segment as well.

New information on the implementation of activities described herein can be found on the Serbian Environmental Protection Forum website at: www.shcef.org.

Serbian Environmental Protection Forum will provide the medium through which the general public will be able to exchange views and opinions on this issue, which is of extreme importance for the health and healthy environment for all the citizens of Serbia.



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REZIME

NOVA DIMENZIJA KVALITETA SISTEMA ZDRAVSTVENE ZAŠTITE - BEZBEDNO UPRAVLJANJE INFEKTIVNIM MEDICINSKIM OTPADOM

Upravljanje otpadom se u Republici Srbiji smatra jednim od veoma važnih pitanja i to u više različitih sektora, a ne samo u zdravstvenom sektoru. Međutim do sada je detaljnija analiza situacije i količine stvaranja infektivnog medicinskog otpada u zdravstvenim ustanovama u javnom sektoru u Srbiji, bila uglavnom realizovana samo u okviru raznih projekata i donacija. Medicinski otpad je od posebnog značaja posebno zbog rizika koje donosi kako humanoј populaciji, tako i životnoj sredini.

Medicinski otpad se stvara u zdravstvenim ustanovama u značajnim količinama. Količine otpada koje se stvaraju u zdravstvenom sektoru zavise od tipa zdravstvene ustanove, broja kreveta tj. posteljnih kapaciteta, tipa bolesti koje se leče, kao i vrste zdravstvenih usluga koje se pružaju. Medicinski otpad se u Srbiji ne odlaze adekvatno. Procenjuje se da se ukupno u našoj zemlji godišnje proizvede oko 48, 000 tona ovog otpada. Oko 9.600 tona medicinskog otpada treba smatrati opasnim otpadom i treba se posvetiti uvodjenju pravila u rukovanju i zbrinjavanju istog.

Nacionalna strategija za otpad usvojena je od strane Vlade Republike Srbije 2003. godine, ali iz nepoznatih razloga upravljanje medicinskim otpadom još uvek nije zadovoljavajuće. Aktivnosti u okviru projekta „Tehnička podrška u upravljanju medicinskim otpadom“ je samo prva faza u dugotrajnoj i održivoj aktivnosti Ministarstva zdravlja, Ministarstva zaštite životne sredine, kao i Uprave za vetrinu.

Ključne reči: *Zdravstvena zaštita, upravljanje medicinskim otpadom, infektivni medicinski otpad.*