FINAL RESULTS OF A SURVEY ON THE AWARENESS OF THE RADIATION PROTECTION IN MEDICAL SECTOR IN TURKEY

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ABSTRACT

In this study, final results of a survey performed between 2012 and 2015 on the awareness of radiation protection were presented. The survey was conducted at six hospitals, four training and research hospitals, one medical faculty hospital, and one state hospital, in Istanbul. Target audience was medical doctors, technical staff (technicians and medical physicists) and patients. Besides, the survey was also applied for the participants of the 7th National Radiology Technicians and Professionals Education Seminars held in Antalya in 2013 May.

The questionnaires were prepared in different content for each group. Questionnaires prepared for physicians and patients consist of 20 questions, while those prepared for technicians have 30 questions.

Questions about demographic characteristics such as gender, age, occupation and experience years, education, etc., general knowledge about radiation and radiation protection and biological effects of radiation were asked for all target audience. Additionally, some questions were directed to the technicians and doctors about the ALARA culture and about the effective doses received by the patients during radiological examination.

The questionnaires were conducted by face-to-face interviewing with a total of 1372 people consisting of 208 physicians, 870 patients and 294 technicians. Survey results were analyzed using SPSS (Statistical Products and Service Solutions).

1. Introduction

There is a great increase in the use of ionizing radiation for medical purposes. According to the UNSCEAR 2008 report worldwide, the number of diagnostic radiology examinations increased by 2.25 times in about 20 years. Due to the increase in the number of diagnostic radiology examinations, the population dose increases by 1.7% [1]. In the United States, the effective dose from medical irradiation at the beginning of the 1980s was 0.54 mSv, but in 2006 this value increased to 3 mSv and increased by 600% [2-5].

In France, the annual average dose received from medical irradiation in 2002 was 0.8 mSv, while in 2007 it raised to 1.3 mSv with an increase of 57% [6]. Compared to 2007, in 2012 the average annual effective dose became 1.6 mSv with an increase of 20%. In 2012, the contribution of CT analyzes to the frequency is 10.4%, while the contribution of collective effective dose is 71.3% [7, 8].

In 2013, CT examination frequencies in Switzerland increased by 17% compared to 2008. While CT frequencies constitute 9.6% of the total frequency of X-ray examinations (i.e. Mammography, X-rays, Interventional Therapeutic, Interventional Diagnostic, Conventional Fluoroscopy, Dental), its contribution to the collective effective dose is 70.5% [9].

It is estimated that approximately 5807 (1.8%) of the cancer cases that took place in 2010 in the UK are directly related to radiation exposure from both natural and artificial radiation sources. 0.6% of all cancer cases are directly associated with diagnostic radiology examinations [10].

Because of the increase in the use of radiation for medical purposes, spreading of ALARA culture in medical sector has begun to be of great importance. Great effort have being made and various educational programs have being organized to spread the ALARA culture [11, 12].

The benefits and risks of the patient, constraints in occupational and patient exposures must be considered in the use of ionizing radiation. A successful practice requires well-trained staff. This study is a survey conducted to determine the needs and deficiencies about radiation awareness in the medical sector. Preliminary results of this study were presented in ETRAP 2013 [13].

2. Survey Details

In order to be able to implement the survey to the targeted group, necessary protocols were signed with the Ministry and Institutions to which the hospitals were affiliated and permission was obtained. According to the protocol signed with the institutions, the names of the hospitals where the survey carried out were not disclosed.

Survey was performed between 2012 and 2015. Questionnaires were carried out by means of one-on-one interview with the persons who accepted to participate. The target audience was the technical staff (technician and medical physicist), the physicians and the patients.

Additionaly, the questionnaire prepared for the radiation practitioners was also applied to the participants of the seminar held in Antalya in 2013.

The obtained data were analyzed using SPSS (Statistical Product and Service Solution). " **n** " expresses the number of people who answered the question.

3. Results

3.1 Profile of Target Audience

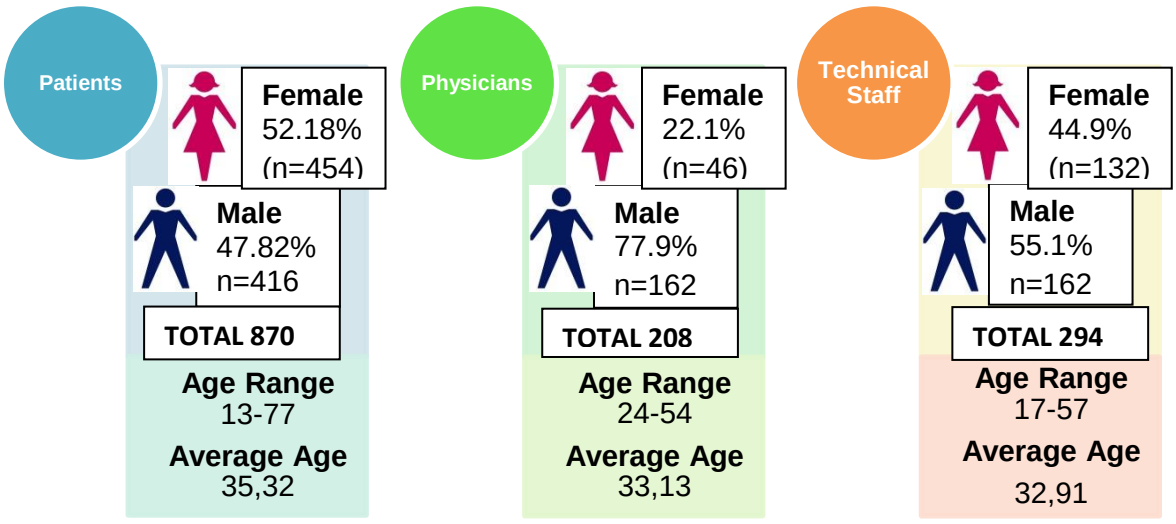


Fig 1: Profile of Target Audience

Patients					
Your Professions			**Educational Status**		
	%	n		%	n
Business Manager	0.7%	6	Illiterate	2.30%	20
Director	1.4%	12			
Engineer	2.8%	24	Literate	2.50%	22
House Wife	23.7%	206			
Officer	10.4%	90	Primary School	30%	260
Others	13.4%	116			
Retired	8.8%	76	High School	32.40%	282
Shopkeeper	4.4%	38			
Student	15.0%	130	University	31%	270
Teacher	2.5%	22			
Unemployment	2.5%	22	Post Graduate	1.80%	16
Worker	14.5%	126			

Tab 1: Education and Professions of the Patients

Physician						
Your Professions				**Experience**		
		%	n		%	n
Surgical Medicine Specialty	Cardiovascular Surgery	1.0%	2	<5	60.6%	126
	Emergency medicine specialist	27.9%	58	6-10 years	16.3%	34
	General Surgeon	4.8%	10	**≤10**	**77%**	**160**
	Neurosurgery	2.9%	6	11-15 years	6.7%	14
	Obstetrician and gynecologist	10.6%	22	16-20 years	7.7%	16
	Orthopedics and traumatology	20.2%	42	21-25 years	4.8%	10
	Otorhinolaryngology	1.9%	4	26-30 years	2.9%	6
	Thoracic Surgery	1.0%	2	30 <	1.0%	2
	Urology	8.7%	18	**10<**	**23%**	**48**
Internal Medicine Specialty	General Practitioner (GP)	1.0%	2			
	Internist	12.5%	26			
	Neurology	1.9%	4			
	Physiotherapy and Rehabilitation	2.9%	6			
	Pulmonology	1.0%	2			

Tab 2: Professions and Experience of the Physician

78.8% (n = 164) of the physicians participated in the survey was surgical medicine specialist, 19.2% (n = 40) of those was internal medicine specialist . 1.9% (n = 4) of those was general practitioner.

Technical Staff Experience		
	%	n
<5	24.57%	72
6-10 years	23.21%	68
≤10	**48%**	**140**
11-15 years	13.99%	41
16-20 years	23.89%	70
21-25 years	9.90%	29
26-30 years	4.10%	12
30 <	0.34%	1
10<	**52%**	**153**

Tab 3: Experience of Technical Staff

Table 3 shows the years of professional experience of radiation practitioners.

There is one radiation practitioner with 30 years or more of experience (> 30).

15 of the radiation workers who have 5 years or less experience are students who work as interns in the institutions where the work was carried out.

284 (97%) person are working in radiology, 8 (2.7%) person are working in nuclear medicine and 1 person is working in (0.3%) radiotherapy units.

3.2 Questions Directed to the Target Audience

"*Which examinations; X-ray, computed tomography, magnetic resonance imaging, barium meal, cardiac angiography studies, contain ionizing radiation*" was the common question directed to the target groups. They gave one of the following answers : "*Yes it includes radiation*", "*No it does not include radiation*", and "*I do not know*". Fig 2 shows the distribution of percentage for the answer "*Yes it includes radiation*" given by the Target Audience.

Fig 3 shows the distribution of percentage for MRI and USG examinations anwers given by Target Audience. Although MRI and USG do not contain radiation, 61% of the Patients, 7% of the physicians and 4% of the technical staff answered "*Yes*".

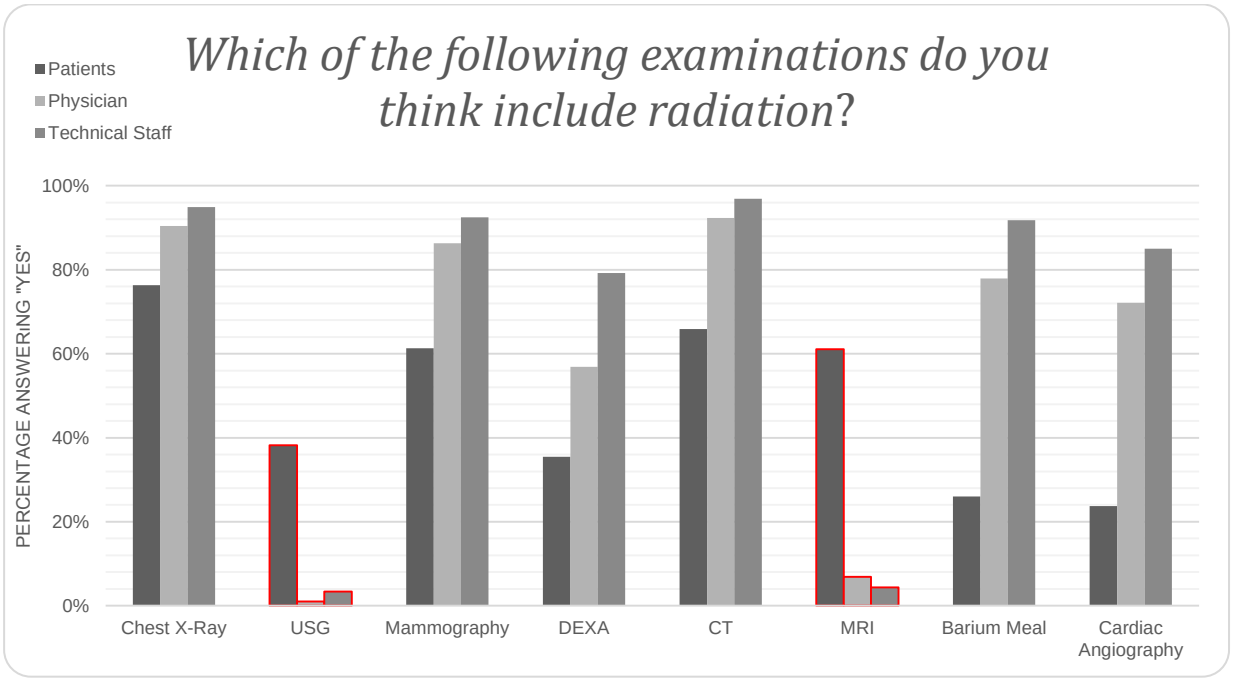


Fig 2: Distribution of Percentage for "Yes" Answers given by Target Audience

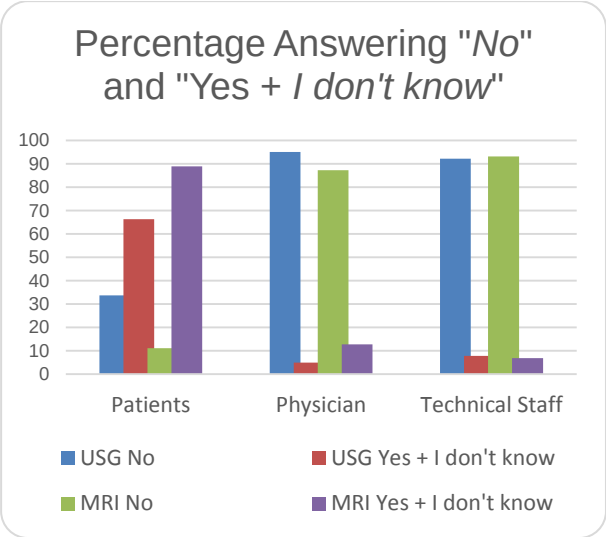


Fig 3: MRI and USG Distribution of Percentage for "*No*" and "Yes + *I don't know"* Answers Given by Target Audience

The proportion of those who answered all options correctly

- ✓ **%37 for the doctors**
- ✓ **%0.5 for the patients**
- ✓ **%63 for the technical staff**

- ➢ The vast majority of patients think that MRI involves radiation.

Only 30% (n = 62) of the physicians who participated in the survey were trained on radiation protection. 76% of the trainees were trained at the medical faculty, 5% at the workplace training, and 19% at the hospital or other institutions.

88.5% of the patients who underwent radiological examination stated that they have knowledge about radiation. Table 2 shows the distribution of answers given by the patients for the question "*What is radiation*". 25.5% of the patients defined the radiation as " *invisible harmful waves*". 15.6% think that radiation is an energy. Figure 4 shows the distribution of the studies that the patients think is most harmful. 23.3% of patients think that MRI examinations are the most harmful examination for them.

What is the radiation?	**Percentage**	**Person(n)**
Invisible hazardous waves	25.50%	222
Carcinogen	20%	174
Energy	15.60%	136
A hazardous material	12.60%	110
Poison	9.40%	82
Others	7.10%	62
I don't know	5.50%	48
Microbe	2.10%	18
A state of matter	1.60%	14
Temperature	0.50%	4

Tab 2. Distribution of Percentage for "***What is the Radiation*?"** Answers given by patients

Which of the following radiological examinations is more harmful on the basis of radiation? (Fig 4)

MRI 23,3%	**X-RAY** 23%	**CT** 17.3%

- ✓ Among these examinations, the CT is the one with the highest average effective dose.
- ✓ 17.3% of the patients gave the "*CT scan*" answer.

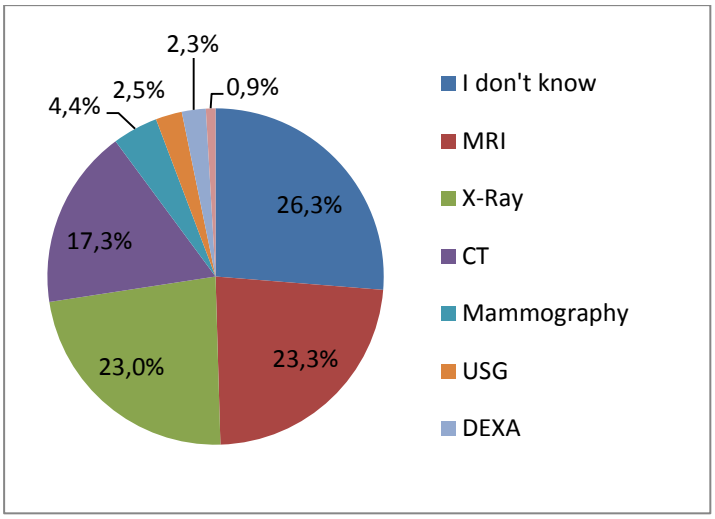


Fig 4: Distribution of Percentage for "***More harmful radiological examination***" Answers given by patients

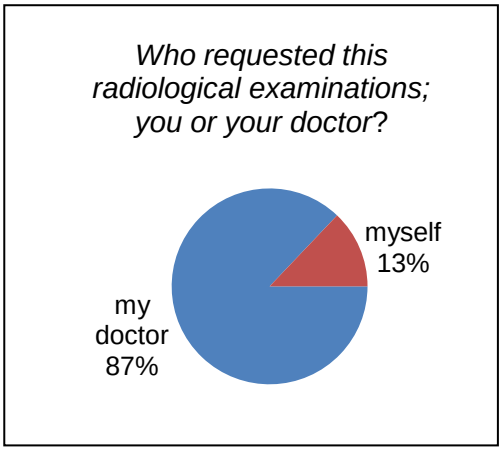


Fig 5: Distribution of Percentage for question answers given by patients

Do you request any information about the risk and benefit of the examination from your doctor or do you research yourself before application?

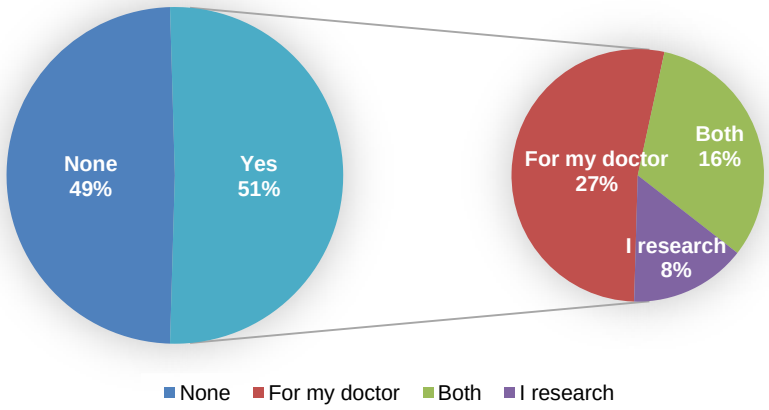


Fig 5: Distribution of Percentage Answers Given by Patients

55% of the patients in examination centers declared not believe that the properly and safely.

The majority (38%) of the patients who did not have knowledge about the examination to be exposed had given the answer " I believe in my doctor" when asked why they should not do the research.

The proportion of those who said "I did not think about it before" was 18%

The rate of those who think "I do not think the examination is a risk to my health" is 4%.

Fig.6 shows the distribution of the answers given by technicians and physicians about the ALARA ('***As Low As Reasonably Achievable***') principle. 44% of the physicians and 60% of the technicians answered correctly. Only 8 of 62 physicians who have been educated in radiation protection had heard about ALARA principle, only 6 of them responded correctly about ALARA.

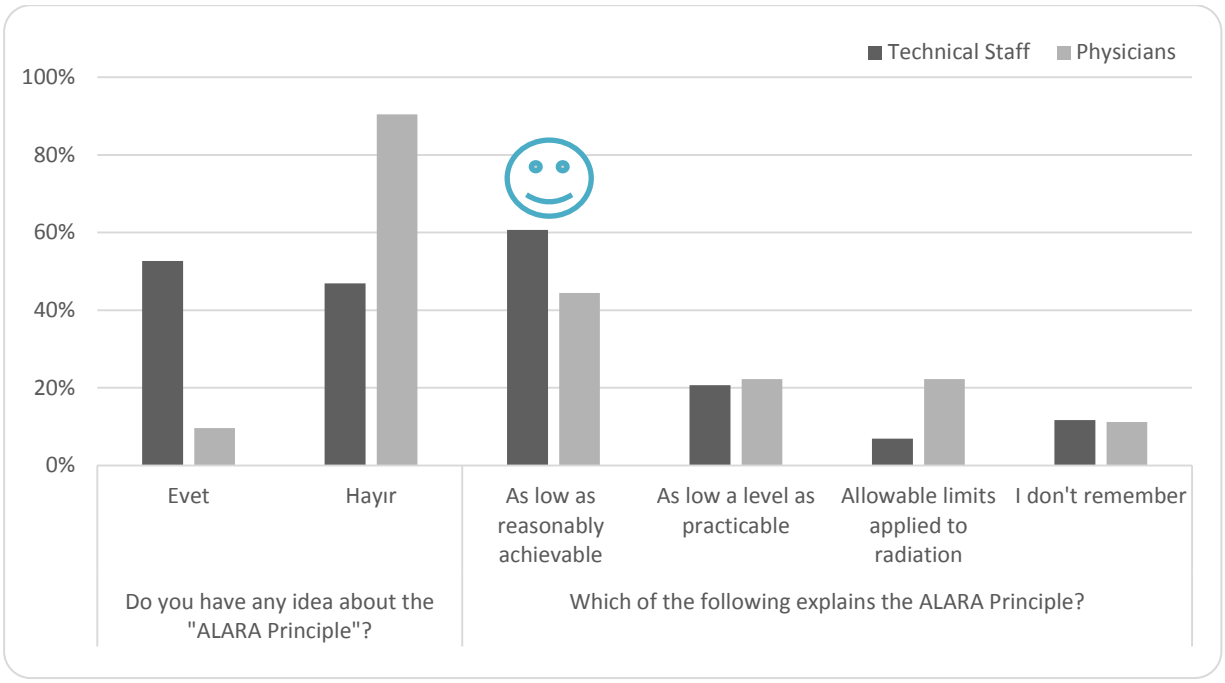


Fig 6: Distribution of Percentage for ALARA Questions Answers Given by Technical Staff and Physician

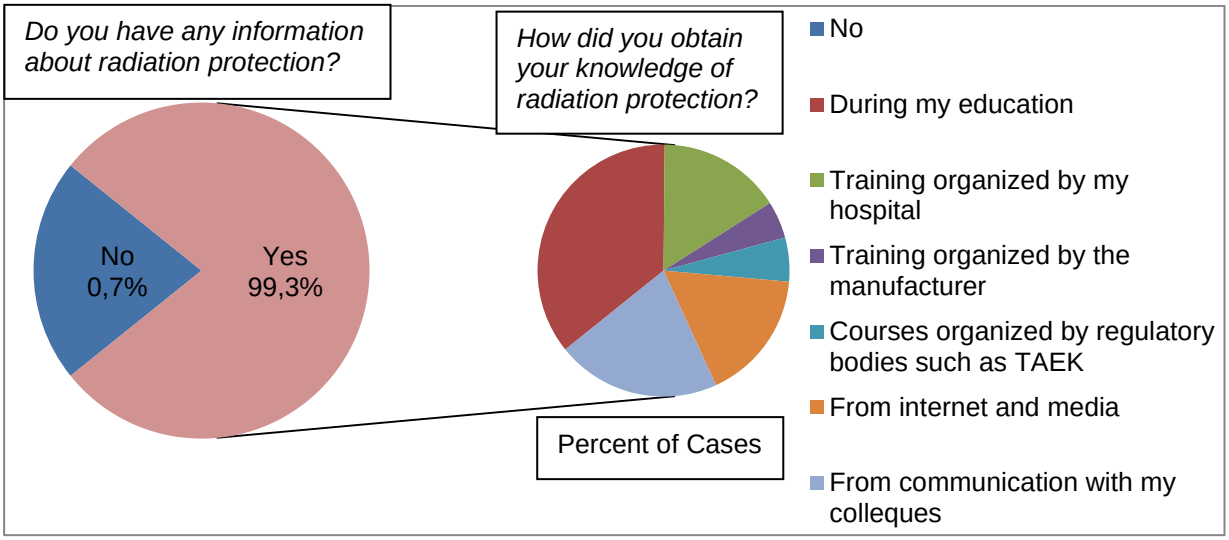


Fig 7: Distribution of Percentage for Radiation Protection Knowledge Question Answers Given by Technical Staff

Physicians and technicians were asked to estimate the contribution of medical exposures to the total effective dose. In this study, with reference to article of Mettler et al., the contribution of medical exposures to the total effective dose was assumed to be 50% [2-4]. 54.8% of the physicians and 49.8% of the technicians made an estimation less than this value. Tab.3 shows the distribution of answers given to the question.

What can you say about the contribution of the medical exposure to the annual effective dose?				
	Correct Responses (%)	**Underestimates (%)**	**Overestimates (%)**	**I have no idea**
Physicians	11.54%	54.81%	0.96%	32.69%
Technical Staff	15.8%	49.8%	2.9%	31.5%

Tab 3: Distribution of Percentage for "*Contribution of the medical exposure to the annual effective dose*" Question Answers Given by Technical Staff and Physicians

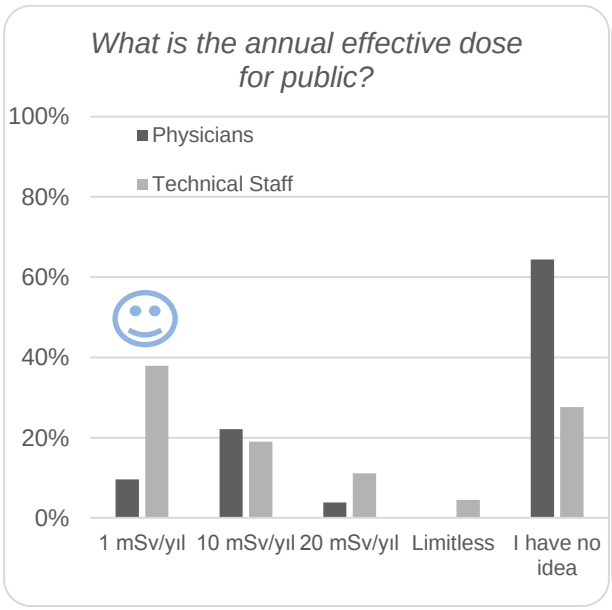


Fig 8: Distribution of Percentage for Dose Limits for Public Question Anwers Given by Technical Staff and Physicians

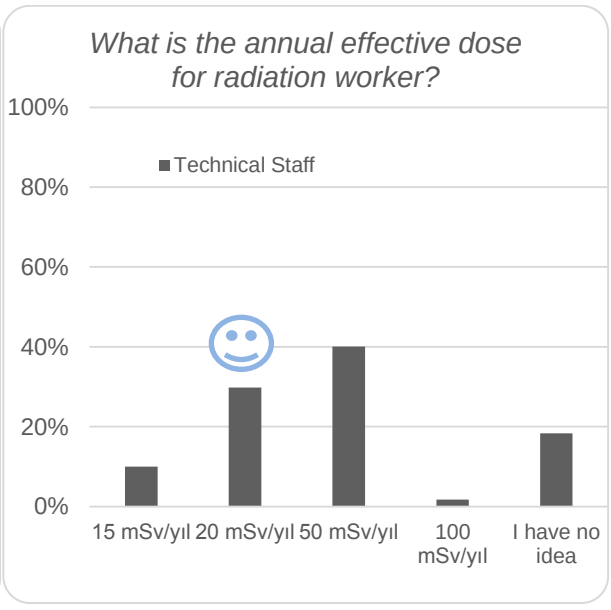
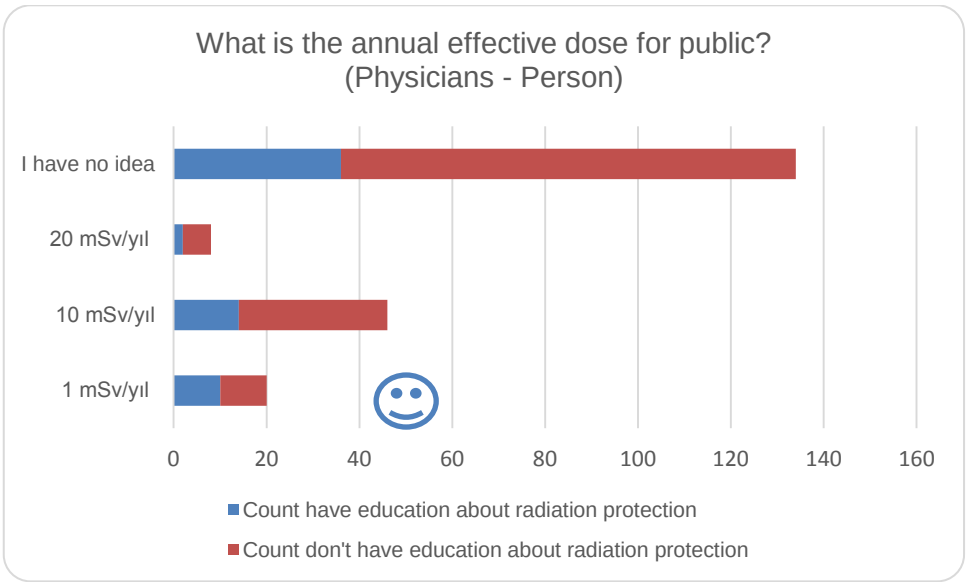


Fig 9: Distribution of Percentage for Dose Limits for Radiation Worker Question Anwers Given by Technical Staff



For the questions related to dose limits, ICRP 103 Directive was taken as reference.

Fig 10: Person-based distribution of the answers given by physicians who did or did not receive radiation protection training for the question of dose limits for public.

Fig.8 shows the distribution of the answers given by technicians and physicians for the annual dose limit for the individual. Fig.10 shows the distribution of the answers given by the physicians who did or did not receive radiation protection training. The physicians did not give the answer "*No Limit*" to the question. The maximum permissible dose limit that an individual can receive in a year is **1mSv / year** [14].

The technicians were asked the *maximum annual allowable dose limit for the radiation worker.* The maximum permissible dose limit for radiation workers in a year is 20 mSv / year. The average of 5 years does not exceed **20 mSv / year** and can not exceed 50 mSv in any one year [14]. 29.8% of technicians answered correctly. 36% of the technicians responded correctly to both questions regarding dose limits.

Finally, the target group was asked whether *diagnostic radiological examinations increased the risk of cancer.* The distribution of the answers given to this question is shown in Fig.11.

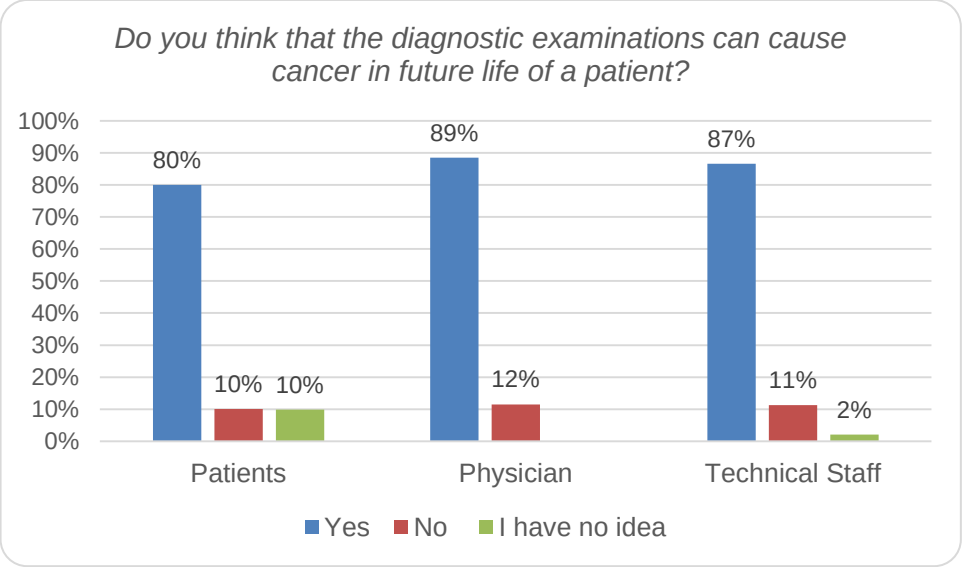


Fig 11: Distribution of Percentage for Cancer Question Answers Given by Target Audience

4. Discussion

Medical uses of ionizing radiation are being increased day by day. The population collective dose is also increasing as directly proportional to the dose of each individual. Even low doses could lead to long-term biological problems by accumulating.

It is observed that most of the physicians participated to the survey did not receive any education related to radiation protection before. The vast majority of technicians and physicians have estimated as less than the reference value the contribution of medical irradiations to the total effective dose.

Even the smallest dose could cause the stochastic effects of cancer. For this reason, the creation of awareness of radiation protection (ALARA culture) would reduce the unnecessary radiation exposure in all areas of life and may offer us the opportunity to obtain maximum benefit from the beneficial effects of radiation. Education about radiation will increase this awareness.

Acknowledgement

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