Orijinal Araştırma

Evaluation of Nursing Students' Medical Waste Knowledge Level

Hemşirelik Öğrencilerinin Tıbbi Atık Bilgi Düzeyinin Değerlendirilmesi

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ABSTRACT

Aim: Failure to properly manage medical waste potentially exposes healthcare professionals, waste handlers, patients, and the general public to risks such as infection, toxic effects, injuries, and environmental pollution. The study was planned in a descriptive cross-sectional type and it was aimed to evaluate the medical waste knowledge levels of nursing students.

Methods: The sample consisted of 100 nursing students studying in the 1st, 2nd, 3rd, and 4th grades of a state university. The Kuder Richardson 20 coefficient was found to be 0.744 by collecting data based on the self-reports of the participants with the questionnaire created by the researchers in the study. The level of significance is taken $\alpha=0.05$. Categorical variables were analyzed with the Chi-Square test, Fisher's exact Chi-square test, and Fisher Freeman Halton test.

Results: In our study, 70 (70.00%) people take a course on medical waste, 6 (6.00%) people work in any health institution. It was found that the rate at which medical waste bags should be filled and the evaluation of expired or unused drugs as pharmaceutical waste was statistically significant according to gender ($p = 0.028$, and $p = 0.047$).

Conclusion: As nursing students take lectures or courses on medical waste, and their grade levels rise, their knowledge of medical waste increases. Based on the results of our study, increasing medical waste education is of great importance in terms of public health, personnel health, and environmental health.

Key words: Environmental Health, Medical Wastes, Nursing Students, Public Health

ÖZET

Amaç: Tıbbi atığın uygun şekilde yönetilmemesi, potansiyel olarak sağlık çalışanlarını, atık işleyicilerini, hastaları ve toplumu, enfeksiyon, toksik etkiler, yaralanmalar ve çevre kirliliği gibi risklere maruz bırakmaktadır. Çalışma tanımlayıcı kesitsel türde planlanarak hemşirelik öğrencilerinin tıbbi atık bilgi düzeylerinin değerlendirilmesi amaçlanmıştır.

Yöntem: Bir devlet üniversitesinde 1., 2., 3., ve 4. sınıflarda öğrenim gören 100 hemşirelik öğrencisi ile örneklem oluşturmuştur. Çalışmada araştırmacılar tarafından oluşturulan anket ile katılımcıların özbildirimlerine dayalı olarak veriler toplanarak Kuder Richardson 20 katsayısı 0.744 bulunmuştur. Anlamlılık seviyesi $\alpha=0.05$ olarak alınmıştır. Kategorik değişkenler Ki Kare testi, Fisher'in Kesin Ki kare testi ve Fisher Freeman Halton testi ile analiz edilmiştir.

Bulgular: Araştırmaya katılan hemşirelik öğrencilerinin 70 (%70.00)'inin tıbbi atık kursu aldığı, 6 (%6.00)'sının hemşire olarak çalıştığı bulunmuştur. Tıbbi atık poşetlerinin doldurulma oranının, son kullanma tarihi geçmiş veya kullanılmayan ilaçların farmasötik atık olarak değerlendirilmesinin cinsiyete göre istatistiksel olarak anlamlı olduğu bulunmuştur ($p = 0.028$ ve $p = 0.047$).

Sonuç: Hemşirelik öğrencileri tıbbi atıklarla ilgili dersler veya kurslar aldıklarında ve sınıf seviyeleri yükseldikçe tıbbi atıklarla ilgili bilgi düzeyleri de artmaktadır. Çalışmamızın sonuçlarına dayanarak, tıbbi atık eğitimlerinin artırılması halk sağlığı, personel sağlığı ve çevre sağlığı açısından büyük önem taşımaktadır.

Anahtar Kelimeler: Çevre Sağlığı, Halk Sağlığı, Hemşirelik Öğrencileri, Tıbbi Atıklar

INTRODUCTION

Wastes are generated in the field of health; blood contains a wide variety of materials, from used needles and syringes to dirty dressings, body parts, diagnostic samples, chemicals, drugs, medical devices, and radioactive materials. An estimated 16 billion injections are made worldwide each year; however, most needles and syringes are not properly disposed of after use. Incineration of medical wastes can cause emissions of dioxins, furans, and particulates in some cases. It is essential that all medical waste is segregated at the point where it is produced, handled properly, and disposed of safely (World Health Organization, 2014).

Hospitals and other healthcare facilities, laboratories and research facilities, morgue and autopsy centers, animal research and testing laboratories, blood banks and collection services, and nursing homes for the elderly are major sources of medical waste (WHO, 2014). Since 85% of the wastes obtained by healthcare professionals are domestic waste, they are not dangerous; but the remaining 15% is classified as hazardous waste that can be infectious, toxic, or radioactive. The failure to manage the hazardous wastes generated in health services can infect both the health workers themselves, the waste carriers, processors, and the society, causing toxic effects and injuries. In addition, it can cause the spread of drug-resistant microorganisms to the environment (WHO, 2017).

The "Medical Waste Control Regulation" regulates the procedures and principles of the stages up to the formation and disposal of medical waste. This regulation includes articles 3, 8, 11, 12, and 13, dated 9/8/1983 and numbered 2872, and article 2, article 8 of the Decree of the Ministry of Environment and Urbanization dated 29/6/2011 and numbered 644. 33 (Ministry of Environment and Urbanization, 2017).

In the current COVID-19 pandemic, protective face masks are considered as medical waste as they are potential carriers of pathogens. In the current pandemic period, medical waste management gains importance to reduce the risk of epidemics in hospitals (Jie and et al, 2020).

High-income countries produce up to 0.5 kg of hazardous waste per day per hospital bed, while low-income countries produce an average of 0.2 kg. Medical waste is generally not separated into hazardous or non-hazardous waste in low-income countries, suggesting that the actual amount of waste is higher (WHO, 2014).

Separation is an important element of inefficient medical waste management. By separating the hazardous wastes specified in Table 1 from non-hazardous wastes, the volume of waste that requires special treatment can be significantly reduced. Other elements of medical waste management include waste classification, waste minimization, containerized handling, color coding, labeling, use of signs,

waste handling, shipping, storage, treatment, and finally disposal. The continuity of such a system can be provided by continuous training, planning, budgeting, monitoring, evaluation, documentation, and record-keeping (UNEP, 2012). Although most of the developed countries have medical waste legislation, there is little information about which objects should be identified as infectious (Brooks and Windfeld, 2015). Healthcare professionals' awareness of medical waste management can prevent the spread of infectious diseases and epidemics (Joseph and et al, 2015). The contents of medical wastes are presented in Table 1.

Table 1. Medical Wastes And Their Contents

Wastes	Content of waste
Infectious waste	Waste contaminated with blood and other body fluids (e.g. from diagnostic discarded samples), cultures and stockpiles of infectious agents from laboratory studies (e.g. waste from autopsies and laboratories from infected animals), or waste from infected patients (e.g. bandages and disposable medical devices)
Pathological waste	Human tissues, organs or fluids, body parts, and contaminated animal carcasses;
Cutting waste	Syringes, needles, disposable scalpels, and blades, etc.
Chemical waste	Solvents and reagents for medical preparations (eg mercury in broken thermometers) and laboratory preparations, disinfectants, sterilants, and heavy metals in batteries
Pharmaceutical waste	Expired, unused and contaminated medicines, and vaccines
Cytotoxic wastes	Substances containing genotoxic properties (i.e. very dangerous substances that are mutagenic, teratogenic, or carcinogenic), such as cytotoxic drugs used in cancer therapy and their metabolites
Radioactive waste	Radioactive diagnostic material or products contaminated with radionuclides, including radiotherapeutic materials
Non-hazardous or general waste	Wastes that do not pose any biological, chemical, radioactive, or physical hazards

METHODS

There are various studies in the literature on the level of medical waste information. In general, some results were obtained by measuring the knowledge levels of health professionals. Our study included nursing students.

Type of Research

The study was planned in a descriptive cross-sectional type.

Place of Research

It was done at the Department of Nursing in a state university between July and September in 2019.

Population and Sample of the Research

Aimed to evaluate the medical waste knowledge levels of 100 students studying at the Department; approximately 700 students are studying in the department.

Data Collection Tools

The questionnaire consists of 22 questions created by the researchers according to the relevant literature. The questionnaire was prepared according to the curriculum including the definition, collection, separation of medical wastes, as well as demographic characteristics such as age, gender, and taking a course or not about medical wastes.

The questionnaire was prepared based on the literature and similar studies on medical waste (Ministry Of Environment And Urban Planning, 2017; Altinkaya, Arslan, Hascuhadar, Kaya and Serbetcioglu, 2007; Ertas and Guden, 2019; Ministry of Environment and Forestry. Medical Waste Control Regulation, 2005).

Evaluation of Data

Questionnaire's the first 8 questions were prepared to measure demographic characteristics, and questions 9-22 were prepared to measure their knowledge levels.

Data were analyzed with SPSS software (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). The answers given to the questionnaire we created were coded as 1 if correct and as zero if incorrect. Kuder Richardson 20 coefficient is 0.744. The level of significance is taken $\alpha=0.05$. Descriptive statistics were given with median(minimum-maximum) and frequency with percentages. In comparisons of categorical variables between groups were analyzed with Chi-Square test, Fisher's Exact Test, and Fisher Freeman Halton test.

Ethical Aspect of Research

The research was conducted by the Helsinki Declaration Principles. The research was approved by the Medical and Health Sciences Research and Ethics Committee of Bursa Uludağ University where the study was conducted (Ethics Committee Approval Date: 19/06/2019, 26468960-044 / 21587). Necessary permissions were obtained from the Bursa Uludağ University Faculty of Health Sciences Dean's Office to conduct the survey

RESULTS

According to the statistical analysis results of our study, 79(79.00%) female and 21(21.00%) male participants' median age is 21(18-31). In our study, 70 (70.00%) people take a course on medical waste, 6 (6.00%) people work in any health institution. The number of people who consider their level of knowledge as sufficient about medical waste is 44 (44.00%). While 57 (57.00%) of the nursing students participating in this study found their level of knowledge about the disposal of

medical waste originated from home as sufficient, 71 (71.00%) people gave the wrong answer when the level of knowledge was measured for this question. Demographic information is shown in Table 2, and the comparison results of the survey questions with demographic characteristics are presented in Table 3.

There are some issues caused by the fact the following issues are not considered important, as, where to dispose of medical wastes originated from homes and which color of the bag to be placed, which infectious body fluids to be placed in the correct waste bag; the wastes such as amalgam, genotoxic and pharmaceutical wastes are not classified as hazardous, pouring and spreading of infectious medical wastes. It was found that it was statistically significant to receive a course or training on medical wastes in giving correct answers about concentrating infectious fluids with appropriate absorbent material (paper towel, etc.) by the "biological emergency spill-scatter procedure" (respectively p=0.024, p =0.026, p<0.001, p=0.017, p=0.012, p=0.006, p=0.026, and p=0.035).

Table 2. Demographic Features

	n	(%)
Gender		
Female	79	79.00
Male	21	21.00
What grade are you in?		
1st class	4	4.00
2nd class	44	44.00
3rd class	31	31.00
4th class	21	21.00
Did you take a course or training on medical waste?		
Yes	70	70.00
No	30	30.00
Do you work on a permanent or contracted basis in any health institution?		
Yes	6	6.00
No	94	94.00
Do you consider your level of knowledge about medical waste sufficient?		
Yes	44	44.00
No	56	56.00
Do you find your knowledge about the disposal of medical waste at home sufficient?		
Yes	57	57.00
No	43	43.00

It was found that the rate at which medical waste bags should be filled, that the personnel responsible for carrying medical wastes had gloves that they were obliged to wear during the study, and the evaluation of expired or unused drugs as pharmaceutical waste was statistically significant according to gender (p = 0.028, p = 0.042 and p = 0.047).

Table 3. Comparison of The Answers Given To The Questionnaire And Demographic Characteristics

	Gender			Did you take a course or training on medical waste?			What grade are you in?				
	Female (n=79)	Male (n=21)	p	Yes (n=70)	No (n=30)	p	1st (n=4)	2nd (n=44)	3th (n=31)	4rd (n=21)	p
What would you do in the disposal of medical waste at home?	20 (25.32%)	9 (42.86%)	0.115	25 (35.71%)	4 (13.33%)	**0.024**	0 (0.00%)	10 (22.72%)	9 (29.03%)	10 (47.62%)	0.136
Which colored bags or sacks can the household waste be collected with?	35 (44.30%)	12 (57.14%)	0.295	38 (54.29%)	9 (30.00%)	**0.026**	0 (0.00%)	19 (43.18%)	13 (41.93%)	15 (71.43%)	**0.025**
Which colored bag or bags can medical waste be collected?	75 (94.94%)	19 (90.48%)	0.603	66 (94.29%)	28 (93.33%)	1.000	4 (100.00%)	41 (93.18%)	30 (96.77%)	19 (90.48%)	0.665
What rate should the bags for medical waste be filled at most?	78 (98.73%)	18 (85.71%)	**0.028**	69 (98.57%)	17 (90.00%)	0.079	3 (75.00%)	42 (95.45%)	30 (96.77%)	21 (100.00%)	0.237
Which unit or units are responsible for medical waste?	29 (36.71%)	10 (47.62%)	0.362	25 (35.71%)	14 (46.67%)	0.303	2 (50.00%)	10 (22.72%)	15 (48.39%)	12 (57.14%)	**0.017**
Please mark each of the information given on medical waste bags according to your knowledge											
- Bags for medical waste are in black.	74 (93.67%)	18 (85.71%)	0.359	66 (94.29%)	26 (86.67%)	0.236	3 (75.00%)	39 (88.64%)	29 (93.55%)	21 (100.00%)	0.176
- "Caution Medical Waste" is written on the bag.	78 (98.73%)	19 (90.48%)	0.111	69 (98.57%)	28 (93.33%)	0.213	4 (100.00%)	41 (93.18%)	31 (100.00%)	21 (100.00%)	0.392
- There is an "International Biohazard" emblem on the bag.	58 (73.42%)	18 (85.71%)	0.241	56 (80.00%)	20 (66.67%)	0.153	3 (75.00%)	29 (65.91%)	25 (80.64%)	19 (90.48%)	0.142
- There is a "Caution Hazardous Waste" inscription on the bag.	26 (32.91%)	7 (33.33%)	0.971	25 (35.71%)	8 (26.67%)	0.378	2 (50.00%)	17 (38.64%)	5 (16.13%)	9 (42.86%)	0.077
Mark the items that are suitable for medical waste bags.											
-Infectious body fluids	56 (70.87%)	16 (76.19%)	0.630	58 (82.86%)	14 (46.67%)	**<0.001**	2 (50.00%)	26 (59.09%)	24 (77.42%)	20 (95.24%)	**0.007**
- Contaminated laboratory waste (Pipette, slide, coverslip)	66 (83.54%)	16 (76.19%)	0.523	58 (82.86%)	24 (80.00%)	0.733	3 (75.00%)	36 (81.82%)	24 (77.42%)	19 (90.48%)	0.576
- Serum, medicine bottle waste	31 (39.24%)	10 (47.62%)	0.488	33 (47.14%)	8 (26.67%)	0.056	1 (25.00%)	16 (36.36%)	9 (29.03%)	15 (71.43%)	**0.011**
- Plastic waste	50 (63.29%)	15 (71.43%)	0.487	46 (65.71%)	19 (63.33%)	0.819	2 (50.00%)	28 (63.64%)	23 (74.19%)	12 (57.14%)	0.529
- Cleaning material waste	62 (78.48%)	13 (61.90%)	0.119	50 (71.43%)	25 (83.33%)	0.208	3 (75.00%)	32 (72.72%)	22 (70.97%)	18 (85.71%)	0.633
- Injectors and scalpel blades	32 (40.51%)	7 (33.33%)	0.549	26 (37.14%)	13 (43.33%)	0.561	1 (25.00%)	24 (54.54%)	11 (35.48%)	3 (14.29%)	**0.011**
Tick the items related to hazardous waste.											
- Pharmaceutical waste	46 (58.23%)	12 (57.14%)	0.929	46 (65.71%)	12 (40.00%)	**0.017**	0 (0.00%)	22 (50.00%)	21 (67.74%)	15 (71.43%)	**0.024**
- Amalgam waste	53 (67.09%)	12 (57.14%)	0.396	51 (72.86%)	14 (46.67%)	**0.012**	0 (0.00%)	27 (61.36%)	24 (77.42%)	14 (66.67%)	**0.023**
- Blood products and objects contaminated with them	9 (11.39%)	0 (0.00%)	0.198	8 (11.43%)	1 (3.33%)	0.272	0 (0.00%)	5 (11.36%)	4 (12.90%)	0 (0.00%)	0.373
- Guinea pigs used in biological experiments	7 (8.86%)	0 (0.00%)	0.340	5 (7.14%)	2 (6.67%)	1.000	0 (0.00%)	3 (6.82%)	3 (9.68%)	1 (4.76%)	0.836
- Genotoxic wastes	59 (74.68%)	16 (76.19%)	0.887	58 (82.86%)	17 (56.67%)	**0.006**	0 (0.00%)	36 (81.82%)	26 (83.87%)	13 (61.90%)	**0.002**
Mark the items that the personnel responsible for transporting medical waste are obliged to wear while working.											
- Mask	70 (88.61%)	18 (85.71%)	0.712	62 (88.57%)	26 (86.67%)	0.749	4 (100.00%)	35 (79.54%)	29 (93.55%)	20 (95.24%)	0.222
- Protective goggles	64 (81.01%)	15 (71.43%)	0.371	57 (81.43%)	22 (73.33%)	0.362	4 (100.00%)	28 (63.64%)	28 (90.32%)	19 (90.48%)	**0.014**
- Glove	79 (100.00%)	19 (90.48%)	**0.042**	69 (98.57%)	29 (96.67%)	0.512	4 (100.00%)	43 (97.72%)	30 (96.77%)	21 (100.00%)	1.000
- Blue dress	16 (20.25%)	5 (23.81%)	0.766	15 (21.43%)	6 (20.00%)	0.872	2 (50.00%)	7 (15.91%)	3 (9.68%)	9 (42.86%)	**0.011**
Please mark each of the information on medical waste in line with your knowledge.											
- Medical waste transport vehicles are regularly cleaned and disinfected weekly	15 (18.99%)	5 (23.81%)	0.759	14 (20.00%)	6 (20.00%)	1.000	0 (0.00%)	9 (20.45%)	4 (12.90%)	7 (33.33%)	0.279
- Medical wastes and domestic wastes can be loaded into the same vehicle.	69 (87.34%)	17 (80.95%)	0.485	60 (85.71%)	26 (86.67%)	1.000	4 (100.00%)	38 (86.36%)	24 (77.42%)	20 (95.24%)	0.298
- Medical wastes and hazardous wastes can be loaded into the same vehicle.	45 (56.96%)	9 (42.86%)	0.249	36 (51.43%)	18 (60.00%)	0.431	2 (50.00%)	25 (56.82%)	19 (61.29%)	8 (38.09%)	0.399
- During the transportation of medical wastes, it is mandatory to have personnel in charge of medical wastes.	73 (92.40%)	17 (80.95%)	0.211	65 (92.86%)	25 (83.33%)	0.161	4 (100.00%)	39 (88.64%)	26 (83.87%)	21 (100.00%)	0.269

			p			p					p
For what reasons do you think problems with medical waste arise; mark it.											
- The issue is not considered important	70 (88.61%)	16 (76.19%)	0.164	64 (91.43%)	22 (73.33%)	**0.026**	3 (75.00%)	38 (86.36%)	27 (87.10%)	18 (85.71%)	0.867
- Not meeting enough waste bags	53 (67.09%)	10 (47.62%)	0.100	44 (62.86%)	19 (63.33%)	0.964	2 (50.00%)	28 (63.64%)	19 (61.29%)	14 (66.67%)	0.934
- Lack of information	76 (96.20%)	18 (85.71%)	0.105	67 (95.71%)	27 (90.00%)	0.361	4 (100.00%)	40 (90.91%)	29 (93.55%)	21 (100.00%)	0.593
- Other	59 (78.67%)	14 (73.68%)	0.758	52 (78.79%)	21 (75.00%)	0.687	3 (75.00%)	34 (80.95%)	26 (86.67%)	10 (55.56%)	0.079
Please tick each of the information provided for Liquid Infectious Medical Wastes to your knowledge											
- Liquid infectious waste is never drained into the sink.	68 (86.08%)	15 (71.43%)	0.187	60 (85.71%)	23 (76.67%)	0.270	3 (75.00%)	33 (75.00%)	26 (83.87%)	21 (100.00%)	**0.045**
- Liquid infectious waste is collected in a desktop waste collection container with an autoclave bag.	37 (46.83%)	7 (33.33%)	0.268	27 (38.57%)	17 (56.67%)	0.095	1 (25.00%)	21 (47.73%)	16 (51.61%)	6 (28.57%)	0.332
- It is decontaminated with the collection container when the job is finished, waiting to be filled.	13 (16.46%)	3 (14.29%)	1.000	9 (12.86%)	7 (23.33%)	0.236	0 (0.00%)	8 (18.18%)	5 (16.13%)	3 (14.29%)	1.000
- Infectious fluids spreading into the environment as a result of spillage-spillage are also concentrated with an appropriate absorbent material (paper towel, etc.) by the "biological emergency spill-scatter procedure".	44 (55.70%)	12 (57.14%)	0.906	44 (62.86%)	12 (40.00%)	**0.035**	0 (0.00%)	25 (56.82%)	21 (67.74%)	10 (47.62%)	0.059
What are the characteristics of the container or bag in which the highly infectious waste is disposed of?											
- Red-colored, labeled, durable, waterproof, plastic bag or autoclave resistant containers.	54 (68.35%)	13 (61.90%)	0.576	46 (65.71%)	21 (70.00%)	0.676	3 (75.00%)	33 (75.00%)	20 (64.52%)	11 (52.38%)	0.311
- They are yellow-red colored, labeled, waterproof, plastic bags or containers.	12 (15.20%)	3 (14.29%)	1.000	13 (18.57%)	2 (6.67%)	0.220	0 (0.00%)	9 (20.45%)	2 (6.45%)	4 (19.05%)	0.333
- They are yellow-colored, labeled, puncture-resistant containers.	15 (18.99%)	3 (14.29%)	0.757	13 (18.57%)	5 (16.67%)	0.820	0 (0.00%)	11 (25.00%)	4 (12.90%)	3 (14.29%)	0.492
- Yellow labeled plastic bags or containers.	13 (16.46%)	4 (19.05%)	0.751	12 (17.14%)	5 (16.67%)	0.954	0 (0.00%)	8 (18.18%)	5 (16.13%)	4 (19.05%)	1.000
Which of the following or which are considered as pharmaceutical waste?											
- Batteries and broken thermometers	28 (35.44%)	7 (33.33%)	0.857	24 (34.29%)	1 (36.67%)	0.819	2 (50.00%)	18 (40.91%)	7 (22.58%)	8 (38.09%)	0.319
- Blood pressure measuring devices	35 (44.30%)	12 (57.14%)	0.295	34 (48.57%)	13 (43.33%)	0.631	2 (50.00%)	26 (59.09%)	11 (35.48%)	8 (38.09%)	0.169
- Excess fluids from radiotherapy or laboratory research	11 (13.92%)	5 (23.81%)	0.317	11 (15.71%)	5 (16.67%)	1.000	0 (0.00%)	9 (20.45%)	4 (12.90%)	3 (14.29%)	0.840
- Tools and tissues that come into contact with infected patients	27 (34.18%)	5 (23.81%)	0.365	22 (31.43%)	10 (33.33%)	0.852	0 (0.00%)	17 (38.64%)	7 (22.58%)	8 (38.09%)	0.262
- Expired or unused drugs	59 (74.68%)	11 (52.38%)	**0.047**	49 (70.00%)	21 (70.00%)	1.000	3 (75.00%)	28 (63.64%)	26 (83.87%)	13 (61.90%)	0.186
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- Expired or unused drugs	59 (74.68%)	11 (52.38%)	**0.047**	49 (70.00%)	21 (70.00%)	1.000	3 (75.00%)	28 (63.64%)	26 (83.87%)	13 (61.90%)	0.186

The n (%) values of the correct answers are given. p<0.05 is considering statistical significance.

On the other hand, knowledge of disposal of medical waste at home, bag color of household waste, bag color of medical waste, responsible units, information of medical waste bags, knowledge of the items which should be put in medical waste bags except for infectious body fluids, contaminated blood products and guinea pigs used in biological experiments knowledge of these substances as hazardous waste, knowledge of obliged to wear while transporting medical wastes, some of the liquid infections, characteristics of the container or bag for highly infectious waste, pharmaceutical wastes had no statistically significant difference between gender (p>0.05).It was found statistically significant that the person obliged to carry are protective glasses and blue clothes among the items they are obliged to wear during the work, and that liquid infectious wastes should never be emptied into the sink, differing according to their grade (respectively p=0.025, p=0.017, p=0.007, p=0.011, p=0.011, p=0.024, p=0.023, p=0.002, p=0.014, p=0.011, and p=0.045). On the other hand, knowledge of disposal of medical waste at home, bag color of medical waste, the filling rate of medical waste bags, information of medical waste bags, knowledge of the items which should be put in medical waste bags except for infectious body fluids, serum, medicine bottle, injectors, and scalpel blades; contaminated blood products and guinea pigs used in biological experiments knowledge of these substances as hazardous waste, knowledge of obliged to wear while transporting medical wastes except protective goggles and blue dress and other questions as presented in Table 3 had no statistically significant difference between grade levels (p>0.05).

DISCUSSION

Hospital wastes are threatened public health and caused environmental pollution. Additionally, they are much more dangerous than household wastes.

Healthcare professionals, especially nurses are injured or infected as a result of medical waste in hospitals and laboratories. For this reason, in the USA in 1980, the institutions named 'Centers for Disease Control and Prevention (CDC)', 'Environmental Protection Agency (EPA)', 'Occupational Safety and Health Administration (OSHA)' made several regulations and they have brought rules (Altinkaya, Arslan, Hascuhadar, Kaya and Serbetcioglu, 2007). As our study taking a course or training in medical wastes are increased the knowledge.

The first studies in this field in our country started with the Framework Law No. 2872 of 09.08.1983 and the Medical Waste Control Regulation No. 21586, dated 20.05.1993, issued by this law (Akbolat, Cimen, Dede and Isık, 2012).

In our study, most of the respondents stated that they were trained in medical waste, however, there is 56(56.00%) participant who thinks that their level of knowledge about medical waste is not sufficient and 43(43.00%) who think that their level of knowledge about medical waste at home is not sufficient.

It was observed that 25(35.71%) of the participants who received medical waste training gave correct answers about the disposal of medical waste generated at homes. Additionally, 46(65.71%) persons answered correctly that pharmaceutical wastes were hazardous wastes, 51(72.86%) persons that amalgam wastes were hazardous wastes, and 58(82.86%) persons that genotoxic wastes were included in this category. It was observed that 44(62.86%) people gave the correct answer that infectious fluids spilled into the environment as a result of spillage-scattering should be concentrated with appropriate absorbent material (paper towel, etc.) by the "biological emergency spill-scatter procedure".

It was observed that 0(0%) of the first-year participants, 19(43.18%) of the second-year students, 13(41.93%) of the third-year students and 15(71.43%) of the fourth year students answered the color of the bag correctly. It was observed that there were 2(50%) people in the 1st grade, 10(22.72%) in the 2nd grade, 15(48.39%) in the 3rd grade, and 12(57.14%) in the 4th grade, who knew that the responsibility for medical waste belongs to the chief physician. 2(50%) people in the 1st grade, 26(59.09%) in the 2nd grade, 24(77.42%) in the 3rd grade, and 20(95.24%) in the 4th grade, who know that infectious body fluids are among the materials that are suitable to be put in medical waste bags. It was observed that there was 1(25.00%) participant in the 1st grade, 16(36.36%) in the 2nd grade, 9(29.03%) in the 3rd grade, and 15(71.43%) in the 4th grade who knew that it was not appropriate to put the serum and medicine bottle wastes in the medical waste bag. It was observed that there were 1(25.00%) in the 1st grade, 24(54.54%) in the 2nd grade, 11(35.48%) in the 3rd grade, and 3(14.29%) in the 4th grade, who knew that injectors and scalpel blades should be placed in medical waste bags.

It was observed that there were 0(0%) people in the 1st grade, 22(50.00%) in the 2nd grade, 21(67.74%) in the 3rd grade, and 15(71.43%) in the 4th grade who knew that pharmaceutical wastes were hazardous waste. Knowing that amalgam wastes are hazardous wastes, there are 0(0%) people in the 1st grade, 27(61.36%) in the 2nd grade, 24(77.42%) in the 3rd grade, and 14(66.67%) in the 4th grade. There were 0(0%) people in the 1st grade, 36(81.82%) in the 2nd grade, 26(83.87%) in the 3rd grade, and 13(61.90%) in the 4th grade who correctly answered that genotoxic wastes are hazardous waste.

Participants of 1st grade 4(100.00%), 28(63.64%) in the 2nd grade, 28(90.32%) in the 3rd grade, and 19(90.48%) in the 4th grade, knowing that the personnel responsible for the transportation of medical wastes are obliged to wear gloves while working. It was observed that there were 2(100.00%) people in the 1st grade, 7(15.91%) in the 2nd grade, 3(9.68%)

in the 3rd grade, and 9(42.86%) in the 4th grade who knew that the person carrying the medical waste is not obliged to wear blue clothes.

Most of the students participating in the questionnaire gave the correct answer for the color of the bag in which the household waste was put, but they gave the wrong answer for the color of the bag in which medical waste should be put.

The first rule in waste management is the process of sorting wastes according to their types. It is important and necessary to know the colors of the bags to be placed in household and medical wastes to perform the separation correctly (Terzi and Yuce, 2017). In the process of collecting and transporting medical wastes, nursing students to be able to implement medical waste training will be an important step in preventing the damages that may occur as a result of medical wastes (Cansaran, 2017). We obtained the same results in our study. Likewise, we have seen that as grade level increases, the level of knowledge increases.

CONCLUSION

Based on the results of our study, increasing medical waste education is of great importance in terms of public health, personnel health, and environmental health. Our study showed that medical waste education at this state university improves nursing students' knowledge.

Healthcare professionals have a crucial role to solve the medical waste problem at its source and reflect their knowledge to their practices therefore continuing training should be provided for nurses and all health professionals.

Conflict of Interest

No conflicts of interest between the authors and/or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, shareholding, and similar situations in any firm.

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