

RISK OF POTENTIAL EXPOSURE INCIDENT IN NON-HEALTHCARE WORKERS IN CONTACT WITH INFECTIOUS AND MUNICIPAL WASTE

TVEGANJE ZA IZPOSTAVLJENOST NEZDRAVSTVENIH DELAVCEV, KI SO V STIKU Z INFEKTIVNIMI IN KOMUNALNIMI ODPADKI V AMBULANTAH DRUŽINSKE IN ZOBNE MEDICINE

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Received: Apr 8, 2017
Accepted: Jan 17, 2018

Original scientific article

ABSTRACT

Keywords:

medical waste,
injuries, primary
healthcare

Introduction: The proper classification of sharp and infectious waste in situ by the healthcare workers is an important measure of prevention of sharps and other exposure incidents in non-healthcare workers, who handle such waste. The aim was to examine the practice of classifying sharp and infectious waste in family and dental practices.

Methods: An analysis of 50 bags of infectious and 50 bags of municipal waste from five family and five dental practices for five days in October 2016 at the Health centre Osijek.

Results: Healthcare workers in 70% of the practices deposited sharps in infectious waste. In 56% of infectious waste bags, sharp object were found. More risky bags of infectious waste were produced by family practices (64%), but with no significant differences in relation to dental practices (48%), ($P=0.143$). Disposing of infectious into municipal waste was the case in 90% of the practitioners, where in 60% of municipal waste bags, infectious waste was disposed. Dental practices produced more risky bags of municipal waste (76%) in relation to family practices (44%), but with no significant difference ($P=0.714$).

Conclusions: The results of this research point to importance of performing audits of proper disposal of sharps and infectious waste to reduce the risks of injury to non-healthcare workers who come into contact with the said waste. Given results could be used for framing written protocols of proper disposal of sharps and infectious waste that should be visibly available in family and dental practices and for education of healthcare workers.

IZVLEČEK

Ključne besede:

medicinski odpadki,
poškodbe, primarna
zdravstvena zaščita

Uvod: Pravilno sortiranje ostrih predmetov in infektivnih odpadkov, ki ga izvajajo zdravstveni delavci, je pomembno za preprečevanje opozorilnih nevarnih dogodkov, posebej vbodov z ostrimi predmeti pri nezdravstvenih delavcih, ki z odpadki prihajajo v stik. Cilj je bil raziskati ločevanje ostrih in infektivnih odpadkov v ambulantah družinske medicine in ambulantah zobne medicine.

Metode: Analiziranih je bilo 50 vreč infektivnih in 50 vreč komunalnih odpadkov iz petih ambulant družinske medicine in petih ambulant zobne medicine v petih dneh v oktobru 2016 v Domu zdravlja Osijek.

Rezultati: Zdravstveni delavci so v 70 % ambulant odlagali ostre predmete v infektivne odpadke. V 56 % vreč z infektivnimi odpadki so bili najdeni ostrimi predmeti. Ordinacije družinske medicine so ustvarile več rizičnih vreč infektivnih odpadkov (64 %), vendar brez pomembne razlike glede na ambulante zobne medicine (48 %) ($P=0,143$). Odlaganje infektivnih odpadkov v komunalne je bilo v praksi dokazano v 90 % ordinacij, infektivni odpadki pa so bili dokazano prisotni v 60 % vrečah komunalnih odpadkov. Ordinacije zobne medicine so imele več rizičnih vreč komunalnih odpadkov (76 %) kot ordinacije družinske medicine (44 %), vendar brez pomembne razlike ($P=0,714$).

Zaključki: Rezultati tega raziskovanja nam kažejo pomembnost izvajanja testiranj o pravilnem odlaganju ostrih in infektivnih odpadkov, da bi se zmanjšalo tveganje za poškodbe nezdravstvenih delavcev, ki prihajajo v stik z navedenimi odpadki. Dobljeni rezultati bi lahko bili uporabljeni za oblikovanje pisanih protokolov za pravilno odlaganje ostrih in infektivnih odpadkov, ki naj bi bili vidno dostopni v družinski in zobni medicini, in za edukacijo zdravstvenih delavcev.

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1 INTRODUCTION

In Croatia, waste management and its individual segments are regulated by numerous legal documents, which are fully compliant with European regulations (1), where medical waste management was regulated as a separate category of waste (2). The largest producer of medical waste is the health system, i.e., it is the by-product of the health service delivery (3). Most medical waste in Croatia consists of non-hazardous waste, which in its composition, corresponds to municipal waste, and only a small portion (14%) consists of hazardous medical waste (4), which requires special methods of disposal and treatment (2). In Croatia, hazardous medical waste, in respect with the hazardous properties and the methods of management, is divided into infectious waste, sharps, pharmaceutical waste, chemical waste, cytotoxic and cytostatic waste, amalgam waste from dental care and other hazardous waste - any waste that has some of the hazardous properties listed in Appendix III of the Act on sustainable waste management (1). Despite significant progress in the medical waste management in recent decades, errors are still present, and their consequences can be disastrous (5). Among the many potential health hazards from contact with hazardous medical waste are HIV infection, hepatitis B and C, gastroenterological, respiratory, skin, and numerous other infections (3). All persons who come into close contact with hazardous medical waste are exposed to a potential risk of injury, including those that produce such waste and those who handle it (3). The main groups of people at risk of injury in health institutions are nurses and support staff, where the highest rate of injury through medical waste is present in the staff responsible for cleaning and workers involved in the transport and disposal of waste (3). Although hospitals are the largest producers of medical waste, we should not neglect its production at the level of primary health care, which deals with 80-85% of health problems in the community (6) and is the input filter into higher levels of health system (7). In Croatia, there is no data on behaviour patterns of healthcare workers in family practice (FP) and dental practice (DP) when disposing of components of sharps and infectious waste. The aim was to examine the practice of classifying sharps and infectious waste of healthcare workers in FP and DP, and to examine the

existence of risks for potential sharps injury and other exposure incidents in non-healthcare workers (cleaning staff, municipal workers) in contact with the said waste. These results would contribute to clarifying the pattern of behaviour of healthcare workers in FP and DP, when disposing of sharps and infectious waste, and point to the possible need for interventions that would enhance the said practice to reduce the risks of injuries in non-healthcare workers.

2 METHODS

In the area of Osijek - Baranja County in the year 2015, there were a total of 169 contracted FP teams and 123 DP teams. Of the total number of contracted teams, in six health centres in Osijek-Baranja County, there were 64 contracted FP teams and 47 contracted DP teams, where the Health centre Osijek had the largest number of contracted teams in these sectors (31 FP teams and 22 DP teams) (8). FP and DP teams in Health Centre Osijek were chosen for medical waste analysis, as they are the most numerous among all services provided by all health centres and are the largest producers of sharps and infectious waste. In order to select practitioners that constitute a representative sample, categories of family and dental practitioners in Health Centre Osijek were determined based on their levels of activity and the annual patient visits in 2015 (8). Three categories of FP have been determined, namely: up to 12000 visits, from 12001 to 15000 visits and more than 15000 visits, as well as three categories of DP: up to 2000 visits, from 2001 to 2500 visits and more than 2500 visits. Based on these categories, five FP teams (16.1%) and five DP teams (22.7%) from Health Centre Osijek were selected with the purpose of analysing infectious and municipal waste (Table 1). Given the relatively small daily amount of waste production in practice (in relation to the hospital), the overall, i.e., 100% daily production of infectious and municipal waste during 8 working hours per day, in selected 10 practices, over five average working days (weekends and holidays are excluded) in October 2016, was included for analysis of the types and quantities of waste components. Healthcare workers in the selected practices were unaware of the waste analysis.

Table 1. The method of selection of FP and DP for waste analysis in Health Centre Osijek.

Health centre Osijek	Categories of practices according to the annual number of patient visits in 2015	Number of practices within a category	Number of selected practices from a particular category (%)
FP	≤12000	12	2 (16.6)
	12001-15000	12	2 (16.6)
	>15000	7	1 (14,2)
DP	≤2000	8	2 (25)
	2001-2500	8	2 (25)
	>2500	6	1 (16.6)

FP - family practice; DP - dental practice

2.1 Waste Analysis

The waste was collected by the staff in charge of cleaning and analysed the same or the following day in order to avoid inaccurate results due to shrinkage of waste (9). When handling the waste during the analysis, personal protective equipment, a gripper for sorting and a protective pad on which the waste was sorted, were used. The sorted waste was weighed according to the groups and was later returned to the previously prepared new bags (9). Weighing was conducted on a moderate scale, with test spacing of 1 g, with the maximum value of 3000 g. In order to save the data anonymity, all practices were numbered during monitoring according to the order of waste analysis on the first day of monitoring, i.e., the name of the practice was replaced by a number (i.e. FP-1, FP-5, FP-9 etc.). Waste analysis of other practices (i.e., paediatric, pulmonary, occupational medicine, etc.) has been conducted as well, but due to the small number of these practices and a small waste production, was not included in this analysis. Waste analysis was photo-documented.

2.2 Statistical Analysis

Categorical data are presented in absolute and relative frequencies. Numerical data are presented in the median and limits of interquartile range. The differences of categorical variables were tested by Fisher's exact test. The normality of the distribution of numerical variables was tested by the Shapiro-Wilk test. The differences of normally distributed numerical variables between the two independent groups were tested by the Mann-Whitney U test. All P values are double-sided. The level of significance was set at $\alpha=0.05$. The statistical program MedCalc Statistical Software version 14.12.0 (MedCalc Software bvba, Ostend, Belgium; <http://www.medcalc.org>; 2014) was used for the statistical analysis.

3 RESULTS

Two healthcare workers in each practice, where one worker had a high school education (nurse/technician) and the other a university degree (medical doctor/dentist), or a total of 20 healthcare workers, were involved in the production of medical waste. Given the fact that every practice produced one bag of infectious and one bag of municipal waste daily, an analysis of the quantity and composition of 50 bags of municipal and 50 bags of infectious waste was conducted. A few years ago, containers for sharps (1.5 l) and infectious waste (25 l), marked by the type of waste, were set beside the municipal waste container in every practice (25 l). Although the Ordinance of waste management in Health Centre Osijek was adopted a few years ago, no written protocols were available to the healthcare workers until after the implementation of this waste analysis. Improper disposal of sharps waste (needles, ampoules) into infectious waste was found in 70% of the practices, i.e., in four FPs and three DPs. The proportion of sharps waste into infectious waste in FP ranged from 4 to 20% of the total of infectious waste over five days and in DP from 1 to 2% (Table 2).

Table 2. Five-day production of components of sharps in infectious waste in family and dental practices in Health Centre Osijek.

	The proportion of sharps in infectious waste/5 days (%)	TOTAL infectious waste/ 5 days (%)
FP-1	30 (4)	815 (100)
FP-5	94 (20)	478 (100)
FP-9	29 (5)	548 (100)
FP-12	55 (10)	531 (100)
FP-13	0	626 (100)
DP-3	11 (1)	1864 (100)
DP-4	29 (2)	1387 (100)
DP-8	0	2252 (100)
DP-10	19 (1)	2141 (100)
DP-11	0	3111 (100)

FP - family practice; DP - dental practice

The production of infectious waste in DP was significantly higher in relation to FP ($P=0.009$). Although the proportion of sharps in infectious waste was higher in FP, there were no significant differences in relation to DP ($P=0.090$) (Table 3).

Table 3. The average five-day production of sharps in infectious waste in family and dental practices in Health Centre Osijek.

	The median (interquartile range)		P*
	Family practice	Dental practice	
The proportion of sharps in infectious waste/ 5 days (g)	30 (14.5-74.5)	11 (1-18)	0.090
Total infectious waste/ 5 days (g)	548 (505-721)	2141 (1626-2682)	0.009

*Mann Whitney U test

Given the number of bags of infectious waste produced over five days in all practices in which incorrectly disposed of sharps (needles, ampoules) were found, 28 (56%) of a total of 50 bags of infectious waste represented the potential risk for sharps injuries for other persons who come into contact with infectious waste. Although FP produced a larger number of high-risk infectious waste bags, 16 (64%) of the total 25 bags, no significant differences in relation to DP were found (12 (48%)) ($P=0.143$) (Table 4).

Table 4. The type and frequency of sharps in infectious waste over five days in family and dental practices in Health Centre Osijek.

	Number of needles/ ampoules in infectious waste					Number of risky bags IW	Total number of risky bags IW	P*
	Day 1	Day 2	Day 3	Day 4	Day 5			
FP-1	0/5	1/3	0/1	0/6	0/3	5	16	0.143
FP-5	0/1	0/2	0/8	0/5	0/1	5		
FP-9	0/1	0/1	0/2	0/5	0/2	5		
FP-12	0	0	0	0/1	0	1		
FP-13	0	0	0	0	0	0		
DP-3	2/0	3/0	1/0	1/0	0	4	12	
DP-4	1/0	1/1	0	2/1	4/2	4		
DP-8	0	0	0	0	0	0		
DP-10	1/2	1/0	0/1	0/1	0	4		
DP-11	0	0	0	0	0	0		

FP - family practice; DP - dental practice; IW - infectious waste; * Fisher's exact test

Improper disposal of infectious waste in municipal waste was established in 90% of the practices, that is, only one FP has not deposited infectious waste into municipal waste. The proportion of infectious waste in FP ranged from 2 to 4% of the total of municipal waste over five days, and in DP, from 5 to 25%. No sharps in municipal waste bags have been established (Table 5).

Table 5. Five-day production of components of infectious waste in municipal waste in family and dental practices in Health Centre Osijek.

	The proportion of infectious in municipal waste/ 5 days (%)	TOTAL municipal waste/ 5 days (%)
FP-1	40 (2)	1652 (100)
FP-5	34 (4)	767 (100)
FP-9	3 (0)	1030 (100)
FP-12	61 (4)	1637 (100)
FP-13	0	898 (100)
DP-3	149 (18)	841 (100)
DP-4	297 (10)	2951 (100)
DP-8	308 (25)	1252 (100)
DP-10	89 (6)	1374 (100)
DP-11	75 (5)	1607 (100)

FP - family practice; DP - dental practice

Although DPs produced a larger amount of municipal waste, there were no significant differences of production of municipal waste in relation to FPs ($P=0.602$). Significantly more of infectious waste in municipal waste in relation to FP was deposited by DP ($P=0.009$) (Table 6).

Due to disposing of infectious waste into municipal waste, 30 (60%) of the bags of the total of 50, presented a risk for potential exposure incident for other persons who came into contact with them (cleaning staff, municipal workers). Although DP produced a larger number of high-risk municipal waste bags, 19 (76%) of the total of 25, compared to FP (11 (44%)), no significant differences have been determined ($P=0.714$) (Table 7).

Table 6. The average five-day production of infectious waste in municipal waste in family and dental practices in Health Centre Osijek.

	The median (interquartile range)		
	Family practice	Dental practice	P*
The proportion of infectious in municipal waste/ 5 days (g)	34 (2-51)	149 (82-303)	0.009
Total municipal waste/ 5 days (g)	1030 (833-1645)	1374 (1047-2279)	0.602

*Mann Whitney U test

Table 7. The amount and frequency of infectious waste in municipal waste over five days in family and dental practices in Health Centre Osijek.

	Infectious waste in municipal waste (g)					Number of risky bags MW	Total number of risky bags MW	p*
	Day 1	Day 2	Day 3	Day 4	Day 5			
FP-1	10	0	7	6	17	4	11	0.714
FP-5	0	21	13	0	0	2		
FP-9	0	0	0	0	3	1		
FP-12	17	15	13	0	16	4		
FP-13	0	0	0	0	0	0		
DP-3	100	7	15	18	9	5	19	
DP-4	58	44	63	53	79	5		
DP-8	25	6	62	79	0	4		
DP-10	0	25	30	34	0	3		
DP-11	20	55	0	0	0	2		

FP-family practice; DP-dental practice; MW- municipal waste; * Fisher's exact test

4 DISCUSSION

Sharp objects, such as used ampoules, should be disposed in situ into the sharps container (3, 10). Sharp objects which primarily are not contaminated, if stored in the infectious waste, get contaminated as a result of contact with other content of infectious waste (11). Sharps injury analysis in Croatia in the year 2015 (12) shows an increase in the number of reported accidental sharps injuries compared to the year 2014 (13). The largest number of incidents (63%) is related to the injuries with different kinds of needles. The most commonly injured were nurses (50%), followed by medical doctors (25%) and in high third place were the cleaning staff (10%) (12). From this analysis, the circumstances in which the cleaning staff members were injured, the frequency of which is quite high, considering that they are not in direct contact with patients, are not clearly visible (12). Sharps injury analysis in Croatia in 2015, states that a high number of sharps injuries of cleaning staff possibly results from improper sorting of waste in situ (12). The given assumption is supported by results of this research, which shows that healthcare workers in 70% of the practices, deposited primarily non-contaminated sharps waste (mostly empty ampoules) into infectious waste by mistake. Research on the analysis of the sharps injuries in non-healthcare workers in health facilities have shown that 60-80% of such injuries are due to improper disposal of sharp objects in infectious waste (11, 14-16), and that more than 30% of such injuries were caused by sharp objects, such as glass (15). The fact that more than a half of the infectious waste bags were risky, where FP produced a larger number of high-risk bags of infectious waste, shows the frequency of such improper conduct of healthcare professionals and the consequent exposure to accidental sharps injuries of other people who come into contact with infectious waste, such as the cleaning staff. These results can indicate a lack of knowledge of the majority of healthcare workers from this research on the methods of disposal of sharps waste in situ and the lack of awareness of the potential dangers of such practice on the health of other workers who come in contact with infectious waste. In addition, it is possible that the said defect is more present with FP healthcare workers. Despite a number of preventive measures, such as education and design of protective mechanisms, proper sorting and disposal of waste in situ represents the most effective measure to prevent injuries (14). Infectious waste, disposed of in municipal waste, contaminates its entire content (17, 18), which, primarily, was not like that. Results of this research have shown that healthcare workers in almost all practices (90%) mistakenly deposited infectious waste (gloves, material for dental impression...) in the municipal waste, and almost two thirds of municipal waste bags represented risks for potential exposure incidents for other persons

who come into contact with that kind of waste, where the DP prevailed in the number of produced contaminated municipal waste bags. Through such improper conduct of healthcare workers, the risk of endangering the health of others extends to an even greater number of people (e.g. municipal workers). Although the risk of infection in people exposed to exposure incidents through mucous membranes or injured skin is smaller than with injuries by contaminated sharp object, it is necessary to prevent these types of incidents, because the repetition of such exposure incidents increases the risk of transmission of infection (15). Based on the assessment method of disposal of medical waste, it is possible to identify activities where the improper sorting of waste in situ is conducted (19), and to determine the existence of risk of injury for non-healthcare workers (cleaning staff, municipal workers) who come into contact with the waste. While in literature, most attention is given to prevention of sharps injuries and other exposure incidents in healthcare workers, little attention is given to well-being and safety of non-healthcare workers who come in contact with hazardous medical waste (15). The results of waste analysis from this research emphasize the uncomfortable truth that the fundamental problem of exposure to harm of non-healthcare workers is a consequence of the improper conduct of healthcare workers when disposing of hazardous medical waste in situ (5). The results of this research confirm the recommendation on the need to conduct periodic surveys on sharps waste disposal with purpose of identifying incorrect procedures in practice (19), as well as the necessity for municipal waste surveillance, for a fuller insight into the practice of disposal of hazardous medical waste (5), all with the goal of preventing the sharps injuries and other exposure incidents of non-healthcare workers as well as all persons who come into contact with waste from health facilities. Characterization of medical waste is an essential tool not only to assess the production of waste within the institution, but also to accurately identify other types of problems (20). The results of this study reflect the paradox of the health care system in which healthcare workers on one hand 'cure,' but on the other hand 'endanger' the health. Although the results of this research cannot be generalized because of the small sample of monitored practices, they point to one aspect of risks for potential sharps injuries and other types of exposure incidents caused by the improper conduct of healthcare workers when disposing of sharps and infectious waste in situ.

5 CONCLUSION

The results of this research point to the importance of performing audits of proper disposal of sharps and infectious waste in outpatient settings, in order to reduce

the risks of injury to non-healthcare workers who come into contact with the said waste. Given results could be used for framing written protocols of proper disposal of sharps and infectious waste that should be visibly available in family and dental practices, as well as for education of healthcare workers, with an emphasis on the consequent dangers of improper conduct on the health of other people who come into contact with the said waste.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

FUNDING

For the purpose of implementing this medical waste analysis, Health Centre Osijek has provided the nurse for control and prevention of infections with personal protection equipment as well as time needed within her working hours.

ETHICAL APPROVAL

Received from the Commission for Ethical and Status Issues of Health Centre Osijek before the implementation of the research.

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