Figures 3 and 4 also show that the number of x-ray procedures performed per person is approximately the same throughout the entire study period, with the exception of 2016. Then the number of tomographic studies per person more than doubled – from 0.05 to 0.12. How can we explain this increase in tomographic studies since 2019? It is possible that in medical institutions in the Gomel region over the past 5 years the amount of new medical equipment (computer tomographs) has increased. This may be due to the COVID-19 pandemic period from 2019 to 2022. During these years, a large number of the population were in hospitals with diseases of the respiratory system and they underwent a large number of tomographic studies, more than once. Accordingly, the number of procedures has increased and, of course, the amount of radiation doses has increased, the discussion of which we will continue in the next study.

Conclusion

For the period from 2013 to 2021 in the Gomel region, the number of X-ray diagnostic examinations in general and per 1 resident in particular is approximately the same, with the exception of 2016. The number of computed tomography examinations during this period was also almost at the same level until 2019. But from 2019 to 2021, the number of CT procedures more than doubled from 70,658 to 161,620 studies in total, and from 0.05 to 0.12 per resident.

The increased number of CT procedures can be attributed to the COVID-19 pandemic period of these years, when a large number of the population was in hospitals and received CT examinations in greater numbers than before.

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RADIATION DOSES FOR PERSONNEL WORKING WITH RADIOACTIVE SUBSTANCES IN MEDICAL PRACTICE

Introduction

Radiation dose is created by the energy of ionizing radiation being absorbed by some substences, such as biological tissues. The basic unit of dose is the gray (Gy) and dose rates are expressed per unit time (Gy hr-1). There are different types of radiation doses. They are absorbed dose, equivalent dose and effective dose.

1. Absorbed dose – is used to assess the potential for biochemical changes in specific tissues.

2. Equivalent dose – is used to assess how much biological damage is expected from the absorbed dose. (Different types of radiation have different damaging properties).

3. Effective dose – is used to assess the potential for long-term effects that might occur in the future.

In the use of medical procedures involving exposure to ionizing radiation for medical research, such as radiology, the process of justifying the use of ionizing radiation requires weighing the clinical benefits against possible radiation harm [1].

Currently, the ICRP classifies radiation damage as: the development of radiation-induced oncological disease, mortality from radiation-induced oncological disease and the occurrence of hereditary radiation effects. In a modern radiation protection system, a biophysical quantity, the effective dose, is used to assess the impact of various types of ionizing radiation on personnel and the population during external or internal irradiation of the whole body or part of it. It is a measure of the impact of ionizing radiation on a "conditional person" with average age and gender characteristics, proportional to the total radiation damage from stochastic effects [2]. The effective dose is associated with the risk of stochastic effects of radiation (carcinogenic and hereditary) through nominal risk coefficients (averaged by sex and age) for the entire population (5.7 10-2 Sv-1) and for personnel (4. 2·10-2 Sv-1). The use of an effective dose (the concept of which was developed for the radiation protection system of workers and the public) and nominal risk coefficients averaged by sex and age to assess the risks of medical exposure has a number of significant limitations. In particular, the age-sex distribution of personnel and the general population differs significantly from the age-sex distribution of patients exposed to medical exposure [3]. For the Republic of Belarus, the average effective radiation dose due to X-ray diagnostic procedures (radiography, fluorography and fluoroscopy) are 0.86 mSv/year. The use of preparations containing radionuclides causes significantly lower doses – of the order of 10 mSv /year, with the exception of 131 I preparations, which form an individual annual thyroid dose of ≈ 2.4 mSv [4]. Our study was aimed at analyzing the available information in order to study data on medical institutions, personnel working in them and radiation doses in the Gomel region of the Republic of Belarus for the period from 2000 to 2021.

Goal

Analysis of medical institutions using sources of ionizing radiation for medical research, personnel working in them and radiation doses in the Gomel region of the Republic of Belarus for the period from 2000 to 2021.

Material and methods of research

The research tool was data on medical institutions using sources of ionizing radiation, the number and average annual effective doses of personnel contained in the State Dosimetric Register for the period from 2000 to 2021. Statistical data analysis was carried out using the Microsoft Access DBMS and the SQL Selver Management Studio 2014 software package. In addition, traditional methods of statistical analysis were used, which were carried out using the MS Excel 2010 application package. A data analysis was carried out based on the databases of the State Dosimetric Register of the Republic of Belarus according to statistical reporting form No. 1-DOZ for the period from 2000 to 2021 for the city of Gomel and the Gomel region.

The results of the research and their discussion

The dynamics of medical institutions using sources of ionizing radiation for medical research in the city of Gomel and the Gomel region were analyzed (Figure 1).

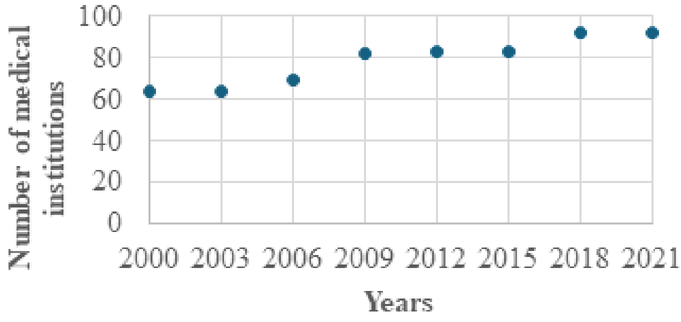

Figure 1 – Dynamics of the number of medical institutions using radiation sources in the Gomel region for the period from 2000 to 2021

As can be seen from Figure 1, the number of medical institutions using radiation sources in the Gomel region is increasing from 64 since 2000 to 98 in 2021. The dynamics of the number of personnel is presented in Figure 2.

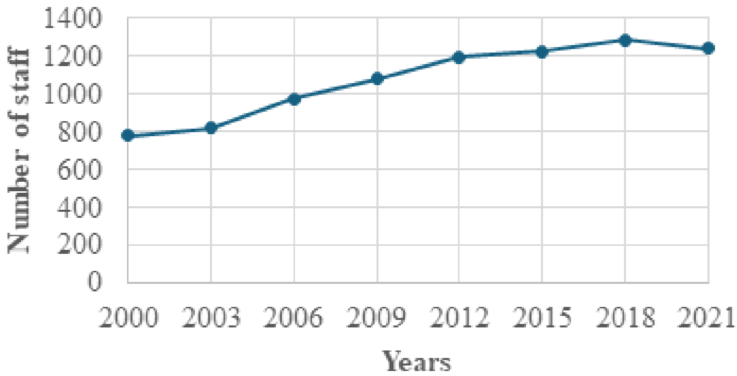

Figure 2 – Dynamics of the number of personnel in medical institutions using radiation sources in their work in the Gomel region for the period from 2000 to 2021

In the city of Gomel and the Gomel region, the dynamics of the number of personnel in medical institutions can be said to have almost doubled since 2000, from 779 people to 1208 in 2021. Thus, the number of medical institutions increased by 1,5 times.

The dynamics of average annual effective doses of external irradiation of personnel for the period from 2000 to 2021 in the city of Gomel and the Gomel region of the Republic of Belarus is presented in Figure 3.

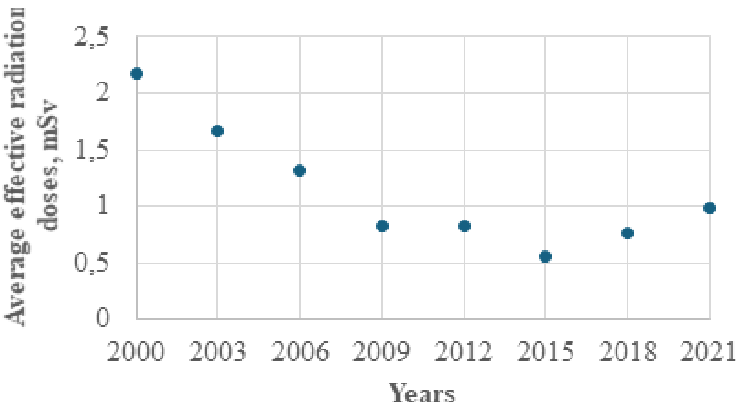

Figure 3 – Dynamics of average effective doses of external irradiation of personnel in the city of Gomel and the Gomel region, mSv

Average annual effective doses of external irradiation of personnel in the city of Gomel and the Gomel region for the period from 2000 to 2021 tend to decrease until 2015 in medical institutions. After 2015, there is a gradual increase in external radiation doses. So in 2000, the external radiation dose in medical institutions was 2.18 mSv, by 2021 it drops to 0.99 mSv, the radiation dose has decreased by 2 times.

Conclusions

1. During the study period from 2000 to 2021 in the Gomel region, the number of medical institutions using sources of ionizing radiation increased by 1,5 times.

2. The number of personnel in medical institutions increases almost 1,5 times in the period from 2000 to 2021 in the Gomel region.

3. Average effective doses of external irradiation of personnel have a general tendency to decrease. Moreover, doses are reduced until 2015. Since 2015 they have had a slight upward trend.

4. The slight increase in the effective dose of external radiation can be explained by an increase in the number of medical personnel and an increase in the number of medical procedures and studies provided.

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ANALYZING THE EFFECT OF ENVIRONMENTAL FACTORS OF RESPIRATORY HEALTH

Introduction

The overall well-being and health of humans, including lung function, is heavily dependent on respiratory health. Environmental factors can have either positive or negative effects on respiratory health. Prolonged exposure to air pollutants such as dust particles, tobacco, and other substances is leading to an increase in respiratory diseases among people. Chronic obstructive pulmonary disease, asthma, bronchitis, lung cancer, and allergies are some of the diseases that we can see today. The respiratory system is influenced by various environmental conditions, including climatic conditions, exercise, humidity, temperature, allergens, viral infection, stress, and inhalation of air pollutants [1].

Today lifestyle and behaviors of people have heavily influenced the respiratory health. Examples include not getting enough exercise, smoking, second-hand smoking, and consuming chemical products [2]. According to the data, 7 million deaths worldwide are caused by indoor and outdoor air pollutants (World Health Organization, 2018). In 2019, the World Health Organization (WHO) recognized air pollution and climate change as the top environmental global threats to human health. According to WHO data, the combined effects of ambient air