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Research Article

Assessment of Radiation Protection Knowledge and Practical Skills Among Health Services Vocational School Students Using Dosimeters

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Abstract:

Radiation-based devices are crucial in diagnosing various diseases. During their clinical internships, students at Health Services Vocational Schools utilize different radiation-based devices under supervision. This survey study is designed to assess the knowledge of health technician students regarding radiation protection and application, as well as to enhance their awareness about ionizing radiation safety. The participants of the study were second-year students from the Health Services Vocational School. They were asked to complete a survey that included 20 multiple-choice questions and 8 demographic questions, aimed at measuring their fundamental knowledge of radiological examinations. A total of 123 students from the School of Health Services Vocational School (40 in the radiotherapy program and 83 in the medical imaging program) participated in the survey. According to the survey results, none of the students were able to correctly answer all the questions regarding radiation safety. However, 76.6% of the students correctly answered the statement “The radiation dose in a radioactive source shot is absolutely safe and has no effect on health.” In addition, 73.5% of the students stated that they were aware of the necessity of using lead aprons and thyroid shields during imaging procedures.Our study found that students at the Health Services Vocational School generally possess a satisfactory understanding of occupational health and safety as well as radiation protection. In light of these findings, it is suggested that universities place a greater emphasis on radiation protection training and enhance opportunities for ongoing education in this area.

1. Introduction

Ionizing radiation has been used in various fields since the discovery of X-rays and radioactivity in the late nineteenth century. It is used in a wide range of areas, from medical diagnostic methods to surgical applications, from cancer treatment to precise dating methods in archaeology and geology, and also in the food industry to prevent food spoilage. This widespread use of radiation has facilitated social life, but has also brought with it many health problems. For this reason, the negative effects of radiation on human health and the ways to protect against these effects are becoming increasingly important [1-5].
The negative effects of radiation vary according to the dose, age, duration, gender and metabolic status of the person exposed. These effects can be divided into two main groups: genetic and somatic. Genetic effects occur in subsequent generations, not in individuals exposed to radiation. Somatic effects are seen directly in the people exposed to radiation [6,7]. Radiology workers, as a professional group that is constantly exposed to low doses of ionizing radiation for years due to their job, can be affected by these effects in both the short and long term [8]. While short-term effects vary depending on the dose of radiation received, long-term effects are associated with repeated exposures and the body's inability to adequately repair the damage caused by these exposures [9-11]. This situation poses a serious risk for healthcare personnel working in the field of radiology [12-14].
The number of radiological examinations is rapidly increasing due to advances in technology in the healthcare field. In recent years, concerns have been growing about the inadequate awareness of

healthcare professionals about the radiation doses used during diagnostic imaging and the risks associated with them. The purpose of this survey study is to evaluate the knowledge of healthcare vocational school students about radiation protection and its application, and also to raise awareness about protection from ionizing radiation.

2. Material and Methods

A survey study was conducted to evaluate the awareness levels of students studying in the Medical Imaging and Radiotherapy Programs at Istanbul Okan University Health Services Vocational School regarding radiation protection. Necessary permissions were obtained before the survey was administered and information was provided to the students participating in the study about the purpose and importance of the study. The survey is based on the voluntary participation of the participants. In order to prevent bias and external factors, the participants answered the survey under supervision. There is no field containing the students' identity information in the survey form. The study consists of two parts: The first part includes questions about the students' demographic information such as age, gender, and educational status, while the second part consists of questions evaluating the importance of radiation protection and their knowledge levels about radiation protection. For statistical analyses, Excel program was used and descriptive statistics of the variables were calculated as numbers and percentages.

3. Findings

A total of 145 students were invited for the survey study, 123 of whom agreed to participate in the study. 67.5% (n = 83) of the participants were students in the Medical Imaging Program, and 32.5% (n = 40) were students in the Radiotherapy Program. 65.10% (n = 80) of the participants were female, and 34.9% (n = 43) were male (Table 1). No participant could answer all the questions about radiation correctly. In the questions that had to be answered as "True" or "False", 80% of the radiotherapy group answered "True" to the question "X-rays reflect off room walls", while 32.53% of the medical imaging group answered the same, indicating that radiotherapy workers are more aware of this issue. A high rate of "True" responses (87.8%) were given to the statement "X-rays cause ionization", indicating a general awareness of the effects of ionization. 92.7% agreed that dental radiography can be performed on pregnant patients by taking the necessary precautions, indicating that workers are knowledgeable about safety procedures. A high level of knowledge was observed among both groups regarding the fact that radiation can cause cell degeneration and that radiation from natural sources is a part of daily life. However, the rate of students who did not agree with the statement "The radiation dose in a radioactive source is absolutely safe" was quite high. This indicates that students generally have a more cautious approach to radiation safety. In general, students in both departments have a good level of knowledge on radiation-related issues, but there are differences in knowledge on some issues. Compared to natural radiation sources, 91.8% agreed with the opinion that medical radiation is lower, indicating that the difference between natural and medical radiation is generally known. 76.6% of the participants responded “wrong” to the statement “The radiation dose from an imaging device is absolutely safe and has no effect on health”, indicating that they are aware of the risks of radiation. Finally, 96.9% of the participants responded “The risk associated with radiation should be lower than the benefits obtained from diagnostic information”, indicating that the participants have a high awareness of the benefit-risk balance of radiation. In general, the table reveals that the participants have a significant knowledge of radiation and safety issues, but they lack knowledge on some issues. The detailed distribution and percentages of the participants’ answers to the questions are presented in Table 2. Table 3 shows the radiation awareness and protection knowledge of the students in the Radiotherapy and Medical Imaging programs. The majority of the students stated that they were not sure about the ionizing radiation doses of radiological examinations. The rate of those who said "I am very sure" was quite low (6%), while the rates of those who said "I am slightly sure" and "I have no idea" were 36.1% and 3.61%, respectively. However, most students stated that it was very important to have information about ionizing radiation doses (85.5%). While radiation-sensitive cells are generally defined as rapidly dividing unspecialized cells (77.1%), there is also a high level of awareness that cells damaged by radiation can be repaired (61.4%). Regarding radiation sources, it

Table 1. *Number of students participating in the study and gender distribution*

Education	Female	Male	Total
Radiotherapy	29 (%23,6)	11 (%8,9)	40 (%32,5)
Medical Imaging	51 (%41.5)	32 (%26,0)	83 (%67,5)
Total	80 (%65,1)	43 (%34,9)	123 (%100)

Table 2. *The questions answered "Right" and "Wrong" and the distribution of the answers given by the participants to the questions.*

Questions	Answers	Radiotherapy (n,%)	Medical Imaging (n,%)	Total (n,%)
X-rays are harmful.	True	15(%37,5)	35(%42,2)	50(%40,7)
	False	25(%62,5)	48(%57,82)	73(%59,3)
X-rays are reflected from room walls.	True	32(%80)	27(%32,53)	59(%48)
	False	8(%20)	56(%67,47)	64(%52)
X-rays cause ionization.	True	34(%85)	74(%89,2)	108(%87,8)
	False	6(%15)	9(%10,82)	15(%12,2)
Pregnant patients can be scanned a limited number of times if necessary, with the necessary protective measures.	True	35(%87,5)	79(%95,2)	114(%92,7)
	False	5(%12,5)	4(%4,8)	9(%7,3)
Radiation causes cell degeneration.	True	34(%85)	77(%92,7)	111(%90,2)
	False	6(%15)	6(%7,3)	12(%9,8)
The average dose of radiation is lower than the amount an individual receives from natural sources in their daily lives.	True	37(%92,5)	76(%91,6)	113(%91,8)
	False	3(%7,5)	7(%8,4)	10(%8,2)
The radiation dose in a radioactive source scan is absolutely safe and has no effect on health.	True	9(%22,5)	21(%25,3)	30(%24,4)
	False	32(%80)	62(%74,7)	94(%76,6)

Table 3. *Responses to survey questions on Radiation Safety and Radiation Protection*

Questions	Answers	Radiotherapy (n,%)	Medical Imaging (n,%)	Total (N,%)
How confident are you in your knowledge of the ionizing radiation dose of radiological examinations? How important should it be to have knowledge of the ionizing radiation dose of common radiological examinations?	Very confident	1 (%2,5)	2 (%5)	5 (%6,0)
	Moderately confident	18 (%45)	(%42)	42 (%50,6)
	Somewhat confident	19 (%47,5)	47 (%30)	30 (%36,1)
	No idea	2 (%5)	5 (%3)	3 (%3,61)
Radiation-sensitive cells are usually;In a cell damaged by radiation:	Very important	33 (%82,5)	82 (%71)	71 (%85,5)
	Moderately important	7 (%17,5)	17 (%8)	8 (%9,6)
	Somewhat important	0 (%0)	0 (%1)	1 (%1,2)
	Not at all important	0 (%0)	0 (%0)	0 (%0)
Which of the radiation sources and which ones affect humans? Do you have knowledge of the ALARA principle?	Somatic cells	6 (%15)	15 (%16)	16 (%19,3)
	Rapidly dividing unspecialized cells	31 (%77,5)	77 (%64)	64 (%77,1)
	No idea	3 (%7,5)	7 (%3)	3 (%3,6)
In order to be protected from radiation in practice;	Never regenerates	9 (%22,5)	22 (%21)	21 (%25,3)
	Can be repaired	25 (%62,5)	62 (%51)	51 (%61,4)
	Always monitored cell death	1 (%2,5)	2 (%9)	9 (%10,8)
	No idea	5 (%12,5)	12 (%2)	2 (%2,4)
How confident are you in your knowledge of the ionizing radiation dose of radiological examinations?	Natural resources	23 (%57,5)	57 (%55)	55 (%66,3)

How important should it be to have knowledge of the ionizing radiation dose of common radiological examinations?	Industry	34 (%85)	85 (%67)	67 (%80,7)
	Medical applications	36 (%90)	90 (%69)	69 (%83,1)
	No idea	3 (%7,5)	7 (%6)	6 (%7,2)
Radiation-sensitive cells are usually;	Yes	24 (%60)	60 (%65)	65 (%78,3)
	No	16 (%40)	40 (%18)	18 (%21,7)
In a cell damaged by radiation: Which of the radiation sources and which ones affect humans?	Standing 3 meters away from the patient	32 (%80)	80 (%34)	34 (%40,9)
	Shooting at the lowest possible dose	29 (%72,5)	72 (%46)	46 (%55,4)
	Using E and F-speed films	15 (%37,5)	37 (%22)	22 (%26,5)
	Using lead aprons and collars	33 (%82,5)	82 (%61)	61 (%73,5)
Do you have knowledge of the ALARA principle? In order to be protected from radiation in practice;	Thermal effect	14 (%35)	35 (%39)	39 (%46,9)
	Ionizing effect	35 (%87,5)	87 (%70)	70 (%84,3)
	Radiofrequency effect	32 (%80)	80 (%26)	26 (%31,3)
	No idea	2 (%5)	5 (%1)	1 (%1,2)

was stated that medical applications affect people the most (83.1%). While the rate of students who have information about the ALARA principle was 78.3%, the use of lead aprons and collars is the most recommended method of radiation protection in practice (73.5%). Finally, among the effects of radiation on cells, the ionizing effect is the most known (84.3%).

4. Discussions

Radiation protection practices are of critical importance for students of health services vocational schools. The aim of this study is to evaluate the knowledge of students who will work in radiation environments about radiation protection and its application and to determine their knowledge levels in radiation applications. At the same time, we aim to minimize unnecessary radiation exposure of both patients and healthcare professionals by creating awareness about the ionizing effects of radioactive devices.

Radiation protection information is provided to students of the Radiotherapy and Medical Imaging program of the Health Services Vocational School during theoretical courses and clinical internships. After graduation, most of them continue to use radiation for diagnosis and treatment purposes in hospital or clinical environments. Therefore, knowledge and application skills regarding radiation safety and protection are extremely important. In addition, healthcare technicians need to be careful to ensure minimum radiation exposure by complying with the ALARA principles.

Determining the awareness level regarding radiation safety is important in order to evaluate the knowledge levels regarding radiation protection. There are many studies in the literature examining the knowledge and awareness levels of associate degree students and radiology doctors regarding radiation protection [15-19]. In addition, some studies are in the form of surveys evaluating the knowledge, attitudes and perceptions of associate degree students on radiation safety and protection [20,12]. In Turkey, a study was conducted in 2005 to evaluate the knowledge of health technicians on dose reduction techniques, radiological equipment and radioactive service quality (22). In a survey conducted in 2018 with only 40 private radiology physicians, the imaging techniques, equipment and radiation protection tendencies used by these physicians were examined[15] To our knowledge, no study has yet been conducted in Turkey to evaluate the knowledge of associate degree students on radiation protection and its application. Studies conducted in other countries reveal that health technician students and physicians generally have a moderate or weak level of knowledge on radiation protection and that sufficient importance is not given to radiation protection methods [18-22]. In our survey study, it was observed that participants answered questions on radiobiology correctly at a rate of 82.2% to 89.7%. However, the rate of students who answered the question "is X-ray harmful" correctly remained at 40%. In terms of radiation protection knowledge, 55.4% of students answered correctly about the lowest dose of radiation, and 73.5% about the necessity of using lead aprons and thyroid protectors, which is a very good result. In the study conducted by İlgüy et al., only 8.7% of healthcare professionals reported using lead aprons and 3.7% using lead collars [22]. In the study conducted by Yasa and Sadık, the rate of using lead aprons was found to be 45% and the use of thyroid protectors was found to be 50%. As a result of our study, we believe that the knowledge and awareness of students about radiation protection increased and that this knowledge was positively reflected in their practice in the radiation area. Many positive feedbacks were received from the participants, especially after the survey. Radiation is an important tools used in different types of works in literature [23-40].

5. Conclusions

It was determined that the students of the health services vocational school who participated in this study had sufficient knowledge about radiation safety and radiation protection. Those who use radiation-generating devices should know radiation safety practices and related regulations in detail in order to protect themselves, their colleagues and their patients. No amount of radiation is completely safe; therefore, radiation protection and correct application of health workers are of great importance.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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