Analysis of consequences of the relationship between man, nature and technology in the context of technogenesis intellectualization

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Abstract. The paper presents the results of the analysis of demographic and medico-social data characterizing the dynamics of morbidity and mortality from environmental diseases, in particular, diseases of the cardiovascular system. The trend of negative natural population growth was revealed, amounting to -6.9 per 1,000 persons by 2019. The number of patients with cardiovascular diseases was 13 817,4 persons, with the overwhelming majority of the working-age population (9020,2 persons). Ischemic heart disease had the largest share in the structure of the studied diseases (62,25 %). There was also a decrease in life expectancy over the past 30 years and an increase in mortality of young and middle-aged people.

1 Introduction

According to the Concept of Health Protection of the Population of the Russian Federation, health protection is one of the priority directions of the state social policy [1, 8, 9, 11, 12]. Many public figures and scientists note that the health of the nation at the present stage of development of social and political relations is the basis of the country's security [1, 3, 5, 7].

When a maladaptive state caused by the prolonged influence of unfavorable factors on the human body, some violation of the adaptive mechanism of self-regulation occurs. In this condition, the initial processes associated with metabolic disorders and the accumulation of toxic products in the body are manifested, neurohumoral mechanisms of homeostasis regulation are disrupted or blocked, the functional activity of the immune system and other protective mechanisms of the human body decreases. All this inevitably leads to various diseases.

Currently, one of the main reasons for the deteriorating health of the nation is the ever-increasing anthropogenic pressure, which is expressed in massive pollution of the main components of the natural environment. Already at the end of the 20th century, estimates appeared that up to 50 % of emerging diseases were directly or indirectly related to deterioration of the ecological state of the environment [2]. Deterioration of the ecological

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situation entails a decrease in adaptive capabilities of the human body, which ultimately contributes to an increase in morbidity and mortality rate in the country.

The aim of the study was to analyze the influence of anthropogenic pressure on the level of morbidity and mortality of the population.

Objectives:

1. To assess the level of anthropogenic pressure in the city of Ryazan.
2. To analyze the dynamics of the demographic situation in Ryazan region.
3. To estimate the average incidence of the population.
4. To study the spectrum and dynamics of diseases of the cardiovascular system.
5. To study the structure of the age and sex distribution of deceased persons in different periods.

2 Materials and methods

The studies were carried out on the basis of the data of the Territorial Body of the Federal State Statistics Service for Ryazan region and the archives of the Regional Clinical Cardiologic Dispensary.

The study of the dynamics of the demographic situation in the city and the region, as well as the morbidity of the population of the region was carried out by analyzing the data of the annual reports of the Territorial Body of the Federal State Statistics Service for Ryazan region.

The study of the frequency of pathologies of the cardiovascular system was carried out on the basis of the study and analysis of the annual reports of the Regional Clinical Cardiologic Dispensary, which describe the symptoms, course, treatment and outcomes of diseases of the cardiovascular system.

In addition, in order to establish the age and gender distribution of the deceased persons for different periods, expeditionary observations were carried out at the New, Voskresenskoye, Sysoevskoye and Bogorodskoye cemeteries in the city of Ryazan.

The selected cemeteries have preserved burials of people for the last 80-100 years and are subdivided into old and new parts. When passing diagonally in one and the other direction in each cemetery, 800 graves were randomly selected, gender, dates of birth and death were copied.

3 Results and discussion

When considering the technogenic load of urban areas, one can notice the features of the distribution of the main centers of concentration of industrial production, which are characterized by a peripheral location. The territorial distribution of industrial enterprises makes it possible to distinguish several industrial zones in the city: north-western, central, southern and eastern.

The southern industrial zone, which accounts for about 85 % of the total emissions of toxic pollutants in the region, is characterized by a fairly high technogenic load due to the concentration of chemical, metallurgical, and energy industries. The total pollution index in the territory of the southern industrial hub is about 35,6.

Another cluster of enterprises that are major sources of aerogenic pollution is located in the north-west of the city, where enterprises of the heat-power, machine-building and machine-tool industries are located. The total index of air pollution in this area is 19,8.

Automobile transport is a special source of anthropogenic pressure on the environment. A steady increase in the contribution of pollutants from road transport to total emissions is noted every year. The main reasons for this situation may be the following: an increase in

the concentration of vehicles in the city, the general deterioration of the car park, as well as the fact that Ryazan, like most ancient Russian cities, is characterized by a weak development of the street city network and poor condition of the road surface that leads to the frequent use of the forced idle mode and low speed of the vehicle.

Thus, the territory of Ryazan is exposed to the intense impact of man-made pollutants entering the environment, both from mobile and stationary sources, the priority of which are heat power engineering, petrochemical and oil refining industries, nonferrous metallurgy, mechanical engineering, and motor transport. The southern and northwestern industrial zones of the city are subject to the greatest pollution. All areas of Ryazan are under the increasing pressure of technogenic pollution and exhaust gases from cars.

The increasing anthropogenic pressure on the environment is one of the powerful ecological and social factors of the population's ill-being, which is expressed in a decrease in the birth rate, an increase in the level of morbidity and mortality of the population.

When analyzing the archival data of the Territorial Body of the Federal State Statistics Service for Ryazan region, it was revealed that over the past 20 years, unfavorable trends have developed in most demographic indicators in Ryazan.

The average annual population in 2020 has been 539,29 thousand people, which is slightly higher than in 2010 (525,1 thousand people) [3]. However, there is still a negative natural population growth trend, which was first recorded in 1992, and by the end of 2019 it reached 6,9 per 1,000 persons (Fig. 1).

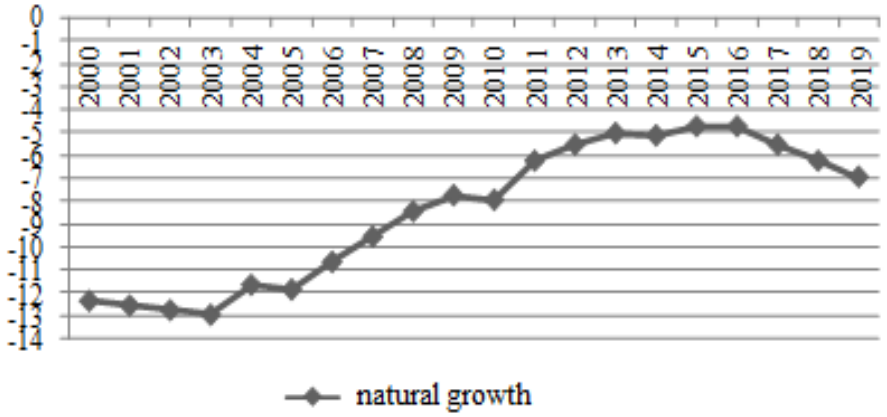

Fig. 1. Rates of natural population growth in Ryazan per 1,000 persons

Considering the process of depopulation in Ryazan, one cannot but note the fact that in recent years the situation has begun to improve and the level of negative natural population growth has slightly decreased compared to the beginning of the century. The peak was in 2002-2003, after which a gradual rise in the rate of natural growth began.

The excess of the number of deaths over the number of births is the determining factor of the depopulation process (Fig. 2).

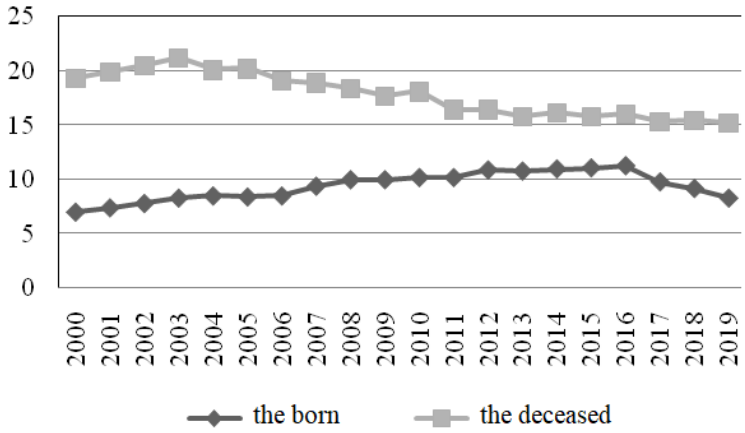

Fig. 2. Birth rate, mortality per 1,000 persons

In 2000, there was a 2-times excess and the natural increase in absolute terms was -15,544 people or -2,3 persons per 1,000 population, that is, this indicator increased 8,5 times in comparison with the 1992 level. In 2019, while the trend of negative natural increase continued, the indicators were not so frightening (-7 617 persons and -6,9 persons, respectively), that gave hope for optimistic forecasts of the development of the situation.

Considering the statistics of the incidence of the population, one can also note negative trends in the increase in the total number of diseases in the region, both in absolute terms and per 10 000 people.

The studied dynamics of morbidity by the main classes of ecologically caused diseases indicates a steady increase in the number of cases, both in absolute terms and per 10 000 persons. The highest rates of growth in the number of new diagnoses are characteristic of diseases of the endocrine system, nutritional disorders, metabolic disorders, as well as diseases of the cardiovascular system.

To confirm the statistical data, an analysis of the data from the archive of the Regional Clinical Cardiologic Dispensary was carried out for the period from 2015 to 2019.

The study of the archive data of this medical institution showed that during the research the number of patients with cardiovascular diseases was 13 817,4 persons. At the same time, the share of sick working-age population accounted for 9 020,2 persons, that is, the overwhelming majority. The mortality rate was 147 people (Table 1).

Table 1. Results of the analysis of data from the archive of Ryazan Regional Clinical Cardiologic Dispensary

Parameter	Years of research					Average
	2015	2016	2017	2018	2019	
Total	12,040	14,537	13,658	14,041	14,811	13,817.4
Able-bodied population	8,382	9,134	9,056	9,112	9,417	9,020.2
Rheumatic heart disease	329	335	257	262	452	327
Ischemic heart disease	6,588	10,212	8,743	7,543	9,926	8,602.4
Hypertension	2,468	2,282	3,445	4,414	2,723	3,066.4
Atherosclerosis	628	180	182	458	461	381.8
Others	3,027	1,582	942	1,364	1,249	1,632.8
Mortality	145	140	108	142	200	147

The largest share in the structure of the studied diseases of the cardiovascular system is occupied by ischemic heart disease (62,25 %) and the second place belongs to diseases caused by an increase in blood pressure (22,19 %). The dynamics of these diseases is somewhat different. If the incidence of ischemic heart disease gradually increases from year to year, then the second group of diseases is characterized by unstable dynamics, with a maximum in 2018.

The ecological orientation of diseases of the cardiovascular system has been proven by the studies of many scientists [4, 6, 10]. Thus, S.B. Petrov [6] notes that an increase in air pollution with suspended solids increases the incidence of diseases associated with an increase in blood pressure, as well as ischemic heart disease, a consistently high level of which has been noted in our studies. G. Rudez, N. Janssen, E. Kilinc [11] add that the combined effect of air pollutants can lead to an increase in platelet aggregation and blood clotting, which contributes to the development of ischemic heart disease.

When studying the statistical data of the Territorial Body of the Federal State Statistics Service for Ryazan region, a slight decrease in the number of deaths due to diseases of the cardiovascular system was revealed (Fig. 3). Moreover, the number of men who died for this reason was consistently lower than the number of women. So, if 3 400 men and 4 127 women in Ryazan region died due to diseases of the cardiovascular system in 2000, then in 2019 there were 2 328 and 2 379 persons who died for these reasons, respectively.

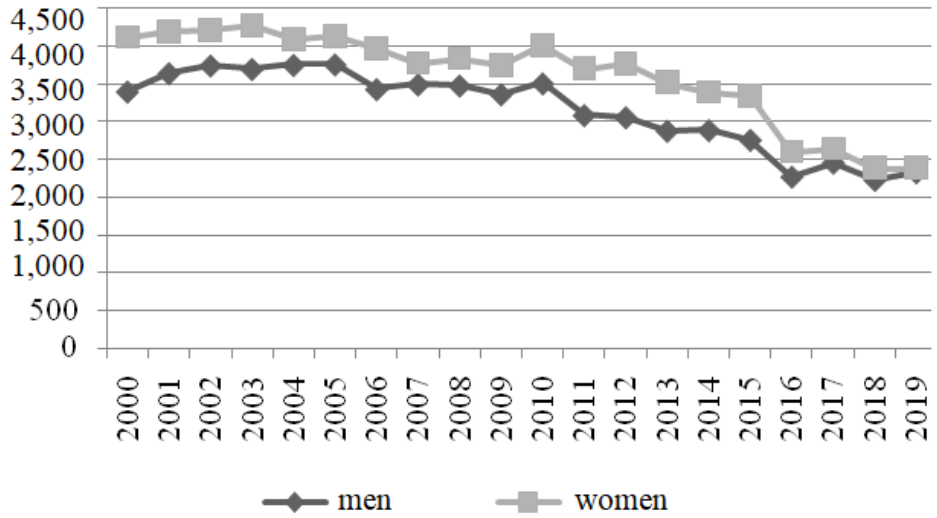

Fig. 3. Deaths due to diseases of the cardiovascular system

Studying the burials at New, Voskresenskoye, Sysoevskoye and Bogorodskoye cemeteries in the city of Ryazan, it was noted that from May 16 to July 24, 2019, 276 persons were buried at New cemetery, 177 persons at Voskresenskoye cemetery, 210 persons at Sysoevskoye cemetery and 225 persons at Bogorodskoe cemetery (Table 2).

Table 2. Results of expeditionary observations at the city cemeteries

Gradation	Life expectancy		
	men	women	average
The old part of the cemeteries	63,47	72,47	67,75
The new part of the cemeteries	40,38	31,44	38,37
Life expectancy difference	23	41	30

An analysis of the burials at Sysoevskoye (old) cemetery revealed the predominance of elderly people - approximately from 60 to 90 years. The burial of 35-50 years old people is the minimum. Burials of children and people under 30 are not found.

The study of burials at New, Voskresenskoye and Bogorodskoye cemeteries from 1984 to the present has shown the predominance of young and middle-aged people - from 10 to 40 years old. Burial of children under three years old, young people aged 18-25, people aged 50-70 was noted. Thus, there has been a decrease in life expectancy over the past 30 years and an increase in deaths among young and middle-aged people.

The difference in life expectancy of people in the Old and New cemeteries is 30 years, which gives an extremely disappointing picture and confirms the data on depopulation of the population, noted when studying the archives of the Territorial Body of the Federal State Statistics Service for Ryazan region.

4 Conclusion

1. The territory of Ryazan is subject to intense impact of man-made pollutants entering the environment, both from mobile and stationary sources, the priority of which are heat power engineering, petrochemical and oil refining industries, nonferrous metallurgy, mechanical engineering, and motor transport. The southern and northwestern industrial zones of the city are subject to the greatest pollution.

2. The trend of negative natural population growth is still observed, which was first recorded in 1992, and by the end of 2019 reached 6,9 per 1000 persons. The natural growth in absolute terms in 2019 amounted to 7617 persons.

3. The dynamics of morbidity by the main classes of ecologically caused diseases testifies to a steady increase in the number of cases, both in absolute terms and per 10 000 persons. The highest rates of growth in the number of new diagnoses are characteristic of diseases of the endocrine system, nutritional disorders, metabolic disorders, as well as diseases of the cardiovascular system.

4. During the research, the number of patients with cardiovascular diseases was 13 817,4 persons. At the same time, the share of sick working-age population accounted for 9 020,2 persons, that is, the overwhelming majority. The average death rate was 147 persons.

5. The largest share in the structure of the studied diseases of the cardiovascular system is occupied by ischemic heart diseases (62,25 %) and the second position belongs to diseases caused by an increase in blood pressure (22,19 %).

6. There has been a decline in life expectancy over the past 30 years and an increase in deaths of young and middle-aged people.

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