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## **Patient awareness of diagnostic radiology potentials and its safety**

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## ABSTRACT

**Background:** Adequate general knowledge (GK) of diagnostic radiology potentials and its safety among general population might affect patient health condition and clinical outcome. Poor awareness might result in over diagnosis, misdiagnosis and lead to iatrogenic or a late-diagnosed medical condition.

**Materials and methods:** Observational study has been carried out at the Radiology Department of The Hospital of Lithuanian University of Health Sciences Kaunas Clinics. Adult patients who had a radiological examination from 1<sup>st</sup> December 2017 until 1<sup>st</sup> March 2018 were assigned to the study. The original survey included questions about the safety of the diagnostic radiology and its potentials. The participants were grouped according to the age, gender and education. Results were compared among the groups. The statistical analysis was performed using SPSS 23.0 software. Significance level  $p < 0.05$  was chosen for testing statistical hypothesis.

**Results:** 201 respondents participated in the survey. The general knowledge (GK) of diagnostic radiology of the study population equaled to  $58\% \pm 17.28\%$ . Knowledge of radiological safety was evaluated as  $53.23\% \pm 18.13\%$ , although knowledge about the potentials of diagnostic radiology was  $65.37\% \pm 23.56\%$  out of 100%. The GK of diagnostic radiology did not differ between gender ( $p > 0.05$ ), however, it was found that patients with vocational or university education had better GK of diagnostic radiology compared to patients with primary or secondary education. However, GK did not differ statistically significantly between vocational and university education groups ( $p > 0.05$ ). According to the respondents age it was found that in the group of age  $> 55$  y/o GK of diagnostic radiology was poorer compared to the group of 36-55 y/o respondents, significantly ( $p = 0.01$ ).

**Conclusion:** According to the study results it was estimated that patient awareness of diagnostic radiology does not depend on the gender, but on the age and education. GK of patients about diagnostic radiology is average.

**Keywords:** Diagnostic radiology; safety; diagnostic awareness; radiological imaging

## **Introduction**

Contemporary medicine is hardly imagined without radiological diagnostics, nuclear medicine and radiotherapy. The growing demand for radiological examination worldwide testifies about constantly increasing importance of radiological diagnostics. Based on the written sources in 2013 about 3.9 mln x-ray imaging procedures were performed in Lithuania alone, the biggest number being - roentgenograms 86,5% and computer tomography (CT) examinations 8,6% (1). Due to the growing demand for radiological examination in medicine visual examination has become one of the main sources of man-made radiation (2). Radiation Protection Center states that on the basis of international radiological safety standards, every country is obliged to observe and evaluate medical radiation patients are exposed to. In the year 2011 exposure to medical radiation in Lithuania accounted to 27% of all the exposure per capita (3). It is believed that even a small dose of ionizing radiation might cause cancer diseases and the amount of risk is directly proportional to the radiation dose received by an individual, nevertheless the radiation doses used for diagnosis are low thus the danger to the health is insignificant as well(1,4). Medical literature states that chance of cancer after performing chest x-ray is one in a million since this radiation dose is equal to the amount of radiation received from the environment in 10 days or after 3 days of lying on the beach. This kind of information might be important and useful for the patient to help make a decision about necessity of the examination estimating proportion between harm and potential benefit (5).

It is necessary to know that not all radiological examinations are based on ionizing radiation. Magnetic resonance imaging (MRI) is noninvasive imaging technique using strong magnetic field and radio waves while ultrasound examination is performed using high frequency sound waves. There is no evidence that ultrasound diagnostics could cause harm to human health thus ultrasound examination is considered to be one of the safest methods of radiological examination (6).

Dental care during pregnancy is another challenge. According to the dentists there are cases when patients refuse dental care when panoramic jaw x-rays are required because of the fear to badly affect the fetus, however, it is known that panoramic jaw roentgenogram is a method of localized x-ray imaging during which woman's uterus is not exposed to radiation thus it is safe for pregnant women (7-9).

The aim of this paper was to evaluate basic knowledge of the patients about radiological diagnostics and its safety.

## **Materials and methods**

The observational study has been carried out at the Radiology Department of The Hospital of Lithuanian University of Health Sciences Kaunas Clinics. The participants of this study were patients aged 18 and older who had a radiological examination carried out at the Hospital of Lithuanian University of Health Sciences Kaunas Clinics during the period from 1 December 2017 until 1 March 2018. The original questionnaire consisting of 12 dichotomous questions was used

to evaluate basic knowledge of diagnostic radiology opportunities and its safety (Table 1). The first seven questions were to evaluate the participants' knowledge of radiological safety, and the next five questions were used to evaluate knowledge of diagnostic radiology opportunities in general. Correct answers were assigned one point each (maximum score - 12 points (100%)). The results of the survey were expressed as proportion (percentage) of correctly answered questions and compared between age groups (18-35 y/o, 36-54 y/o, >55 y/o), education and gender of the patients. Data was analyzed using SPSS (Statistical Package for Social Sciences) software version 23.0. Non-parametric Mann Whitney – U and Kruskal Wallis tests were used for testing statistical hypothesis. Data is represented as mean  $\pm$  Standard deviation. P value less than 0.05 was considered significant.

## Results

A total of 201 respondents were surveyed. Sociodemographic characteristics of the study population is shown in Table 2. According to the results of the survey the general knowledge (GK) of diagnostic radiology of the study population equals to 58%  $\pm$  17.28% (the minimum result was

8.33% and maximum - 91.67%). The knowledge of radiological safety was evaluated as 53.23%  $\pm$  18.13%, although knowledge about the opportunities of diagnostic radiology was 65.37%  $\pm$  23.56% out of 100%. The general knowledge of diagnostic radiology did not differ between gender ( $p>0.05$ ), however, it was found that patients with vocational training and university education had better general knowledge of diagnostic radiology compared to patients with primary and/or secondary education, significantly ( $p=0.005$  for vocational education and  $p<0.001$  for university education). However, general knowledge of diagnostic radiology did not differ statistically significantly between vocational training and university education groups ( $p>0.05$ ). According to the respondents age it was found that in the group of age >55 y/o general knowledge of diagnostic radiology was poorer compared to the group of 36-55 y/o respondents, significantly ( $p=0.01$ ), though in comparison to the other age groups no significant difference was estimated ( $p>0.05$ ), (Figure).

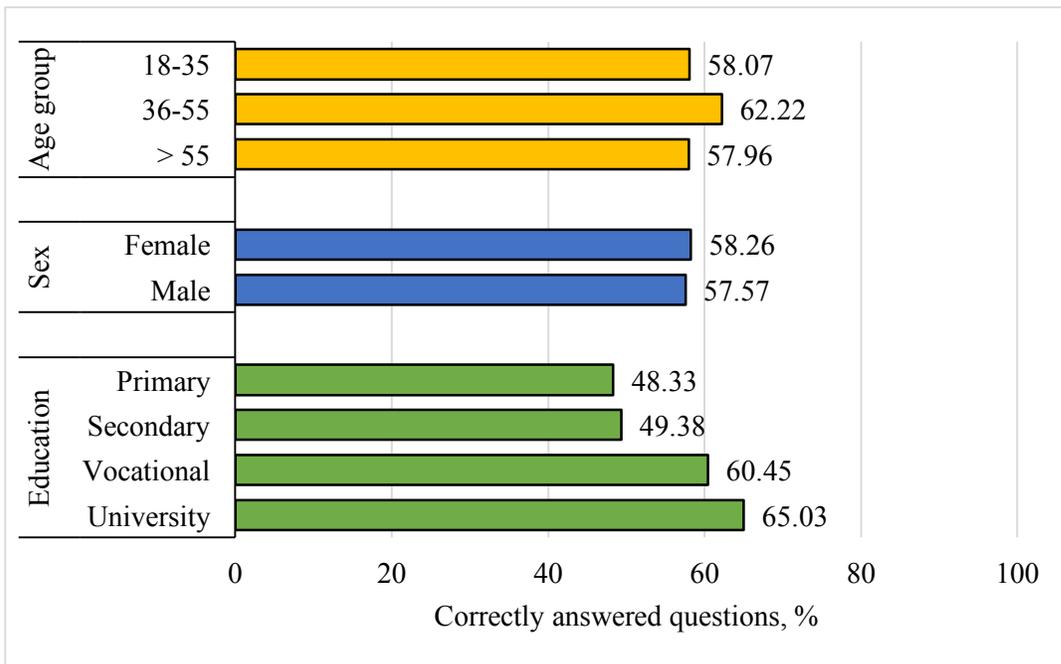
**Table 1. Original questionnaire with results.**

<i>Question (Correct answer)</i>	<i>Percentage of correct answers</i>	<i>Percentage of incorrect answers</i>
1. Is MRI performed using ionizing radiation? (No)	48,8% (98)	51,2% (103)
2. Is ultrasound examination a safe diagnostic method? (Yes)	84,1% (169)	15,9% (32)
3. Is CT imaging safer diagnostic method than roentgenogram? (No)	30,8% (62)	69,2% (139)
4. Is it correct that dose of radiation received during one chest x-ray equals to the radiation quantity received in 10 days from the environment? (Yes)	57,2% (115)	42,8% (86)
5. Is ionizing radiation used for diagnostic purposes likely to cause infertility? (No)	39,3% (79)	60,7% (122)
6. Is it safe to perform panoramic jaw x-ray during pregnancy? (Yes)	38,8% (78)	61,2% (123)
7. Do radiological examinations which use ionizing radiation increase the risk of cancer? (Yes)	72,1% (145)	27,9% (56)
8. Is ultrasonography an appropriate method to evaluate bone structures? (No)	51,7% (104)	49,3% (99)
9. Which radiological examination is the most appropriate to diagnose brain structural changes? (MRI)	54,7% (110)	45,3% (91)
10. Which answer on angiography is correct? (Radiological examination visualizing blood vessels)	50,7% (102)	49,3% (99)
11. What radiological method is used during echocardiography? (ultrasound)	79,1% (159)	20,9% (42)
12. Is x-ray an appropriate method to diagnose bone fractures? (Yes)	89,1% (179)	10,9% (22)

**Table 2. Socio-demographic data of participants.**

Characteristics		Frequency (%) n = 201	
		n	%
Sex	Female	114	56.72
	Male	87	43.28
Age	18-35 y/o	32	15.92
	36-54 y/o	90	44.78
	>55 y/o	79	39.3
Education	Primary	5	2.49
	Secondary	67	33.33
	Vocational	63	31.34
	University	66	32.84

**Figure 1. GK of diagnostic radiology according to patient age, gender and education.**



## Discussion

In contemporary medicine instrumental examination methods play a key role not only in diagnosing various illnesses and conditions, but also performing therapeutic interventions. Despite of frequent usage of radiological examination patient knowledge related to diagnostic methods is relatively poor. In our study population we have observed that majority of the patients do not have basic knowledge about radiological diagnostics its potentials and/or safety which was observed in the previous studies as well (10). Only a few investigations have been found in written sources in which evaluation of patient knowledge of radiation and/or radiological examination was studied. Grauzinyte et al. in their study evaluated general knowledge on radiological diagnostics among population not related to medicine. According to the data of the study 62.4% of respondents provided correct answers to the questions about radiological diagnostics, radiation, types of radiation and possible side effects (2). Our study results were similar, average percentage of correct answers was 58%. According to the previous literature knowledge about diagnostic radiology does not depend on the gender, however it is associated with education (2,11). Our results were similar, however, it was found that age also played a significant role.

In previous studies it was estimated that 45 – 60,7% of the patients thought that ionizing radiation was received during MRI scanning, meanwhile 4,5 - 32.7% of the patients thought that ionizing radiation was received during ultrasonography respectively (2,11,12). In our case the percentage was 51.2% (MRI) and 15.9%

ultrasonography. Similar results were published by Jason G. Domina et al., in their large sample size (n=1976) study 45% of respondents thought that MRI uses ionizing radiation and 10% accounted that to ultrasonography (12). Zwank and Domina in their publications estimated patient knowledge about CT. According to the authors 10%-30% of the respondents were not aware that ionizing radiation is used during CT (12,13). Similar study was performed by Nadine A. Youssef et al. in 2011. The study population consisted of 487 patients in need of medical treatment. More than half of them (56%) did not know total ionizing radiation dose difference between CT and X-ray imaging. 22% stated that CT does not increase cancer risk in the future, 41.3% of patients wanted to have head CT done after head trauma though doctors did not observe any indications for that. Authors emphasized in their conclusions that the knowledge of patients about diagnostic radiology is poor, however majority of patients would like to have more information on risk of CT to their health (14). According to our estimations 69.2% of respondents highlighted that CT is safer diagnostic method than x-ray, although 72.1% of the patients knew that ionizing radiation increases cancer risk. Similar results are published by other authors as well (2).

No studies were found about patients' opinion on safety of radiological examination during pregnancy. According to our data more than a half (61.2%) of respondents believe that panoramic jaw X-ray is not safe for a pregnant woman. Our results as well as the results of previous studies only confirm that a lack of patient knowledge about radiologic diagnostics might be a

cause of more difficult clinical work and communication with patients. The patients because of lack of knowledge of radiological examination principle and their effect on the organism frequently have incorrect evaluation of potential benefit and /or harm and tend to demand sophisticated methods of examination or vice versa – avoid common radiological examinations such as X-ray imaging because of fear of high ionizing radiation, meanwhile approve CT as innocent diagnostic examination.

According to the study results it was estimated that patient awareness of diagnostic radiology does not depend on the gender, but on the age and education. GK of patients about diagnostic radiology is average.

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