UDC 001.891.53+614.254+616-092+378-057+623.454.862
DOI: 10.56871/MHCO.2024.94.39.008

PREFERENCES OF MEDICAL STUDENTS IN SOURCES OF INFORMATION ON RADIATION SAFETY ISSUES

© Artem M. Biblin[2], Alexander V. Vodovatov[1, 2], Yuliya N. Kapyrina[1], Almas A. Imamov[3], Victor G. Puzyrev[1], Vasiliy I. Orel[1], Karina E. Moiseeva[1], Radoslava A. Guseva[1]

[1] Saint Petersburg State Pediatric Medical University. 2 Lithuania, Saint Petersburg 194100 Russian Federation

[2] Saint Petersburg Research Institute of Radiation Hygiene after Professor P.V. Ramzaev. 8 Mira str., Saint Petersburg 197101 Russian Federation

[3] Kazan State Medical University. 49 Butlerova str., Kazan 420012 Russian Federation

Contact information: Yuliya N. Kapyrina — Assistant of the Department of General Hygiene.
E-mail: kapirina-yuliya@yandex.ru ORCID: https://orcid.org/0000-0002-1018-5200 SPIN: 4969-0394

For citation: Biblin AM, Vodovatov AV, Kapyrina YuN, Imamov AA, Puzyrev VG, Orel VI, Moiseeva KE, Guseva RA. Preferences of medical students in sources of information on radiation safety issues. Medicine and Health Care Organization. 2024;9(2):81–91. DOI: https://doi.org/10.56871/MHCO.2024.94.39.008

Received: 13.05.2024 ***Revised: 14.06.2024*** ***Accepted: 15.07.2024***

ABSTRACT. Sources of ionizing radiation are increasingly used in modern healthcare for diagnostic and therapeutic purposes. They can pose a hazard to both patients and medical practitioners if sanitary regulations are not met and safety culture is poor. Competencies in the field of radiation impact on humans and the environment, ensuring radiation safety are being set in the process of higher education. The study of students' information preferences allows to develop measures to improve the efficiency of the educational process and, as a result, to increase the competence of students in the issues of radiation safety of patients and the population as a whole. The aim of this work was to identify effective ways to improve information work on radiation safety issues for the students of a medical university. The study was carried out on the basis of St. Petersburg State Pediatric Medical University. A total of 301 people were interviewed. The study revealed a high level of students' interest in radiation issues. In the content structure of students' information requests on radiation issues four leading semantic components are distinguished: "radiation protection measures available at the place of residence", "the trends in the change of the radiation situation", "radiation effect on health", as well as "dangerous and safe levels of radiation". Internet and SMS-alerting were the leading ways of receiving information. Among all the sources of information, according to the students' opinion, EMERCOM, Rospotrebnadzor and specialists/scientists are the most trusted in radiation safety issues among the population. The overwhelming majority of respondents are in favor of providing the population with complete and reliable information in case of a radiation accident.

KEYWORDS: students, sociological survey, radiation protection, information work, ionizing radiation, radiation accident

ПРЕДПОЧТЕНИЯ СТУДЕНТОВ МЕДИЦИНСКИХ ВУЗОВ В ИСТОЧНИКАХ ПОЛУЧЕНИЯ ИНФОРМАЦИИ ПО ВОПРОСАМ РАДИАЦИОННОЙ БЕЗОПАСНОСТИ

© Артем Михайлович Библин[2], Александр Валерьевич Водоватов[1, 2], Юлия Николаевна Капырина[1], Алмас Азгарович Имамов[3], Виктор Геннадьевич Пузырев[1], Василий Иванович Орел[1], Карина Евгеньевна Моисеева[1], Радослава Алексеевна Гусева[1]

[1] Санкт-Петербургский государственный педиатрический медицинский университет. 194100, г. Санкт-Петербург, ул. Литовская, д. 2

[2] Санкт-Петербургский научно-исследовательский институт радиационной гигиены имени профессора П.В. Рамзаева. 197101, г. Санкт-Петербург, ул. Мира, д. 8

[3] Казанский государственный медицинский университет. 420012, г. Казань, ул. Бутлерова, д. 49

Контактная информация: Юлия Николаевна Капырина — ассистент кафедры общей гигиены.
E-mail: kapirina-yuliya@yandex.ru ORCID: https://orcid.org/0000-0002-1018-5200 SPIN: 4969-0394

Для цитирования: Библин А.М., Водоватов А.В., Капырина Ю.Н., Имамов А.А., Пузырев В.Г., Орел В.И., Моисеева К.Е., Гусева Р.А. Предпочтения студентов медицинских вузов в источниках получения информации по вопросам радиационной безопасности // Медицина и организация здравоохранения. 2024. Т. 9. № 2. С. 81–91. DOI: https://doi.org/10.56871/MHCO.2024.94.39.008

Поступила: 13.05.2024 ***Одобрена: 14.06.2024*** ***Принята к печати: 15.07.2024***

РЕЗЮМЕ. Источники ионизирующего излучения находят все более широкое применение в современном здравоохранении в диагностических и терапевтических целях. При несоблюдении требований санитарного законодательства и низкой культуре безопасности они могут представлять опасность как для пациентов, так и для медицинского персонала. Компетенции в области радиационного воздействия на человека и окружающую среду, обеспечения радиационной безопасности закладываются будущим специалистам в процессе обучения в высших учебных заведениях. Исследование информационных предпочтений студентов позволяет разработать меры по повышению эффективности образовательного процесса и в итоге повысить компетенции обучающихся в вопросах радиационной безопасности пациентов и населения в целом. Цель данной работы заключалась в определении путей совершенствования информационной работы по вопросам радиационной безопасности со студентами медицинского вуза. Исследование выполнено на базе Санкт-Петербургского государственного педиатрического медицинского университета. Всего был опрошен 301 человек. Выявлен высокий уровень интереса студентов к радиационной тематике. В тематической структуре современных информационных запросов студентов по радиационной проблематике выделяются четыре ведущих смысловых компонента: «меры защиты от радиации, доступные по месту жительства», «как будет меняться радиационная обстановка», «действие радиации на здоровье», а также «опасные и безопасные уровни радиации». Ведущими способами получения информации стали Интернет и СМС-оповещение. Среди всех источников информации наибольшим доверием в вопросах радиационной безопасности у населения, по мнению студентов, пользуются МЧС, Роспотребнадзор и специалисты/ученые. Подавляющее большинство респондентов выступают за предоставление населению полной и достоверной информации в случае радиационной аварии.

КЛЮЧЕВЫЕ СЛОВА: студенты, социологическое исследование, радиационная безопасность, информационная работа, ионизирующее излучение, радиационная авария

INTRODUCTION

Sources of ionizing radiation (SIR) are increasingly used in modern healthcare for both diagnostic and therapeutic purposes [1–3]. Ongoing work is being done to introduce new methods of radiation diagnostics and therapy into practice. Such widespread use of SIR, along with undeniable benefits for patients, is associated with risks of adverse effects on health of both patients and health workers. Risk factors in this case are non-compliance with the requirements of sanitary legislation in the field of radiation hygiene and poor safety culture [4, 5]. The use of SIR makes high demands to competencies of medical personnel to ensure radiation safety of patients and to be aware of the possible risks of SIR exposure for health.

Basic training of medical specialists and instilling the safety culture is carried out in the course of higher education. Competencies in the radiation impact on humans and the environment, as well as in ensuring radiation protection in graduates of medical universities are formed throughout all years of study [6, 7]. The radiation safety of patients largely depends on the quality of training of young specialists. One of the main tasks of training in the departments of radiation diagnostics and radiation hygiene is to develop competencies

in radiation protection for future doctors. This is especially relevant for those who use medical SIR and/or refer patients for X-ray examinations. However, not all scenarios of use ionizing radiation in medicine may be addressed in the specialized training cycles. In addition, it is important that studies within the several years after the Chernobyl accident shows that physicians are one of the most authoritative categories of people. The population believes that the behavior of doctors is a role model [8]. Experience in eliminating the consequences of the Chernobyl accident has demonstrated that medical workers are able to increase the effectiveness of protective measures aimed at reducing radiation doses and radiation anxiety of the population.

The level of training of specialists in radiation safety issues plays a special role in a separate type of X-ray examinations (interventional radiology). Doses of radiation during X-ray and its exposure on patients and personnel are largely determined by health workers' qualification. Particular attention is paid to the level of knowledge about the effects of ionizing radiation on human body and practical methods of ensuring radiation safety [5, 9].

A young specialist will turn to available sources of information to obtain the necessary knowledge. There is need to critically evaluate accessible sources of information on radiation safety in view of adequacy, credibility and usability. Studies to identify trusted sources and preferred means of information dissemination are mandatory when developing programs for information work with the population on radiation safety issues [10, 11]. Research of students' information preferences allows to develop measures to improve the efficiency of the educational process. As a result, this will lead to an increase in students' competencies in the issues of radiation safety of patients and the population as a whole.

AIM

The aim of this work was to identify ways to improve information work on radiation safety issues for the students of a medical university.

The following main tasks to achieve this goal were set:

- to study the information needs of students on radiation safety;
- to identify the students' preferred ways of receiving information on radiation safety issues;
- to determine the students' degree of confidence in the sources of information on radi-ation safety;
- to identify the students' preferred methods of increasing environmental literacy of the population.

MATERIALS AND METHODS

The study was carried out on the basis of St. Petersburg State Pediatric Medical University (SPbSPMU). The survey was conducted from September 2023 to March 2024. A total of 301 people were interviewed. The respondents were students of St. Petersburg State Pediatric Medical University. The questionnaires were filled out in the Google Forms[1] service.

Sample characteristics are presented in Table 1.

The questionnaire consisted of 27 questions. Separate blocks of questions were devoted to the information needs of interviewees on radiation safety issues, preferred ways of receiving such information and trust in it.

The results of this study were compared with the results of a research of the opinions of fifth-year students of the Faculty of Preventive Medicine of the North-Western State Medical University named after I.I. Mechnikov (NWSMU). The latter was conducted in 2019 by the authors in the form of an in-person survey. A total of 123 people were interviewed. Among those who responded to the questionnaire, 20.3% were men and 79.7% were women [12].

The study materials were subjected to statistical analysis using parametric and non-parametric methods. Collection, correction, systematization of initial information and visualization of the obtained results were carried out in Microsoft Office Excel 2016 spreadsheets. Statistical analysis was conducted using the STATISTICA 12 program.

The normal distribution of the quantitative data sets was tested using the Kolmogorov–Smirnov test. The normality test refuted the hypothesis of normal distribution of responses to all questions considered in the article. Nominal data were described with absolute values and percentages. Comparison of the measurement results of different subgroups in samples on ordinal scales was made using the Kolmogorov–

[1] https://docs.google.com/forms/d/12Trgyo6BHkYTkoBULC-esTGyo0nGhbIKK-i884m3tb4.

Table 1

Characteristics of the samples

Таблица 1

Характеристика выборки

Пол,% / Sex,%					
Мужской / Male			Женский / Female		
13			87		
Возраст, лет / Age, years					
Минимум /Minimum		Среднее / Average		Максимум / Maximum	
17		20,4		44	
Курс,% / Year of study,%					
1	2	3	4	5	6*
15	14	26	20	16	9
Специальность,% / Specialty,%					
Педиатрия / Pediatrics	Лечебное дело / Medicine	Медико-профилактическое дело / Preventive medicine		Стоматология / Stomatology	Прочее / Other
45,7	18	19,3		8,3	8,7

Smirnov Z-test. Differences between samples were considered significant at $p < 0.05$.

RESULTS AND DISCUSSION

Figure 1 shows the distribution of answers to the question on respondents' interest in the information about radiation situation in the region and locality of residence.

The distribution of answers to this question in both universities is identical. Such information is in demand by 80% of interviewees. However, the majority does not see the need for this information in a normal situation. They believe that access to such information should be possible when necessary.

Figure 2 presents the distribution of answers to the question on what information about radiation and radiation safety respondents would like to know first. The samples of students from two universities differ significantly in the choice of answer options: "protection measures" ($p=0.006$), "hazardous and safe radiation levels" ($p=0.007$), "how the radiation situation will change" ($p < 0.001$). Students of SPbSPMU showed greater interest in these topics than students of NWSMU.

In the content structure of students' information requests on radiation issues, four leading semantic components are distinguished, each of which was of interest to more than 50% of interviewees at SPbSPMU: "radiation protection measures available at the place of residence", "the trends in the change of the radiation situation", "radiation effect on health", as well as "dangerous and safe levels of radiation". A small number of respondents demonstrated lack of interest in information on radiation.

It should be noted that all these issues in one form or another are included in the educational programs for training students of medical faculties.

The distribution of respondents' preferences regarding sources of dissemination of information on radiation situation in their place of residence is presented in Figure 3. The samples differ significantly in the response option "SMS notification" ($p=0.04$). Students of SPbSPMU showed greater interest in this type of information.

As expected, the leading way of receiving information, especially given the demographic characteristics of the respondents, was the Internet. This answer option was chosen by 95.7% of interviewees at SPbSPMU. The high interest in SMS-alerting indicates that a significant part of the population is waiting for precisely the operational information on radiation situation, dangerous situations and accidents. Only a third of respondents indicated TV. The students' choice of specialists' lectures as a preferred source may be associated with an established habit of receiving information in this format. Traditional ways of getting information, such as radio and newspapers, were not of interest to interviewees.

Figure 4 shows the parameters of public trust in various sources of information on radiation conditions and safety, according to respondents. The samples differ significantly in the answers: “information on the Internet” ($p < 0.01$) and “Roshydromet” ($p < 0.001$). The answer option “medical practitioners” in the survey of students of NWSMU was absent.

Among all sources of information, EMERCOM was the undisputed leader in terms of public trust, according to students at both universities. Rospotrebnadzor and specialists/scientists (as a generalized category) demonstrated high levels of trust., According to interviewees of SPbSPMU, more than 50% of residents of St. Petersburg and the Leningrad Region trust them on radiation issues.

Table 2 presents the results of responses to the question about the right of authorities to restrict access to information about an accident at

Fig. 1. Interest in the information about radiation situation (%)

Рис. 1. Интерес к сведениям о радиационной обстановке (%)

Fig. 2. Information needs on radiation safety issues (%)

Рис. 2. Информационные запросы по вопросам радиационной безопасности (% от общего числа опрошенных, возможно несколько вариантов ответа)

a radiation-hazardous facility. Statistically significant differences in the answers of students from the two universities to the question about restricting access to such information were not identified.

As can be seen, the overwhelming majority of respondents in both universities are in favor of providing the population with complete and reliable information in case of a radiation accident.

Statistically significant differences in the responses of students from the two universities to the question about the most effective methods

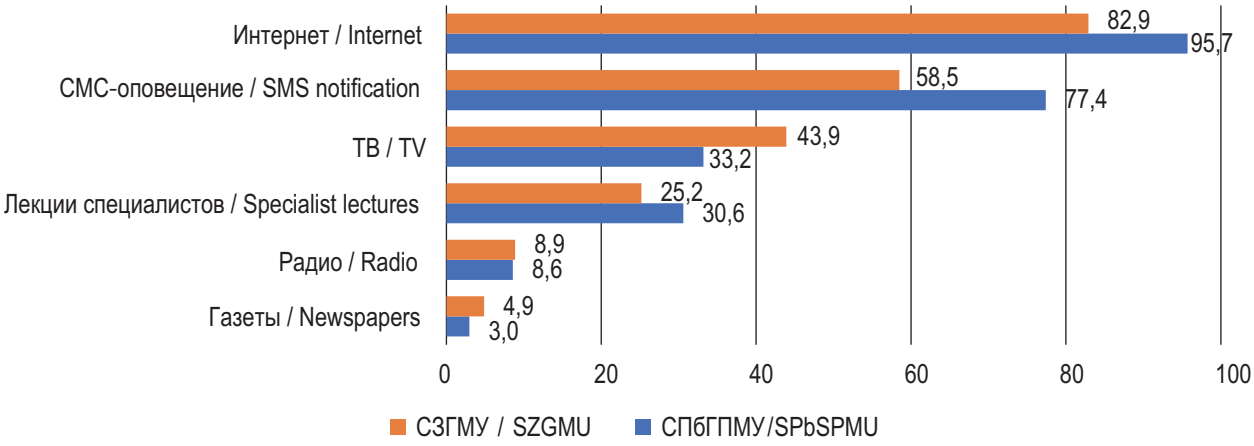

Fig. 3. Percentage of the most preferred sources of information on radiation situation in the region (%)

Рис. 3. Удельный вес наиболее предпочтительных источников получения информации о радиационной обстановке в регионе (%)

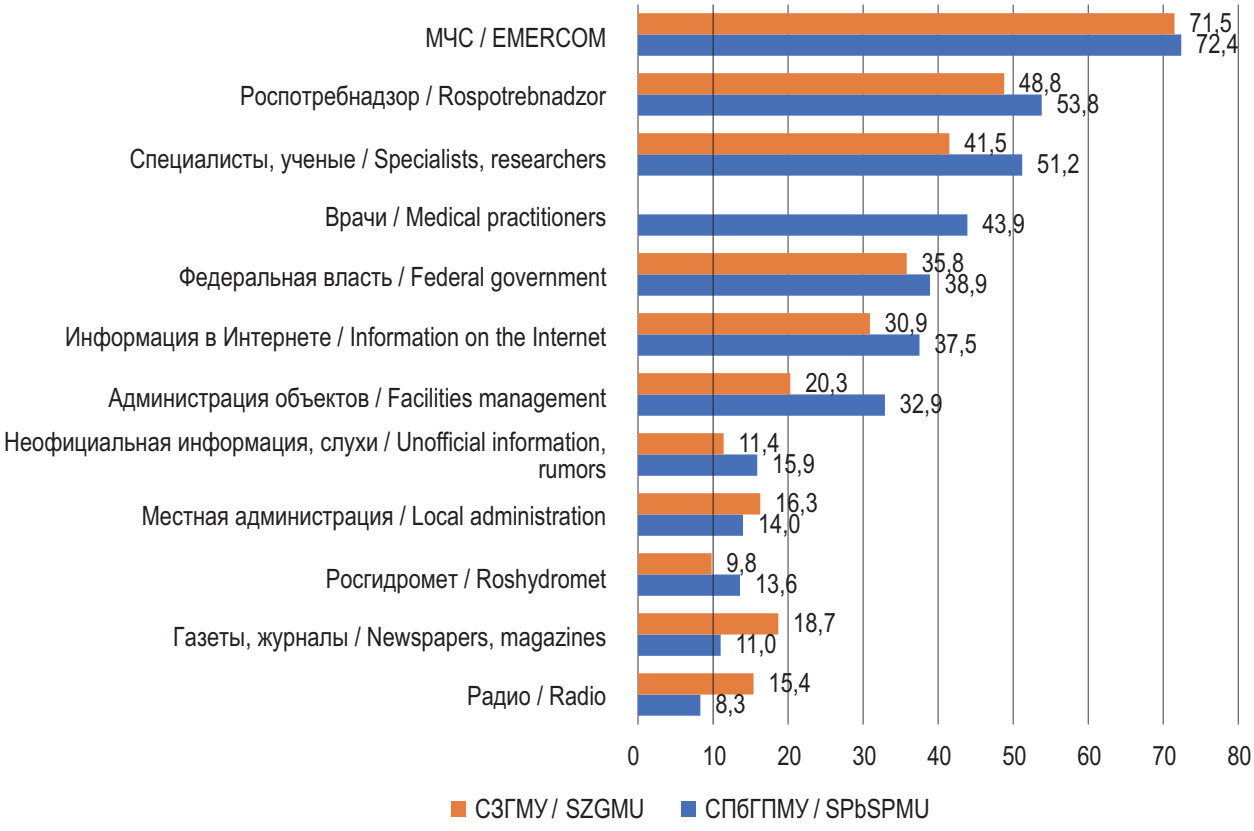

Fig. 4. Public trust in sources in the issue of radiation situation assessment according to respondents (%)

Рис. 4. Общественное доверие источникам информации в вопросе оценки радиационной обстановки по мнению респондентов (%)

to improve environmental literacy of the population were not found (Fig. 5).

The most popular answer was popular science films. Also, significant part of surveyed students supposed localizing the issues of increasing environmental literacy of the population in the education system within the framework of school and university programs. Interest in active and interactive forms (excursions, games, competitions) was declared by a third of interviewees.

The study showed a high degree of students' interest in available source of information about radiation situation. In the structure of information requests of students on radiation issues are leading topics that allow to learn about the fact of radiation accident and ways to maintain health in case it occurs.

Internet has predictably become the most preferred way to receive information on radiation situation. Its use enables to quickly obtain information about various aspects of radiation safety at any convenient time. The Internet provides information from authorities, scientific institutions and independent experts, which allows users to compare various points of view and form their own opinion [13, 14].

Among other things, using the Internet as a source of information, including information related to health issues, is accompanied by a number of risks. Thus, any user can position himself/herself as an expert and publish unreliable information. Some, even official, sources may provide inaccurate or outdated data, which may lead to incorrect risk assessment and actions that may negatively affect one's own health or the health of patients [13]. Using the Internet as a source of information about radiation safety requires the development of critical thinking skills in users. Dissemination of unreliable or distorted information on radiation safety issues may cause a surge in radiation anxiety among the population.

The second most popular source of information is SMS-notification. It allows quickly and effectively inform the population about necessary actions and precautions in case of emergency [15, 16], including a radiation accident. This is especially important in conditions where traditional media may be unavailable or overloaded. Receiving SMS-alerting does not require access to the Internet. This source allows to disseminate information about radiation safety instantly among the population, that is critical in emergency situations. SMS-notification cannot be used in everyday life, but is necessary when there is the potential threat of an accident or its occurrence.

Table 2

Right of authorities to restrict access to information about an accident at a radiation-hazardous facility (%)

Таблица 2

Право органов власти ограничивать доступ к информации об аварии на радиационно-опасном объекте (%)

Вариант ответа / Answer choice	СПбГПМУ,% / SPbGPMU,%	СЗГМУ,% / SZGMU,%
Категорически нет, т.к. в любой ситуации граждане имеют право на своевременное получение полной и достоверной информации / Absolutely not, because dependless on the situation, citizens have the right to receive complete and reliable information	71,8	63,6
Скорее нет, т.к. в современном мире скрыть все равно не удастся — только вызовет недоверие к власти / Rather not, because in the modern world it isn't possible to hide it anyway — it will only cause distrust of the authorities	12,3	8,3
В одних ситуациях это имеет смысл, в других — нет, все зависит от конкретных обстоятельств / In some situations it makes sense, in others not, it all depends on the specific circumstances	10,0	22,3
Скорее да, т.к. большинство простых людей все равно не разбирается в этих вопросах, и считает, что этим должны заниматься специалисты / Rather yes, since most people do not understand these issues anyway, and believe that it should be handled by specialists	1,0	0,8
Безусловно да, если это необходимо для предотвращения паники, беспорядков и других негативных последствий / Absolutely yes, if it is necessary to prevent panic, riots and other negative consequences	3,7	4,1
Затрудняюсь ответить / Hard to say	1,3	0,8

The overwhelming majority of respondents in both universities are in favor of providing the population with complete and reliable information in case of a radiation accident. This complies with the requirements of the laws "On Environmental Protection" and "On Information, Information Technologies and Protection of Information". There legislations prohibit hiding data on the environmental situation from citizens and restricting access to it. Access to such data may not be restricted, except for information that is a state secret under the law of the Russian Federation.

Among all institutional sources of information, the undisputed leaders in terms of public trust are such executive authorities as EMERCOM and Rospotrebnadzor. The competence of EMERCOM includes informing about predicted and existing emergency situations and fires, measures to ensure the safety of the population and territories, methods, and ways of protection. The responsibility of Rospotrebnadzor is inform about the sanitary and epidemiological situation and the measures taken to ensure the sanitary and epidemiological wellness of the population.

The results of the study indicate the importance of developing a specialized information resource. Such resource should contain the entire range of information on existing approaches to ensuring radiation safety during the operation of various SIR, the effects of ionizing radiation on human body and separately on actions in case of a radiation accident. This information resource is advisable to develop jointly by medical educational institutions and specialized institutions of EMERCOM and Rospotrebnadzor, as well as professional societies to reach the target audience (future doctors) and provide it with

Fig. 5. The most effective methods to improve environmental literacy of the population (%)

Рис. 5. Наиболее эффективные методы для повышения экологической грамотности населения (%)

reliable and relevant information. Unfortunately, at the moment there are no such resources in the Russian Federation.

Young specialists may turn to dishonest sources of information, thereby dramatically changing their perception of the danger of ionizing radiation. This is especially important for students of preventive medicine specialties, who after graduation may begin working as radiation hygiene specialist, as well as practicing doctors, for example, radiology surgeons. Inadequate perception of radiation risk (both towards radiation anxiety and towards radiation euphoria) by professionals may negatively affect the provision of sanitary and epidemiological wellness of the population of the Russian Federation and the levels of radiation safety of patients and personnel. Cooperation between the St. Petersburg Research Institute of Radiation Hygiene and SPbSPMU should be aimed, among other things, at developing and supporting such an information resource.

It is important to take into account international experience when developing a website on the Internet dedicated to radiation safety issues in medicine. Similar resources in English have existed for over 15 years and enjoy well-deserved authority and wide popularity among both specialists and patients [17, 18]. At the same time, there is a separate resource on radiation diagnostics of pediatric patients [19].

CONCLUSION

Comparison of the results of the questionnaire of students of SPbSPMU and NWSMU showed the absence of significant differences in most responses. This underlines the adequacy of the research and stable nature of students' information needs and preferences in the methods of receiving information. However, it should be noted that over the past five years, students have increased their demand for information on various emergency situations. It is recommended to supplement the existing training cycles on radiation hygiene with separate classes on responding to radiation accidents to improve student's awareness in case of such an accident, as well as to reduce their radiation anxiety.

It is also useful to develop a specialized resource on the Internet containing reference information on various aspects of radiation safety, as general, as well as specific issues of ensuring radiation safety of patients during individual X-ray examinations. It is important to consider the format of presentation of information, making it available, including through short videos when creating such a resource.

Separate sociological studies to obtain information on the information needs of practicing medical workers in order to improve the quality of additional postgraduate education are also planned.

ADDITIONAL INFORMATION

Author contribution. Thereby, all authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

Competing interests. The authors declare that they have no competing interests.

Funding source. This study was not supported by any external sources of funding.

Consent for publication. The authors received written consent from the respondents to publish the data.

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Вклад авторов. Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

Информированное согласие на публикацию. Авторы получили письменное согласие анкетируемых на публикацию данных.

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