

Biosafety - Public Health and Veterinary Waste Management: A Case Study in Veterinary Clinics in Kermanshah. Iran

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Abstract

BACKGROUND: The harmful, dangerous essence of the veterinary waste of hospitals, clinics and laboratories and the consequences of their inconsistent management, such as problems caused by lack of planning in separating, storing, collecting, transporting and disposing of them, causes many environmental and health problems. On the other hand, according to clause 11 and 2 of the Special Waste Management Law of the Environment Protection Organization (E.P.O) and the Ministry of Health of Iran, the waste of veterinary clinics is also hazardous waste due to the presence of a variety of microorganisms harmful to humans and animals (such as anthrax & brucellosis, etc.).

OBJECTIVES: The guidelines and checklist of the Environment & World Health Organization (WHO) were used in order to increase awareness of the management of the waste from veterinary centers.

METHODS: The answers to the questions were completed by the direct referral of the researcher to 6 public and private veterinary centers. Statistical evaluation was analyzed using SPSS Version 22.

RESULTS: The results showed that although veterinary waste management in clinics and government laboratories is relatively more favorable than private veterinary clinics, it is far from world health standards.

CONCLUSIONS: Application of rules and guidelines, increasing the level of knowledge and staff training at all levels, and continuous monitoring of the collection, transportation and disposal of veterinary waste are necessary.

KEYWORDS: Bio safety, public health, veterinary clinics, waste management

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Introduction

Medical and veterinary waste management is one of the many complex and demanding challenges facing humanity as the global population swells and the demand for medical services increase. Medical waste is classified by the World Health Organization (WHO) as: “waste that is generated in the diagnosis, treatment or immunization of human beings or animals.” Medical waste that is not properly handled and disposed of represents a high risk of infection or injury to healthcare personnel, as well as a lesser risk to the general public through the spread of micro-organisms from healthcare facilities into the environment. As a result, the environmental pollution problems caused by waste production have attracted the attention of researchers (Oweis, Al-Widyan, & Al-Limoon, 2005; Sharma & Gupta, 2017; Windfeld & Brooks, 2015). To ensure the health of humans and animals, in addition to environmental protection, proper management of waste disposal is very important. Hospital and infectious wastes are one of the most dangerous environmental pollutants. According to the report of World Health Organization (WHO), hospital waste is produced during diagnostic, therapeutic, medical, veterinary and biological activities (Moreira & Günther, 2013; Oweis et al., 2005). Particularly, part of the waste produced in the process of providing health services to hospitals, clinics, medical and veterinary laboratories hazardous wastes is infectious (Komilis, Makroleivaditis, & Nikolakopoulou, 2017). Veterinary waste is an important part of the infectious waste containing dangerous and pathogenic agents. On the other hand, the issue of the management of veterinary and medical wastes is a challenge with lack of awareness, general educa-

tion and absence of adequate funding for the proper implementation. The collection and disposal of these types of waste are important because it directly contributes to creating a variety of risks for public and environmental health (Abdulla, Qdais, & Rabi, 2008). Therefore, as in the case of hazardous medical waste, it is also necessary to decide on the nature and methods of disposal of veterinary waste as a serious threat to human health and the environment (Chen, Liu, Feng, & Chen, 2012; Uysal & Tinmaz, 2004, Coad, 1992; Lee, Ellenbecker, & Moure-Eraso, 2004). This study was conducted for the first time to survey the current status of the hazardous and infectious waste management of veterinary service centers (public and private) in Kermanshah, Western Iran.

Material & Methods

Medical & veterinary waste control regulation of Iran

According to the guidelines, the National Environmental Law and the Iranian Ministry of Health have special provisions to control the management of the medical and veterinary infectious waste. On that basis, the collection, temporary storage, transportation and disposal of the waste produced in health centers are divided into six main groups (IN-REH, CWMIM&V, 2005). According to the regulations, solid waste should be collected in black plastic bags and recyclable materials in blue bags. In addition, according to clause 11 and 2 of the Hazardous Waste Management legislation of the High Council of the Environment and the Ministry of Health (Iran's Medical Waste Control Regulation, IMWCR 2008, Iran's Ministry of Environment and Health, 2008), sharp objects

should be put in yellow plastic containers and infectious waste, hazardous chemicals and pharmaceutical waste in red bags with a minimum capacity of 10 kilograms.

Study tool

In this descriptive-analytical project based on the guidelines of the Environmental Protection Agency, Iran's Ministry of Health and the World Health Organization, a questionnaire including seven questions about how to manage the waste of veterinary centers was designed (guideline* and questionnaires**). Then with direct referral and responding to the researcher's questions by experts in each department in three public veterinary centers(I) and three private clinics(II) (Clinics and laboratories), the questionnaire was completed. In order for more accurate evaluation, qualitative data (yes or no answers in the items) was turned into quantitative values. Based on this subject, the state of 1. Separation 2. Collection 3. Primary autoclave and non-bacterial culture medium 4. Keeping Temporarily 5. Evanescence at the site (fur-

nace or lime well (6. Transportation 7. Evacuated outside the place with a special hazardous waste device and disposal of hazardous and infectious wastes, the coefficient 14.285 was considered (in total 100%). General state of waste management for type of study centers was arranged. Favorable (score 1), Average (0.75), Unfavorable (0.5) and Critical (0.25). Finally, 14.285 coefficient was used for calculating the above scores. The total score for each question was calculated. The final score of the waste management was recorded. Data analysis, comparison and rank of public and private centers were performed using SPSS version 22 software with a significance level ($P \leq 0.05$).

I. Three public veterinary centers of Kermanshah, including veterinary centers of the city NO:1 (A), provincial NO:2 (B) and academic NO:3 (C).

II. Three private veterinary centers of Kermanshah, including NO:1(D), NO:2(E) and NO:3(F).

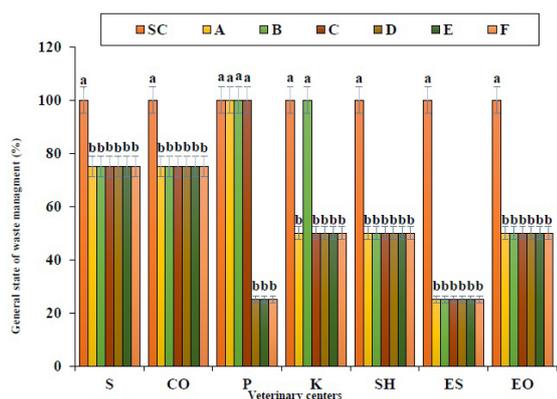


Figure 1. The general state of waste management in studied centers

*SC: Standard Center, Public sector (A), (B), (C), Private sector (D), (E), (F)

** S: Separation, CO: Collecting, P: Primary autoclave and non-bacterial culture medium, K: Keeping temporary, SH: Shipment, ES: evanescence at the site (furnace or lime-well), EO: Evacuated outside the place with a special device hazardous waste

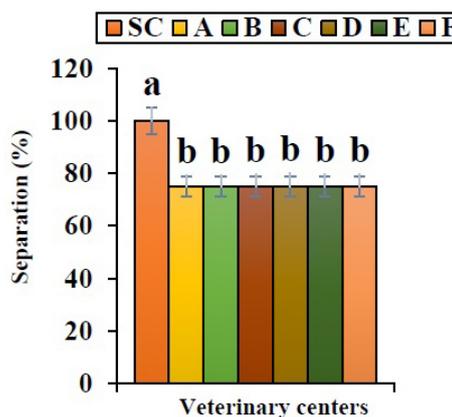


Figure 2. The percentage of separation in waste management in studied centers.

*SC: Standard Condition, Public sector (A), (B), (C), Private sector (D), (E), (F)

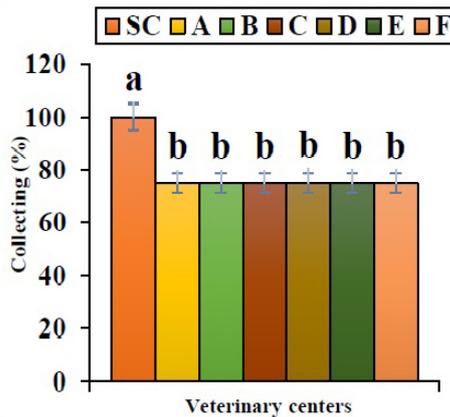


Figure 3. The percentage of collecting in waste management in studied centers

*SC: Standard Condition, Public sector (A), (B), (C), Private sector (D), (E), (F)

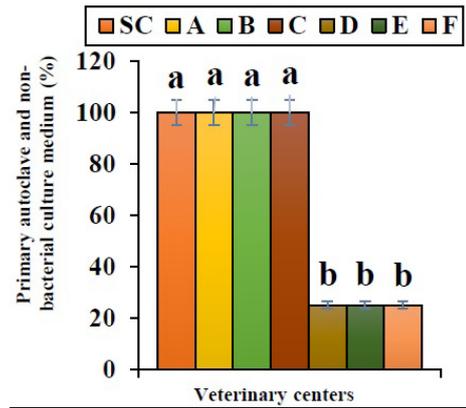


Figure 4. The percentage of primary autoclave and non-bacterial culture medium in waste management in studied centers

*SC: Standard Condition, Public sector (A), (B), (C), Private sector (D), (E), (F)

Table 1: General state of waste management for type of study centers

Veterinary Centers Invested Condition	SC	A	B	C	D	E	F
Separation	F14.285	A 10.713	A 10.713	A 10.713	A10.713	A 10.713	A 10.713
Collecting	F14.285	A 10.713	A 10.713	A 10.713	A10.713	A 10.713	A 10.713
Primary autoclave and non-bacterial culture medium	F14.285	F 14.285	F 14.285	F 14.285	C 3.571	C 3.571	C 3.571
Keeping Temporary	F14.285	U7.142	F 14.285	U 7.142	U 7.142	U 7.142	U 7.142
Shipment	F14.285	U 7.142	U 7.142	U 7.142	U 7.142	U 7.142	U 7.142
Evanescence at the site (furnace or timewell)	F14.285	C 3.571	C 3.571	C 3.571	C 3.571	C 3.571	C 3.571
Evacuated outside the place with a special device hazardous waste	F14.285	U 7.142	U 7.142	U 7.142	U 7.142	U 7.142	U 7.142
General waste management	100%	60.708%	67.852%	60.708%	50.394%	50.394%	50.394%

Veterinary Centers Invested: Standard Condition. (SC). Public sector (A), (B), (C), Private sector (D), (E), (F)

Condition: Favorable (1). Average (0.75). Unfavorable (0.5). Critical (0.25) Standard Condition. (SC)

Coefficient Ultimate =14.285

Results

The waste management status of the veterinary centers was completed on the basis of the checklist. The results showed that the state veterinary sectors (provincial, city administration and veterinary medical-educational center) with 67.852%, 60.708%, 60.708%, respectively, compared with private veterinary clinics (NO:1 clinic, NO:2 clinic and NO:3 clinic) had a better status of 50.394% (Table 1). The situation of waste separation and collection in all public and private centers was medium and average (10.713%). The primary

safe disposal of infectious waste of the microbiological laboratory was carried out only in public centers with an average condition (14.285%). This process was not carried out at any of the private centers (0%). The evacuation proceeding hazardous infectious wastes in and outside place and shipment of this waste with special disposal devices in public and private centers with 3.571% & 7.142% respectively, were critical. Also, the unfavorable grade of all centers was 21.426%. (Table 2). The status of waste management of public and private veterinary centers is shown separately (Fig. 1 - 8).

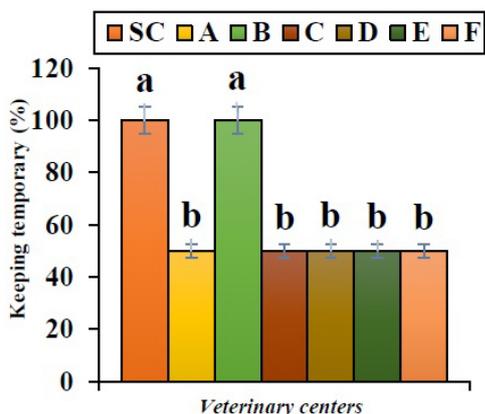


Figure 5. The percentage of keeping temporary in waste management in studied centers.

*SC: Standard Condition, Public sector (A), (B), (C), Private sector (D), (E), (F)

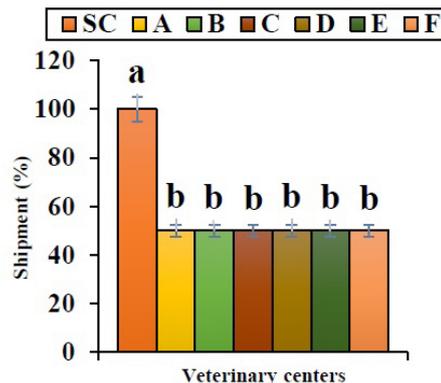


Figure 6. The percentage of shipment in waste management in studied centers.

*SC: Standard Condition, Public sector (A), (B), (C), Private sector (D), (E), (F)

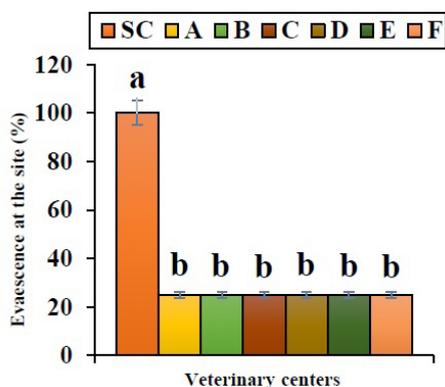


Figure 7. The percentage of evanescence at the site (furnace or lime well) in waste management in studied centers.

*SC: Standard Condition, Public sector (A), (B), (C), Private sector (D), (E), (F)

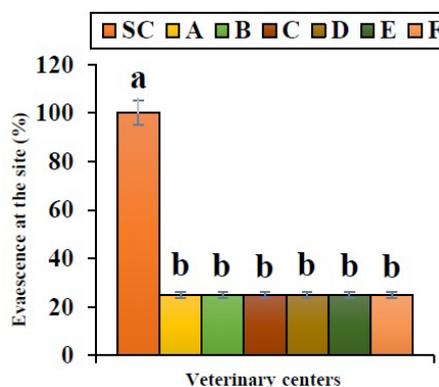


Figure 8. The percentage of evacuated outside the place with a special device hazardous waste in waste management in studied centers.

*SC: Standard Condition, Public sector (A), (B), (C), Private sector (D), (E), (F)

Table 2: General status of the waste management according to the type of medical institution studied Based on the degree of quality ($P \leq 0.05$). *Numbers are expressed in percentage terms.

<i>Veterinary Centers Investigated</i>	<i>Total favorable</i>	<i>Total average</i>	<i>Total unfavorable</i>	<i>Total critical</i>	<i>Total condition</i>
<i>SC</i>	100%	0.0 ^f	0.0 ^f	0.0 ^f	100%
<i>A</i>	14.285 ^c	21.426 ^b	21.426 ^b	3.571 ^e	60.708%
<i>B</i>	28.57 ^a	21.426 ^b	14.285 ^c	3.571 ^e	67.852%
<i>C</i>	14.285 ^c	21.426 ^b	21.426 ^b	3.571 ^e	60.708%
<i>D</i>	0.0 ^f	21.426 ^b	21.426 ^b	7.142 ^d	50.394%
<i>E</i>	0.0 ^f	21.426 ^b	21.426 ^b	7.142 ^d	50.394%
<i>F</i>	0.0 ^f	21.426 ^b	21.426 ^b	7.142 ^d	50.394%

Table 2

Veterinary Centers Invested: Standard Condition. (SC). Public sector (A),(B), (C), Private sector (D), (E), (F)

Condition: Favorable (1). Average (0.75). Unfavorable (0.5). Critical (0.25) Standard Condition. (SC)

Coefficient Ultimate =14.285

Discussion

Focusing on human, animal and environmental health with proper waste management is very important. Infectious waste destroys the environment by contaminating soil and water (directly) and air (indirectly). The dangerous nature of the veterinary waste ignorance and the consequences of improper management of this type of waste (such as problems caused by lack of management of chemical uses, pharmaceutical, separation, primary processing, collection, storage, transportation and disposal) cause widespread environmental and health-related problems (Mahasa & Ruhiiga, 2014; Omar, Nazli, Subramaniam, & Karuppanan, 2012). Despite special management requirements for medical and hospital infectious waste, according to clause 2 of Note 1 of the Iranian Environmental Organization's Waste Management Code, the waste from veterinary clinics is given less attention despite the presence of a variety of pathogenic microorganisms dangerous to humans, livestock and the environment. The increase in the percentage of hazardous waste may be due to the type of hospital waste management, in particular the separation of hazardous waste from usual waste. On the other hand, the lack of training and disregard for the separation and collection of non-infectious waste in bags specialized for infectious waste can also be another reason for the increased percentage of infectious waste that is now more in number than the total waste produced (Bazrafshan & Kord Mostafapoor, 2011). According to the WHO report, about 85% of hospital wastes are safe, 10% infectious and about 5% are non-infectious but dangerous. However, in some cases, the amount of the latter type of waste has risen as a result of inappropriate management and

the comixture of general wastes with infectious waste (Birchard, 2002; Chartier, 2014; Lee et al., 2004; Mohee, 2005). According to the results of the present study the lowest produced waste was the chemical waste. In the examined centers, due to not using radio-medication and related compounds in veterinary services, no radioactive waste was observed. It was also found, in some cases, that separation of the waste from the source was not performed correctly, it was possible that some types of waste (drugs, blades, winners, etc.) could be replaced in infected bags. In the centers studied, complete separation was not thought to have been fully performed between the veterinary waste and the sub-homemade waste (safe). In all centers, the bags were shipped to the temporary storage location, without the specified label explaining the contents of the bags. There was no burial place and no carcass burning oven in any of the centers and therefore the critical conditions for the elimination of veterinary waste were 100% neglected. Also, the waste of the studied centers was not kept away from the effects of climate factors. In all centers of temporary storage tanks, they were not sterilized and penetrated for moisture. Accession to veterinary waste from the place of production to the temporary storage facility was easy. Only at state veterinary centers were the microbiological laboratory wastes after the sterilization initially safe, then it was shipped with other waste produced by ordinary contractors of urban waste. There was not statistically significant difference between public and private centers in the waste separation and collection. Based on researcher's assessment in this case, all centers had average conditions for garbage collection. In all public and private centers, temporary storage of waste was unfavorable. In

this case only the veterinary administration of the province was in a desirable situation. Also, in all centers, waste produced by ordinary trucks without the hazardous waste sign was shipped in an unfavorable situation. The results of this research showed that general management of waste in public veterinary centers is more favorable than private ones (Fig. 1 - 8). Considering the great variety and volume of veterinary centers waste, especially the infectious waste, hazardous waste, the high cost of management of infectious waste, careful and continuous monitoring of the management of this type of waste to provide, maintain and increase the level of staff, other people in the community and the environment health will be essential. Therefore, the type of veterinary waste management, especially the way of separating hazardous waste from public waste is very important. On the other hand, there is a lack of training of personnel, especially service staff, lack of proper supervision over their activities, lack of motivation and some neglect of medical staff in non-infectious waste commixture in waste bags specialized for infectious waste or vice versa. The reasons are the increase in the percentage of infectious waste compared with the total waste. The type of transport and disposal of veterinary waste is done ordinarily and by the contractors of city hall. However, state veterinary centers are required to provide better and higher quality services because of their profitmaking, lack of need for more income and more attention to legal materials. According to factors such as, 1-the use of different colored waste bags for the separation of infectious and non-infectious waste 2- suitable waste storage tanks 3- daily washing and disinfection of tanks 4- the creation of a suitable distance between the temporary storage site and the closest part of

the center 5- more alternation in the collection and transport of waste from the parts to the place of temporary storage until reaching the final disposal site 6- more attention to health issues, have a better relative position. On the other hand, the flexibility and freedom of managers of veterinary centers in the private sector are likely to attract less attention to waste management and reduce the cost of this important issue. Part of the evaluated cases in this study is consistent with some of the studies in the final phase of disposal management for private medical clinics in relation to the release of this waste and the increase of environmental risk and human health (Gulyurt, 2012). The status of waste management in the studied veterinary centers had more unfavorable condition than the status of waste management of the human hospitals reported in Iran, Tabriz University Hospitals, Tehran University of Medical Sciences, Shahid Beheshti and North Khorasan, (Dehghani, Azam, Changani, & Dehghani Fard, 2008; Jaafari, Dehghani, Hoseini, & Safari, 2015; Majlesi, Alizadeh, Forutani, & Gachkar, 2007; Naimi et al., 2015; Taheri, Hamidiyan, & Khazaei, 2013). Based on the findings of the present study, the type and amount of waste produced by veterinary service centers are not only different in the studied centers, but also somewhat different from those of other countries. The reason for this difference is mainly due to various factors such as waste management, type of services provided by the centers, number of active sectors, cultural, economic status of the community, and so on (Le et al., 2018; Oweis et al., 2005; Tsakona, Anagnostopoulou, & Gidakos, 2007). Failure to properly implement the rules for the management of infectious wastes is a major problem for veterinary wastes. As a result, the challenge

of quantity and quality of waste management and its harmful environmental effects in the country will be minimized. Therefore, due to the health importance of various types of waste, especially veterinary wastes, special attention is paid to these types of waste.

Conclusion and Recommendations

One of the most important measures necessary to reduce the environmental and health problems and management costs of veterinary infectious waste is the proper implementation of the approved guidelines and regulations (waste separation program and monitoring of their proper disposal and sanitation). The environmental laws in Iran are mainly focused on the management of medical waste, especially hospital waste. The results of this study were impressive. According to available data, although there is no direct relationship between the quantities produced by hazardous and non-hazardous waste by different veterinary institutes, management of veterinary waste has important deficiencies and is a serious threat to the environment. The management of veterinary centers should be committed to the proper management of hazardous waste. Therefore, despite the sufficient standards and regulations, the lack of attention of the managers of the centers leads to a poor conclusion about waste management. Also, to improve the status of waste management in veterinary treatment centers, to train staff and increase their level of knowledge at all levels, to apply rules and guidelines, to fully comply with standards, to design and implement a program for the proper management of infectious waste, to continuously monitor collection, transportation and disposal of this type of waste is essential. In this case, in order to overcome the problems of this type of waste, the expansion

of inter-departmental cooperation is of great importance in the Ministry of Health, Medical Education, Veterinary, Environmental Protection, Veterinary Schools and city hall. Also, to reduce the potential risk of this type of waste, equipping clinics and veterinary health centers with modern sterilization systems of hospital waste is necessary.

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Conflicts of Interest

The author declared no conflict of interest.

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➤ Regulated Medical (Sharps) Waste: Needles, blades, root canal files, broken glass contaminated with bio-hazardous waste →Sharps container, treated by steam autoclave or disposed of via a registered hauler→ Safe box
➤ Regulated Medical (Bio-hazardous) Waste : Animal blood in containers and/or body parts infected with zoonotic diseases, zoonotic vaccines, cultures, trace chemotherapeutic agents→ Treated by steam autoclave or disposed of via a registered hauler Red Bag stored inside a rigid container→ Tight colored plastic bag
➤ Medical Solid Waste: Treated or decontaminated medical waste, dressings with non-liquid blood, non-contaminated body parts, waste of apparent medical origin. →Regular trash disposed into a secured/locked dumpster or enclosure→ Burning furnace with a filter
➤ Liquid Medical Waste: Body fluids, liquid blood, urine and other non-hazardous fluids→ Sanitary sewer system
➤ Hazardous Waste: Iodine, lead, silver (spent fixer), bulk chemotherapeutic agents, alcohols, cleaners that are corrosive, (pH ≥ 12.5 or ≤ 2.0), cold sterility→Container with a hazardous waste label and a tight-fitting lid→Removed off site under a manifest by a registered hazardous waste hauler→ Container with a hazardous waste label and a tight-fitting lid.
➤ Livestock bodies or Animal carcasses: Livestock bodies, poultry, fish and tissue remain. →Burning carcass and Buried in a lime well. → Burning kiln And Lime wells

*Veterinary Guide Disposal

Veterinary Centers Investigated	Standard Condition	(A). Public sector	(B). Public sector	(C). Public sector	(D). Private sector	(E). Private sector	(F). Private sector
Condition	Favorable(1)	Favorable(1) Average(0.75) Unfavorable(0.5) Critical (0.25)					
Separation	Favorable(1)	Favorable Average✓ Unfavorable Critical	Favorable Average✓ Unfavorable Critical	Favorable Average✓ Unfavorable Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical
Collecting	Favorable(1)	Favorable Average✓ Unfavorable Critical	Favorable Average✓ Unfavorable Critical	Favorable Average✓ Unfavorable Critical	Favorable Average✓ Unfavorable Critical	Favorable Average✓ Unfavorable Critical	Favorable Average✓ Unfavorable Critical
Primary autoclave and non-bacterial culture medium	Favorable(1)	Favorable✓ Average Unfavorable Critical	Favorable✓ Average Unfavorable Critical	Favorable✓ Average Unfavorable Critical	Favorable Average Unfavorable Critical✓	Favorable Average Unfavorable Critical✓	Favorable Average Unfavorable Critical✓
Keeping Temporary	Favorable(1)	Favorable Average Unfavorable✓ Critical	Favorable✓ Average Unfavorable Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical
shipment	Favorable(1)	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical
Evanesence at the site (furnace or lime well)	Favorable(1)	Favorable Average Unfavorable Critical✓	Favorable Average Unfavorable Critical✓	Favorable Average Unfavorable Critical✓	Favorable Average Unfavorable Critical✓	Favorable Average Unfavorable Critical✓	Favorable Average Unfavorable Critical✓
Evacuated outside the place with a special device hazardous waste	Favorable(1)	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical	Favorable Average Unfavorable✓ Critical
General waste management	100%						

**Questionnaires

*Veterinary Guide Disposal of Regulated & Division of Wastes

Generated from Health Services (Iran's Medical Waste Control Regulation, IMWCR 2008)

**Questionnaires: General state of waste management for type of study centers

ایمنی زیستی - بهداشت عمومی و مدیریت زباله های دامپزشکی : یک مطالعه موردی از کلینیک های دامپزشکی در کرمانشاه، ایران

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چکیده

زمینه مطالعه: ماهیت خطرناک پسماندهای دامپزشکی (بیمارستان ها، کلینیک ها و آزمایشگاه ها) و عواقب ناشی از مدیریت ناهماهنگ آنها مانند مشکلات ناشی از عدم برنامه ریزی در مدیریت تفکیک، جداسازی، ذخیره، جمع آوری، حمل و نقل و دفع آنها سبب بروز مشکلات زیست محیطی و بهداشتی فراوانی خواهد شد. از طرفی به استناد ماده ۱۱ و ۲ قانون مدیریت پسماندهای ویژه مربوط به سازمان محیط زیست و وزارت بهداشت ایران، پسماندهای کلینیک های دامپزشکی نیز به دلیل برخورداری از انواع میکروارگانیسم های بیماری زای خطرناک برای انسان و دام (مانند آنتراکس، بروسلوز و...) جزء پسماند های ویژه است.

هدف: برای آگاهی از نحوه مدیریت پسماندهای مراکز دامپزشکی، از دستورالعمل و چک لیست استاندارد سازمان محیط زیست و بهداشت جهانی استفاده شد.

روش کار: پاسخ به سوالات مورد نظر با مراجعه مستقیم پژوهشگر به ۶ مرکز دامپزشکی دولتی و خصوصی تکمیل شد. ارزیابی آماری با استفاده از SPSS نسخه ۲۲ بررسی و تجزیه و تحلیل شد.

نتایج: نتایج نشان داد اگرچه مدیریت پسماند در کلینیک ها و آزمایشگاه های دولتی نسبت به مراکز خصوصی دامپزشکی مطلوبیت نسبی بیشتری دارد اما با استاندارد های بهداشت جهانی فاصله دارد.

نتیجه گیری نهایی: اعمال قوانین و دستورالعمل ها، افزایش سطح آگاهی و آموزش کارکنان در تمامی سطوح، نظارت، کنترل مستمر بر نحوه جمع آوری، حمل و دفع بهداشتی پسماندهای دامپزشکی ضروری است.

واژه های کلیدی:

ایمنی زیستی، بهداشت عمومی، مدیریت زباله، کلینیک های دامپزشکی