

## KNOWLEDGE AND ATTITUDES REGARDING THE MANAGEMENT OF CONTAMINATED WASTE IN DENTAL PRACTICE AMONG DENTAL DOCTORS IN IAȘI, ROMANIA

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### Abstract

Biologically contaminated waste in medical practice has become one of the most urgent environmental issues. As producers of hazardous waste, dentists have the responsibility and obligation to ensure proper waste management in their clinics. **The aim** of the study was to assess the knowledge and attitudes regarding the management of contaminated waste in dental practice among dental practitioners in Iași, Romania. **Material and methods:** A cross-sectional study was conducted using an online questionnaire via the survio platform, including questions related to demographic profile (age, gender, specialization, years of practice) and inquiries evaluating knowledge, awareness, and practice concerning biomedical waste management. **Results:** 78.7% of participants were aware of the guidelines regulating medical activity in dental offices; 85.3% of respondents correctly identified the colors for each type of waste; 46.7% of respondents chose "1 week" as the storage duration for waste; 72% of dentists consider that managing contaminated waste is their responsibility. **Conclusions:** our study revealed that although the attitude towards biomedical waste management was highly positive among the dentists, the results indicate that while dentists understand the importance of managing hazardous waste, knowledge and practice still have room for improvement.

**Keywords:** contaminated waste, dental clinic, dental practitioners

### Introduction

Dental waste originating from clinics and dental offices has become an urgent environmental and public safety concern. Biologically contaminated waste in medical practice has emerged as one of the most pressing environmental issues. As producers of hazardous waste, dentists have the responsibility and obligation to ensure proper management of waste within their clinics. Dental practitioners are increasingly concerned about the potential impact of dentistry on the environment and often take voluntary measures to reduce the production and release of non-polluting waste from their offices. As healthcare practitioners, we should be concerned with promoting not only human health and well-being but also that of the environment. A proactive approach will enable our profession to succeed in an era where there

is heightened public concern for the environment and environmental protection legislation. It is not only our legal obligation to provide dental services that benefit the public with minimal environmental costs but also our moral and ethical obligation (1-4).

Dental practitioners require education regarding proper methods of medical waste disposal to enhance their knowledge. A significant portion of dental practitioners do not practice adequate methods of medical waste disposal. Dental waste is often disposed of in uncontrolled disposal sites, posing a risk to public health and the environment.

Dental waste is regulated by medical waste control regulations in most countries. Even though the quantity of hazardous waste in solid dental waste is relatively small, there is still a risk of cross-infection and potential environmental hazards associated with

improperly managed waste. Hence, understanding waste composition and developing appropriate management alternatives are necessary (5).

The current waste management is characterized by a lack of accurate information regarding the quantity of waste produced, who produces what type and in what quantities, how they are treated, and subsequently disposed of. There is inadequate treatment of waste, insufficient suitable facilities within the waste management system (treatment, disposal), difficulties in finding appropriate waste disposal sites (difficulties in obtaining approvals from local communities and relevant authorities) (6).

It is highly important to establish a medical and dental waste management system that implements existing legislation throughout all waste management cycles, from waste generation to treatment and final disposal (7). Thus, the aim of the study was to assess the knowledge and attitudes regarding the management of contaminated waste in dental practice among dental practitioners in Iași.

#### MATERIALS AND METHODS

A cross-sectional questionnaire-based study was planned and conducted among dentists in the Iași county. Study participants included practicing dentists who responded to the questionnaire distributed online via the Survio platform.

For data collection, a structured questionnaire with closed-ended questions,

adapted from a cross-sectional study conducted by Sanjeev et al. (8), was utilized. The questionnaire comprised inquiries related to demographic profile (age, gender, specialization, years of practice) as well as questions assessing knowledge, awareness, and practices concerning the management of biomedical waste.

The responses were self-reported by the participants and recorded using 'yes' and 'no' answers, with some questions having response options formulated in correlation with the posed question.

The obtained data were analyzed using the SPSS 26.0 software. For statistical descriptive analysis, frequencies, mean values, and standard deviations were utilized. A 'P' value of  $\leq 0.05$  was considered statistically significant.

#### Results

The study involved 75 dental practitioners from the Iași county, with the mean age of the group being  $37.21 \pm 8.056$  years (min. 23 years, max. 54 years). The gender distribution was approximately equal, with male subjects comprising 55% of the participants. Regarding the specialty of the study participants, the results indicate that 55% of participants are specialists. 46.7% of respondents have more than 10 years of professional experience (Table 1).

Tabel 1. Demographic information about study group

Age	37.21± 8.056 years(min.23, max 54 years)
Gender	
Female	45%
Male	55%
Professional status	
Dentist	44%
Dental Specialist	55%
Work experiences	
0-5 years	25.3%
6-10 ears	28%
> 10 years	46.7%

The activity within dental offices is regulated by guidelines aimed at ensuring risk-free medical practices. The enforcement of these regulations results in increased safety in medical procedures. In our study, 78.7% of participants were aware of the existence of guidelines that regulate medical activities in dental offices (Table 2).

Materials left behind after medical procedures are primarily biologically contaminated. If these materials are contaminated with saliva or blood, they can be considered hazardous to those who come into contact with them. 84% of respondents are aware of this situation.

**Table 2. Questionnaire answers distribution.**

Questions	Answers	%	Professional status		
			Dentist	Dental Specialist	P
Did you know that all waste resulting from medical care is considered dangerous?	No	16.0	65.7%	10.0%	0.000
	Yes	84.0	34.3%	90.0%	
Do you know about the color codes for waste separation?	No	14.7	45.7%	27.5%	0.101
	Yes	85.3	54.3%	72.5%	
Are you aware that the clinic must have a standard storage room for keeping infectious waste?	No	18.7	8.6%	12.5%	0.000
	Yes	81.3	91.4%	87.5%	
Do you separate general waste from clinical waste?	No	39%	37.1%	27.5%	0.372
	Yes	61%	62.9%	72.5%	
Should accidents caused by sharp instruments be reported?	No	21.3	8.6%	12.5%	0.000
	Yes	78.7	91.4%	87.5%	
In which category of waste are impression materials and contaminated textile materials included?	Biologically contaminated waste	86.7	82.9%	90.0%	0.637
	Household waste	9.3	11.4%	7.5%	
	Don't know	4	5.7%	2.5%	
Do you know what the Biohazard symbol means?	No	22.7	0.0%	42.5%	0.000
	Yes	77.3	100.0%	57.5%	
Whose responsibility is the management of medical waste?	No	72.0	100.0%	47.5%	0.000
	Yes	28.0	0.0%	52.5%	
Do you believe that your knowledge regarding the management of biomedical waste is adequate?	No	21.3	20.0%	22.5%	0.000
	Yes	69.3	74.3%	65.0%	
	Don't know	9.3	5.7%	12.5%	
Do you believe you need additional information in the field of biomedical waste management?	No	30.7	14.3%	45.0%	0.016
	Yes	66.7	82.9%	52.5%	
	Don't know	2.7	2.9%	2.5%	

Based on the type of origin and degree of contamination, waste from dental offices is categorized into biologically contaminated waste and household waste, differentiated by colors. In our study, only 85.3% of respondents correctly answered the question regarding the recognition of colors for each type of waste. Specialists in dentistry are better informed than general dentists (Table 2).

The current regulations governing the operation of dental offices stipulate that contaminated materials should be stored in a specially designated space, well-ventilated, at a relatively low temperature, isolated from unauthorized access. 81.3% of respondents are knowledgeable about the existence of such a space. Dentists have more knowledge than specialists, and the statistically significant difference was noted ( $p=0.000$ ) (Table 2).

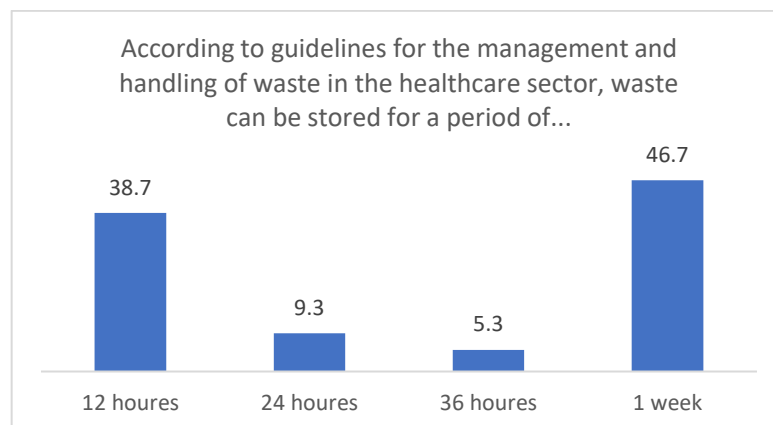


Figure 1. Distribution of answers to the question "According to the guidelines for the management and handling of waste in the healthcare sector, waste can be stored for a period of..."

At the question "According to the guidelines for managing and handling health waste, waste can be stored for a period of...", 46.7% of respondents chose the answer "1 week," followed by those who answered "12 hours." Current regulations permit the storage of contaminated waste for up to one week, provided they are stored properly (Fig.1). Specialists in dentistry were better informed than general dentists, with statistically significant differences recorded ( $p=0.001$ ) (Table 2).

An obligatory condition is the separation of household waste from contaminated waste, the latter requiring a different processing regimen to minimize exposure to contaminating factors. Only 61% of participants responded positively to this question.

In cases where these wastes are not correctly processed, there is an increased risk of accidents, especially when handling sharp or cutting instruments. Only 78.7% of respondents believe that these incidents should be reported. Reporting such incidents is necessary in the event of an accident because the risk of contamination is increased. General dentists responded slightly more than specialists, with statistically insignificant differences ( $p=0.582$ ) (Table 2).

The distribution of responses to the question "Where do you dispose of pharmaceutical waste, textile material, and

other items contaminated with blood?" shows that 70.7% of respondents deposit these materials in yellow biohazard containers, while 29.3% of respondents would store these materials in yellow bags. Materials contaminated with oral fluids or blood should be stored in yellow bags unless the material is sharp or piercing, in which case it should be stored in plastic containers. 78.7% of participants know that these materials should be stored in yellow bags. Out of all participants, 84% correctly answered the statement "Sharp wastes are disposed of in special labeled biohazard containers." These containers must meet certain conditions to prevent injury to the individual handling this type of waste.

Impression materials and contaminated textile material fall into the category of contaminated materials, recognized by 86.7% of participants. Specialists in dentistry responded correctly to a slightly higher extent, with the difference being statistically insignificant ( $p=0.637$ ) (Table 2).

The Biohazard symbol represents biologically contaminated material resulting from medical activities. This sign must be applied to any container, space, or surface posing a risk of biological contamination. All dentists responded positively to this question, unlike specialists, where only half declared knowledge of this term (Table 17).

The person responsible for managing contaminated materials is specifically designated for this role, commonly the dental assistant. This individual ensures that waste has been correctly separated, adequately stored, and timely collected by the specialized waste disposal company. 72% of dentists believe that handling these wastes is the doctor's responsibility, while 28% believe it is both the doctor's and the assistant's responsibility. All general dentists believe that the responsibility lies with the doctor, whereas 52% of specialists believe that responsibility lies with both the doctor and the assistant. The differences are statistically significant ( $p=0.000$ ) (Table 2).

Educating medical staff should begin in dental school, where students receive fundamental information about organizing medical activities. Only 68% of participants believe it's beneficial for students to receive this information in dental school (Table 2).

Out of all participants, only 77.3% consider it necessary to separate medical waste from household waste. After separation and storage, contaminated waste will be collected by a specialized company, typically treating these contaminated waste through incineration in specialized ovens. 41.3% of participants believe these wastes should be incinerated, while 45.3% believe they can be incinerated, buried, or sterilized (Table 2).

When asked if they consider having sufficient knowledge about waste management, 69.3% responded positively, followed by 21.3% who consider they lack sufficient knowledge. 66.7% of participants, mainly dentists, feel they need additional information in the field of biomedical waste management. The recorded differences were statistically significant ( $p=0.016$ ) (Table 2).

### Discussion

This study examines the knowledge, attitudes, and practices of biomedical waste

management among dental practitioners in Iasi County. Recognizing and separating waste represent the best solution for successfully managing contamination through waste (9). Dental offices are distinct spaces as they consist of multiple dental rooms and auxiliary spaces, unlike general dental clinics. The daily medical activity within a dental office generates large quantities of both household and biologically contaminated waste.

Medical waste has been classified by the World Health Organization (WHO) into eight categories: general waste, pathological waste, radioactive waste, chemical waste, infectious or potentially infectious waste, sharp objects, pharmaceutical waste, and pressurized containers (10). According to Nancy Godwin, dental waste can be classified as general waste (unregulated), contaminated waste (regulated and infectious waste), and hazardous waste (regulated and toxic waste) (11).

A generally accepted notion is that only 10-25% of medical care wastes are hazardous. However, the current study indicates that more than half of the surveyed physicians considered all medical care wastes to be hazardous. A study conducted in northern India by Kumar et al. (10) similarly reported that nearly 60% of respondents regarded all medical care wastes as hazardous. Nevertheless, approximately 50% of the participants in this study were knowledgeable about legislations regulating contaminated waste management. Our study's results indicate that our physicians have a lower level of knowledge and attitude compared to many other similar studies (10, 12-14), with the highest reported percentages being 94.6% and 98.6% by Amol et al. (15) and Khatri et al. (16), respectively.

Regarding the time limit for storing contaminated waste, it was observed that just over 40% of participants were aware that, according to national guidelines, contaminated waste cannot be stored for more than one week. This contrasts with a



study among dental medicine residents, where 71.3% of participants were aware of this limitation. However, 73.8% correctly identified the biological hazard symbol, which was higher than that reported by Kulkarni et al., which was 41.3% (17).

More than 70% of the respondents agreed with the segregation of biomedical waste into different categories, aligning with the majority of findings from prior studies (10-15). However, Raghuwar et al. (9) observed in their study that a significant number of respondents (63.7%) were not acquainted with the various categories of biomedical waste. Many of them perceived waste management as a team effort, and approximately 24.4% believed it to be an additional responsibility of the institution. Similar opinions were expressed by 27% and 30.4% of participants (dental practitioners) in studies conducted by Lakshmikantha et al. (13).

Almost 70% of the participants agreed that infectious waste should be sterilized before final disposal, a percentage higher than that reported in other research (52.7%) (15). Equally crucial to waste segregation is the correct labeling of the containers in which they are segregated. The same opinion was expressed by 91.7% of participants in the present study and also by 86% in Kulkarni et al.'s study (17).

The percentage of doctors feeling the need for more training in biomedical waste management, approximately 66%, is lower compared to several other studies, indicating an incorrect attitude towards a healthier and safer environment (9, 13, 15, 16). In practice, 97.5% of the participants routinely separate waste, consistent with a study by Pawar et al. (2) where 93.8% did the same. Practices regarding managing contaminated waste varied between studies. Many studies (12, 15) reported lower values for waste separation practices, while in a

study by Raghuwar et al. (18), around 86.2% disposed of all waste in common bins. Approximately 78% of participants correctly disposed of cotton, gauze, and other blood-contaminated items in yellow bags, which was less than the 70.8% reported by healthcare professionals in Pawar et al.'s study (2) and more than many other studies (15, 19). In Bansal et al.'s study (20), only 16% of doctors practiced the same. More than three-quarters of respondents improperly disposed of pharmaceutical waste. Approximately 75% reported adhering to the color code.

In a dental office, proper disposal of sharp objects such as infected needles is essential to prevent injuries from needle pricks and the contraction of infections like hepatitis and HIV. Correct disposal of these waste items in puncture-resistant containers was practiced by 84% of the respondents in this study, indicating that approximately one-quarter of them do not follow this practice. This observation warrants introspection regarding the proper disposal of sharp objects since there is a high potential for injury through needle pricks for those handling the waste if not disposed of correctly. Hence, doctors need education on the disposal of needles and other sharp objects in puncture-resistant containers. Additionally, the availability of these containers in all clinics should be ensured.

### **Conclusion**

Our study demonstrated that although the attitude toward the management of biomedical waste was highly positive among the doctors, specialist dentists seem to be better informed than general dental practitioners. The study's results indicate that doctors understand the importance of hazardous waste management, but knowledge and practices can still be improved.

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