MEDICAL STAFF AND COMMUNITY KNOWLEDGE ABOUT IONIZING RADIATION

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ABSTRACT

Background and aim. Imaging tests become one of the main human-made ionizing radiation sources in these days. Computed tomography (CT) performed within one year could cause more than 29,000 oncological diseases in the future. Further, high dose of radiation could cause acute sickness, infertility or immune system suppression. It is always important to know community and medical staff knowledge level of radiation to improve the current situation.
Methods. Questionnaire was prepared by researchers using published data in this field. The ratio of correct answers to all questions was converted to the percentage and data was processed by using SPSS 24 (Mann Whitney, Pearson Chi square, Kruskal-Wallis tests).
Results. 184 volunteers were surveyed. The average of respondents results was 67.5 %. The average of correct answers in female group was 66.4% and in male group was 70.9%. Knowledge of female and male did not show statistically significant difference. 75.5% know that X-ray involve radiation and 69.6% of participants know that CT involve it as well. Respondents related to radiology and medical physicians statistically had equal knowledge level. Also, 50.0% of respondents were informed or had information about radiation before radiological tests from different sources. There was no statistically significant difference between subjects who were informed about medical radiation and those who were not informed.
Conclusions. There is no difference between females and males, medical physicians and radiologists, informed and uninformed persons knowledge about ionizing radiation. 75.5% know that X-ray involve radiation and 69.6% of participants know that CT involve it as well. Unfortunately, half of participants state that never were informed about ionizing radiation.

Keywords: ionizing radiation, knowledge, patients knowledge, physicians knowledge

INTRODUCTION

Nowadays imaging tests are available every day and medical and dental X-rays become one of the main man-made radiation sources. Based on published reports near 80% of radiation came from natural sources [1], while in Lithuania in 2015 only 70% of ionizing radiation came from nature. One of the main causes of increased medical radiation is growing number of computed tomography (CT) procedures. In our country 55% of total patients exposure (collective effective dose) is determined by exposure associated with CT [2]. Researchers suggesting that for example the CT scans performed in the United States in 2007 might produce more than 29,000 oncological diseases in the future. Breast, lungs, brain cancer could be consequences of radiation. Unfortunately from 5% to 30% of these procedures still may be medically unnecessary [3]. Other dilemma remains that patients are often uninformed about CT ionizing radiation [4]. Nondisclosure of information is one of the problems in the doctor-patient communication. Specialists highly recommend involving patients in treatment and diagnostic process because it increases positive view of their health status, which may influence their health outcomes [5].
Female gender and young age are risk factors for exposure to ionizing radiation adverse effects [6]. It could cause acute sickness, cataract, skin erythema, infertility for men and for women or bone marrow suppression [1, 7]. High dose of radiation is dangerous to pregnancy. Prenatal

death, delayed growth, future mental retardation and an increased risk of cancer are adverse effects to the embryo. The effect depends on the radiation dose and gestation period [7]. Magnetic resonance is also imaging test but it is producing images without the use of ionizing radiation. Despite this fact it could cause some side effects too. Wires, pulse oximeters, analgesic patches, cardiorespiratory monitors, tattoos or other metallic objects could be the reason of thermal burns during this procedure [8]. It is important to discuss these risks with patients before each of the tests. Based on all this data our study aims were to identify community knowledge about ionizing radiation and how did they get information about it.

MATERIALS AND METHODS

The study was conducted in Lithuanian university of health science, Kaunas, Lithuania from December 2016 to July 2017. We prepared questionnaire using published data from other researchers in this field. Participants were asked their profession, education, incidence of having X-ray, CT, magnetic resonance imaging (MRI), ultrasound (US) and their knowledge about ionizing radiation. All participants were classified in three groups- radiology related, doctors and radiology unrelated persons. Physics, radiographers, radiology technicians were considered as radiology related people. Medical students and doctors were considered as doctors and any other specialty having people were considered as radiology unrelated. For each question about radiation answered correctly we counted 1 point. Then we counted ratio: how many questions were answered correctly comparing to potentially answered all questions. The ratio of correct answers to all questions was converted to the percentage. Data was processed by using SPSS 24 (Mann Whitney, Pearson Chi square, Kruskal-Wallis tests). The results were considered as statistically significant, where $p < 0,05$.

RESULTS

184 volunteers were surveyed. 75.5% of them were females and 24.5% of them were males. 4 (2.2%) responders answered their educational level was general basic, about half of participants (51.6%) had secondary education, 17 (9.2%) higher education and 68 (37%) had higher education of university. 21.2% volunteers answered they were radiology related, 17.4% were doctors and 60.9% were radiology and medicine unrelated (Table 1). Knowledge of responders was counted by assessing answered questions from given questions. This number was converted to percentage and the average of their results was 67.5 %, standard deviation ±15.3%. Minimal result was 30.4% and maximal result was 96.6%. The average of correct answers in female group was 66.4% (30.4% - 93.1%) while male answered 70.9% questions correctly on the average (30.4% - 96.6 %). Knowledge of women and men did not show statistically significant difference.

139 subjects (75.5%) know that X-ray involve radiation and 128 (69.6%) of participants know that CT involve it too. 30.4% of respondents incorrectly answered that MRI and 6.0% of respondents incorrectly answered that US could involve radiation. 60.7% persons stated CT as highest exposure of radiation. Also, 93.5% of participants correctly answered about radiation effect to the embryo and 76.1% of all subjects know about radiation and cancer association (Table 2).

Radiology related persons answered 74.5% of questions right on the average (55.2% - 93.1%). The average of doctors correct answers was 76.7% (48.3% - 93.1%). People who specializes other than radiologists, radio technologists or physics and medical doctors answered 62.4% of questions on the average (30.4% - 96.55%). Radiology related and medical doctors had equal knowledge level (p=0.389). Radiologists, radiology technologists or physics and medical doctors had statistically significantly better knowledge than people claiming their specialty was "other than that".

50.0% of respondents were informed about radiation before radiological tests from different sources (Figure1). 9 of study participants had more than one source of information. There was no statistically significant difference (p=0.718) between subjects who were informed about medical radiation and those who were not in-

formed. Informed respondents answered 70% on the average (44,8% - 96,5%) and those who were not informed answered 70,8% correctly on the average (41,4% - 93,1%).

DISCUSSION

Radiologists, clinicians and other people have exposure to ionizing radiation. To create safe environment it is important to evaluate all community knowledge about it. Lee RK et al. [4] compared radiologists and non-radiologists knowledge about radiological investigations. Radiologists had better knowledge about radiation doses of radiological investigations. None of the non-radiologists right answered about the radiation dose of a chest x-ray while 32% of radiologists knew the right answer. Also, it was noticed that residents of radiology department had better knowledge than senior radiologists. Authors of this publication do not report about statistically significance. There was no statistically significant difference between radiologist and other doctors knowledge in our study. Awosan KJ et al. [1] compared all health workers knowledge of radiation hazards. Imaging specialist, doctors and nurses had better knowledge than administrative and other supporting staff. Also, authors checked sex and knowledge relationship. It was noticed that males had better knowledge than females. Our study did not show statistically significant difference in participants knowledge based on sex. Sin H with colleagues [9] was comparing patient knowledge and did not find correlations between this demographic variable too.

Based on published reports, from 70.0% to 77.6% of patients named CT as ionizing radiation source. Unfortunately, about 60% of subjects still did not know that MRI is radiation free [9, 10]. Our study revealed similar results. Zwank MD et al. [10] published that about half of patients want to get more information about ionizing radiation before imaging test. Usually they are informed by doctors (45.2%-69%) or radiologist (31.3%) [9, 11]. According to our results, half of responders were not informed about radiation before the test at all. 30% of responders were looking for the information about radiation by themselves. In fact, all patients sign agreement before the radiological test is done. Indications, contraindications, hazards of the radiological test are explained in the agreement that is given to the patient to read before the test. Due to the lack of time, some patients are not always informed in detail verbally, but they are always informed in writing. To be more precisely, our research results saying 50% of patients are uninformed show that written information is not always understood or read by patient. Paradoxically, knowledge about radiation was equal of informed and uninformed responders. Despite the effort, community understanding about radiation remains limited so it is important to inform them about tests' risks. Communicating with patients would help them feel more comfortable and would increase the confidence of the doctor [12]. In order to ease doctors work and purify the information they give to their patients, standardized guidelines of what must be said to patient, for example: indications, contraindications, hazards of the test, phone numbers to call if adverse effect happens, should be prepared. To save on doctors time, flyers with this kind of information could be given to every patient in waiting rooms of radiology department. As we concluded that written information is not always read by patients, short movies about radiological tests shown in radiology department waiting rooms would be the option as well. This would help doctors confidently inform patient without fear to forget what must be said or without fair to mislead patient. This would help hospitals to reduce complaints and grievancies about rudeness, negligence and malpractise of personell [13].

Our study revealed that, knowledge about X-ray is sufficient, but there are still 3 from 10 subjects who think that MRI is not radiation-free. There is no difference between females and males, doctors and radiologist, informed and uninformed persons knowledge about ionizing radiation and hazards. Doctors and other staff should spread more necessary information about imaging risks to all the patients independently from their sex or specialty. Finally, we think that spread of information would highly increase the reliance on the medical staff.

Figure.1 Source of information about ionizing radiation

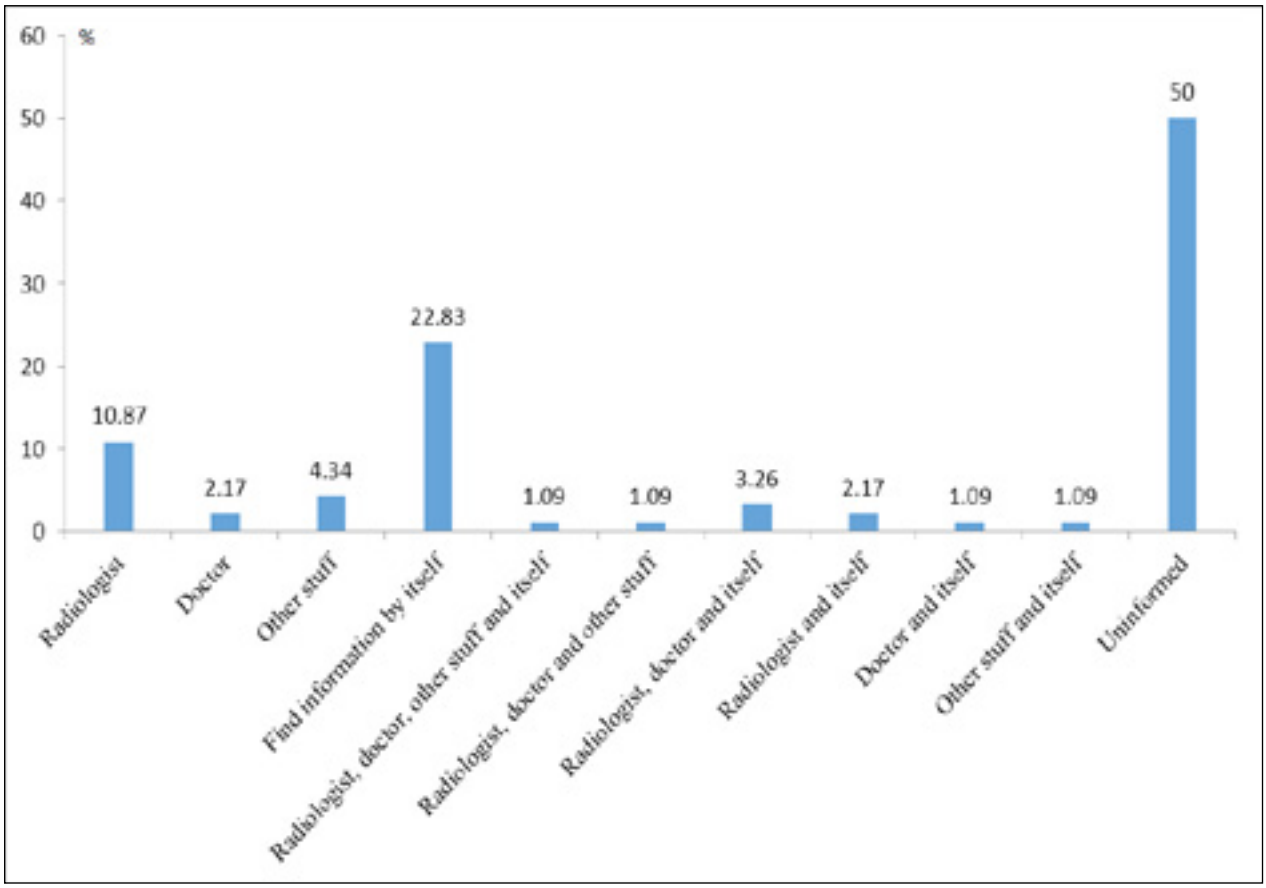

Table 1. Socio-demographic profile of participants.

Characteristics		**Frequency (%)** n = 184	
		n	**%**
Sex	Female	139	75.5
	Male	45	24.5
Specialty	Radiology related	39	21.2
	Doctor	32	17.4
	Other	113	60.9
Education	Primary	4	2.2
	Secondary education	95	51.6
	University	17	9.2
	Higher education of university	68	37.0

Table 2. Correct answers of respondents to questions about radiation

Answered / Questions	Radiology related people	Doctors	Other specialties
Which test has higher radiation: a) X-ray 60times higher than CT; b) CT 70times higher than X-ray; c) the same?	3 (37.5%)	2 (28.6%)	64 (83.1%)
Does X-ray test use radiation?	37 (94.9%)	30 (93.8%)	70 (63.1%)
Does CT scan use radiation?	37 (94.9%)	30 (93.8%)	59 (53.2%)
Does MRI use radiation?	32 (82.1%)	29 (90.6%)	65 (58.6%)
Does US use radiation?	36 (92.3%)	29 (90.6%)	106 (95.5%)
Which test has the highest amount of radiation?	36 (92.3%)	29 (90.6%)	44 (40%)
Do CT or X-ray damage embryo/fetus?	20 (95.2%)	32 (100%)	34 (87.2%)
Do MRI damage embryo/fetus?	10 (47.6%)	22 (68.8%)	12 (30.8%)
Do US damage embryo/fetus?	21 (100%)	30 (93.8%)	36 (92.3%)
Can X-ray make you feel nauseous / vomit?	7 (17.9%)	9 (28.1%)	35 (32.1%)
Can CT-scan make you feel nauseous / vomit?	28 (71.8%)	22 (68.8%)	51 (45.9%)
Can MRI make you feel nauseous / vomit?	18 (47.4%)	16 (50%)	56 (50.9%)
Can US make you feel nauseous / vomit?	34 (87.2%)	29 (90.6%)	104 (93.7%)
Can X-ray damage your immune system?	20 (51.3%)	15 (46.9%)	72 (65.5%)
Can CT-scan damage your immune system?	29 (74.4%)	23 (71.9%)	70 (63.6%)
Can MRI damage your immune system?	25 (64.1%)	27 (84.4%)	63 (57.8%)
Can US damage your immune system?	37 (94.9%)	30 (93.8%)	95 (85.6%)
Does X-ray increase the risk of having cancer?	28 (73.7%)	24 (75%)	87 (78.4%)
Does CT-scan increase the risk of having cancer?	36 (92.3%)	29 (90.6%)	73 (65.8%)
Does MRI increase the risk of having cancer?	31 (79.5%)	29 (90.6%)	60 (55%)
Does US increase the risk of having cancer?	39 (100%)	31 (96.9%)	94 (84.7%)
Can X-ray damage your skin (make inflammation, destruction of skin and nails)?	20 (51.3%)	11 (34.4%)	43 (39.1%)
Can CT-scan damage your skin (make inflammation, destruction of skin and nails)?	27 (69.2%)	18 (56.3%)	45 (40.5%)
Can MRI damage your skin (make inflammation, destruction of skin and nails)?	8 (20.5%)	6 (18.8%)	36 (32.4%)
Can US damage your skin (make inflammation, destruction of skin and nails)?	36 (94.7%)	28 (87.5%)	102 (91.9%)
Does the likelihood of getting adverse effects after X-ray depend on the frequency of the test done (times/ a year)?	31 (79.5%)	30 (93.8%)	88 (79.3%)
Does the likelihood of getting adverse effects after CT-scan depend on the frequency of the test done (times/ a year)?	33 (84.6%)	30 (93.8%)	87 (78.4%)
Does the likelihood of getting adverse effects after MRI depend on the frequency of the test done (times/ a year)?	10 (47.6%)	17 (53.1%)	9 (23.1%)
Does the likelihood of getting adverse effects after US depend on the frequency of the test done (times/ a year)?	16 (76.2%)	22 (68.8%)	22 (56.4%)

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