Ecopathology of the Lipetsk region through environmental factors

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Abstract. The pathology of the Lipetsk region, as a subject of the Russian Federation, is diverse and diverse. Environmental factors that produce this pathology on the population require close attention. The study of the subject under study is conducted recently, but risk factors manifested in other regions, like this one, make it possible to conclude that the positive results obtained in an environmentally unfavorable territory, against the background of insufficient security, can push and lead to even better results in more optimized territories. This conclusion sets up for even more fruitful work in the studied subject of Russia in relation to the risk factors of environmental pathology.

1. Introduction
The majority of residents of the Russian Federation, not to mention medical workers, know that the Basic Law of Russia, which since 1993 has article 41, which stipulates that everyone is given the right to be able to protect their health and receive medical care. Medical care is provided at the expense of the relevant budgets, insurance organizations contributions or other income, i.e. free of charge. It is provided in state and municipal health care institutions, it is also emphasized that officials who conceal facts and circumstances that lead to a threat to the life and health of people can be brought to justice. Article 42 of the same law probably follows the previous One for good reason, since it refers to people who have the right to a favorable environment, while they must have information about risk factors, and if they receive a pathology to their health or property, they must receive compensation for environmental violations [1]. Various scientists called pathogenic environmental factors differently named: I.M. Sechenov - “destructive influences” [2], I.P. Pavlov - “extreme irritants” [3], G. Selye - “stressors” [4], and psychologists - “extreme factors” [5]. But all of them (pathogenic factors) can be divided into mechanical, physical, chemical, biological and social. Very often, these factors act together, reinforcing each other. Examples include the pathogenic effects of weather (the combined effects of ambient temperature, humidity, atmospheric pressure, wind, radiation, ionization, etc.), infections, toxic infections, sunstroke (overheating, ultraviolet radiation), radiation sickness (various types of ionizing radiation), and many other diseases. For a person, a special role in the formation of ecopathology - diseases caused by environmental factors, is played by social factors, which include housing, industrial premises, people’s contacts, water supply, clothing, food and more, which contributes to the development of many diseases. Consider these factors.
1.1. On the environmental situation in the Lipetsk region

Lipetsk region is a fairly young subject of Russia, which was created on January 6, 1954 and borders the Voronezh, Kursk, Oryol, Ryazan, Tambov and Tula regions. The population of the Lipetsk region - 1 144 035 persons (2019) is located on the square in 24047 square kilometers. The environmental rating of the Russian Federation (RF) puts the Lipetsk region in 20 place out of 85 subjects. The industry of the region is represented by metallurgy, mechanical engineering, energy, chemistry, etc. It is the second largest producer of ferrous metals in Russia. Among all the existing problems that create a negative environmental situation in the Federal subject of Russia, special attention should be paid to the availability of water resources. Peter 1 also paid attention to them. And this is the satisfaction of the need for good-quality water not only for people, but also for industry, agriculture and the social sphere.

Big problems are also the appearance of quarries; destruction of forests; the presence of dry winds; the presence of industrial facilities that negatively affect the environmental situation. The Lipetsk region is second only to such industrial giants as Norilsk, Novokuznetsk, and Magnitogorsk in terms of exceeding the air pollution index. In terms of gross emissions, it is in the top five. These "achievements" are the environmental problems of the Lipetsk region.

1.1.1. About metallurgy of the Lipetsk region. The technological process in the operation of metallurgical plants uses the combustion of various types of fuel, so the metallurgical industry, characteristic of the Lipetsk region, is the leader in air pollution of the atmosphere. The population of the region, especially at the enterprises themselves, is forced to breathe thousands of tons of carbon oxides, hydrocarbons, volatile organic compounds, solid particles, nitrogen oxide and sulfur dioxide. The concentration of formaldehyde is recorded more than twice the norm in the atmosphere of the region. Enterprises install modern systems for collecting dust and cleaning exhaust gases, but this does not always create the necessary effect.

1.1.2. About water and landfills of the Lipetsk region. As already mentioned, even Peter 1 was interested in ensuring that the residents of Lipetsk received good-quality water, so considering water resources, we can say that the residents of the Central city of the Lipetsk region have no problems with the purity of water – it comes exclusively from underground sources. Its only drawback can be considered its increased rigidity. But against the background of a decreasing volume of waste water, the quality of drinking water is improving. This is due to a reduction in industrial production. But if the amount of waste water decreases, but the number of surface dumps does not decrease. The so-called old landfills are located on the outskirts of the city, they have long been overflowing and have long been closed according to sanitary standards. A modern waste processing plant with Spanish technological equipment has been put into operation in the region. Waste is sorted, briquetted and disinfected with ultraviolet light. Volumes are reduced and recycled waste materials can be used. However, the new landfill could not replace the old one. The old one has existed for more than forty years, people are used to it and do not want to part. Therefore, almost 30% of all waste is still transported along the old route. The only positive trend in this area of ecology is that the amount of surface waste, as well as runoff, is decreasing.

1.1.3. About transport of the Lipetsk region. Every modern person will agree with the postulate that road transport is a source of both noise and pollution, and this ultimately leads to air pollution. To improve the situation in Lipetsk, an automated traffic management system was developed and implemented. This system creates a traffic mode called "Green wave" based on the data obtained through monitoring and analysis of the amount of exhaust gases from passing vehicles and thus adjusts the operation of traffic lights. But the system does not always work, or the number of cars increases, or something else, but the number of traffic jams does not decrease. Consequently, the number of emissions does not decrease. Noise or "acoustic" environmental pollutant is a new term, although the problem is "old". Its source is also automobile transport. Military fighters often fly over Lipetsk, which also increase the number of
exhaust gases, as well as noise. Officially, the noise level in the city does not exceed sanitary standards. But residents do not agree with this.

1.1.4. About natural objects of the Lipetsk region. To improve the ecology of the Lipetsk region, special territories created by nature are preserved and protected on its territory. These measures create prerequisites for saturation of the air space with oxygen. There are 151 such territories in the Lipetsk region. Especially can be identified "Monastic forest", Park "Bykhanov garden". In addition, in Lipetsk itself there are regional natural monuments: "Lower Park", "Upper Park" and the lower reaches of the Kamenny Log. These territories, created by nature and supported by man, have preserved a century-old oak and a seventy-year-old elm. This may bring a condescending smile, but small things lie at the beginning of big events.

1.2. Our contribution
In this study, we tried to present some positive changes that are being made by the leaders of the Lipetsk region, implementing strategic initiatives on demography, ecology and social direction. We present the already achieved guarantees of environmental positive changes, which, on the one hand, cause a certain optimization, and on the other hand, knowing about the potential lack of resources and reserves for implementation, we do not accept all the assumptions in full. But in General, several major positive cases have shown that the improvements being made are feasible and effective.

1.3. Paper structure
Presenting the rest of the study, we can say that it is organized as follows… The second section provides information about ecopathology of the Lipetsk region from various sources: data from the world Health Organization, decrees and orders of the Lipetsk region's governing bodies, and data from the health Department. The directions of current work (already completed and promising) are presented, which represent directions for future research.

2. Background
According to the World Health Organization, the first 3 places in mortality among the population are diseases of the cardiovascular system, oncological diseases and injuries, poisoning and some other consequences of external causes [6]. Consider the background of the appearance of these diseases.

In 2018, 58 people were registered in the Lipetsk region with the first diagnosis of an occupational disease, the department of Rospotrebnadzor in the Lipetsk region reports. The level of occupational morbidity in the whole region decreased by 6.2% and amounted to 1.52 per 10 thousand employees. Occupational diseases are registered in the following sectors by type of economic activity:

- metallurgical production - 37 cases;
- production of finished metal products - 2 cases;
- production of machinery and equipment - 2 cases;
- production of other non-metallic mineral products - 1 case;
- transport and communications - 2 cases;
- education - 2 cases;
- production and distribution of electricity, gas and water - 1 case;
- agriculture - 8 cases;
- construction - 3 cases.

Among the occupational diseases that are observed in the Lipetsk region, one of the first places can be put nosological forms related to diseases caused by exposure to radiation:

- local vibration - 3.4%;
• industrial noise - 60.3%;
• physical overloads - 13.8%;
• Allergenic factors - 5.2%;
• chemical factors - 6.9%;
• industrial aerosols - 10.4%.

2.1. The damaging effect of mechanical factors
Factors of mechanical influence on the human body can have both local and general damaging effects. The strength of the pathogenic effect is expressed in kg/cm² and determines the degree and quality of this effect: stretching, compression or kinetic energy of the mass moving at a certain speed (MV² / 2G) - a blow, fall, bullet or other gunshot wound. How much the damaging effect of a particular mechanical factor will be expressed depends primarily on the state of reliability, strength or durability of the place where this factor is applied. The ability to resist the deforming effects of mechanical damaging agents on tendons, bones, blood vessels, muscles, etc. is called the strength of biological structures. The ratio of the applied load (P, kg) to the cross-sectional area of the material (F, cm²) is called the ultimate strength (e = P / F). The ultimate strength shows the limit of deformation of the fabric, the stress at which it is destroyed. Living structures can stretch and break. When stretched, the inverse of the elasticity or elasticity of the fabric is shown, i.e. a state that can restore the original state. If the original length is represented as L, then its part DL shows how much of its original length can be stretched. This is an absolute value, but there is also a relative value - e - a measure of relative elongation. It is represented by the formula e = AL / L. The action of the applied force depends on the mechanical strength of the structures, i.e. a certain limit load required for complete rupture of the test body. The most resistant to breakage are bones: tensile strength -800 kg/cm², in second place - tendons: 625 kg/cm². Less resistant to rupture vessels, their strength is 13-15 kg/cm² and muscles -4-5 kg/cm². At the same time, you need to remember that the body can be represented as a part of nature... It is easier to break a branch than a broom made of them. Therefore, the combination of tissues that make up the structure of the organ has a greater resistance to rupture than each of them individually. With age, as you know, the strength and elasticity of tissues decrease. In this regard, older people need to take care of themselves in order to avoid fractures, cracks, sprains and other deformities. Various pathological processes that also accumulate with age affect the extensibility of tissues. They reduce elasticity and increase the stretchability and risk of tearing tendons, ligaments, muscles, and other structures. The initial state of the tissues is also important for the result. For example, a muscle that is at rest is more stretchable than a muscle that is in a state of tension-contraction. With repeated long stretches, the structure and properties of the stretched tissues change. Their extensibility increases, and elasticity, recovery after the termination of stretching decreases. This can be observed with multiple sprains of the ligaments, skin, aorta and other organs. When stretched, there is a gradual atrophy of the tissues, i.e. a violation of function. This can be observed with prolonged stretching of the stomach: when overeating, atrophy of its walls occurs, motor and contractile functions decrease. The bladder, with insufficient emptying due to difficult urination, can also reach atrophy of the walls and, as a result, further weaken the contractile ability. When the lungs are stretched with emphysema or bronchial asthma, their elasticity decreases, which makes it difficult to exhale. When overstretched, the intestines also contract poorly due to overstretching.

2.2. The pathogenic effect of sounds and noise
When we looked at road transport, we already touched on noise, which can be interpreted as an unpleasant or undesirable sound (maybe a combination of sounds). It can be characterized by having an irritating effect on the human body and reducing its performance. Areas of high and low pressure form sound waves that propagate at a speed of 340 m/s and carry a certain amount of energy. Naturally, this negative energy carries videoed to the human body. The human ear perceives sound with a frequency of vibrations from 16 to 20,000 Hz (1 Hz is one oscillation in 1 second). The higher the frequency of sounds (up to 4000 Hz), the louder they appear to a person. If the sound intensity exceeds 1 W/cm², the hearing
analyzer may be damaged. When the sound intensity is more than 3 kW/cm²—there are violations in the General state of the body: possible convulsions, complete loss of consciousness, paralysis. It is important to know that high-frequency noise has the most harmful effect. The permissible level of constant noise is 40-50 dB, if its intensity changes over time by no more than 5 dB. Such a reserve of energy is provided by ordinary human speech. A harmful volume limit can be considered 80 dB, and 90 dB (talking in raised tones) can cause auditory stress. In rooms where the sound volume is more than 135 dB, even short-term stay is prohibited. The noise of a jet plane can exceed 120-140 dB, such as can be observed at concerts of modern rock music, about 40 minutes of stay at such a concert concussion. There is a known case when a stunned fish surfaced during a Pink Floyd concert in a lake located next to an outdoor concert venue. Noise can cause a General disease of the body, in which the hearing system, Central nervous and cardiovascular systems, as well as organs of the gastrointestinal tract are disrupted, i.e., noise disease develops. But a person may not hear some sounds, they are called ultrasound, their frequency exceeds 20 kHz. It is characterized as acoustic radiation in frequency, intensity, and pressure. Ultrasound has become firmly established in medical practice for therapeutic and diagnostic purposes. This is due to the fact that the different degree of absorption and reflection of ultrasound waves in different biological media and tissues due to the different speed of propagation, allows you to identify the shape and localization of tumors, establish the location of fracture and bone fusion, determine the size of the heart in dynamics, etc. If the intensity of ultrasound is up to 100 mW/cm², no significant changes are detected in the tissues during medical research.

2.3 Painful effect of low temperature. Hypothermia.
The effect of low temperatures on the human body can also form both local (local) - frostbite, and General reactions that can occur in the form of a cold, a decrease in body temperature, freezing of the body. The manifestation and severity of changes in the body when it cools are influenced by the temperature of the environment and the nature of its impact, i.e. due to what this happens (from air or water), how fast the air moves (wind) and the presence of moisture in it… At the same time, it is extremely important to find out about the presence of heat-insulating things on a person for the body's thermal protection and other factors. Once again, let's start from General cooling - a violation of the heat balance in the body, which leads to a decrease in body temperature (hypothermia). Hypothermia occurs:

- with increased heat transfer and normal heat production;
- with normal heat transfer and reduced heat production;
- when factors are combined.

Most often, warm-blooded animals, including humans, have the first variant of hypothermia: in the compensation phase, the reactions are primarily aimed at limiting heat transfer - blood vessel spasm occurs reflexively, sweating decreases, and breathing slows down. Next, thermoregulation mechanisms are turned on, aimed at increasing heat production: chills (muscle tremors) occur, the process of glycogenolysis in the liver and muscles increases, blood glucose levels increase, and the main metabolism increases. Low temperatures during prolonged exposure cause a decompensation phase. It is accompanied by an even greater decrease in body temperature, muscle tremor stops, oxygen consumption and the intensity of metabolic processes decreases, and peripheral blood vessels expand. The effect of cortical functions and the suppression of subcortical and bulbar centers reduces blood pressure, slows down the heart rate, weakens the respiratory rate, there is a gradual extinction of all vital functions. Death occurs from paralysis of the respiratory center. Initially, the suppression of Central nervous system functions in hypothermia has a protective value, which reduces the sensitivity of nerve cells to lack of oxygen and inhibits metabolism. The protective value of hypothermia is also shown by an increase in the body's resistance to intoxication, infections and other adverse environmental influences. This is used in medicine when the body is artificially hibernated (in particular, in cardiac surgery and neurosurgery) in order to reduce the body's oxygen demand and prevent temporary brain
ischemia. That is, correctly understood negative effects of low temperatures on the body can acquire positive features if necessary in a clinic.

2.4. Pathogenic effect of thermal energy. Overheating. Heatstroke.

The action of high temperature, which accompanies the metallurgical process in the Lipetsk region, can cause burns, burn disease and overheating of the body. Burn (thermal) - local (local) damage to tissues with an increase in their temperature within 45-50 °C and higher as a result of the action of flame, hot liquids, steam, and heated solids. Four degrees of burns are distinguished depending on the depth of tissue damage: 1) redness of the skin (erythema); 2) the formation of bubbles; 3A) partial or complete necrosis of the malpigian (sprout) layer of the skin; 3B) complete necrosis of the skin in its entire thickness; 4) necrosis of the skin and underlying tissues. The mechanism of burns is associated with an inflammatory reaction at the site of action of the thermal agent and coagulation of proteins, leading to cell death and tissue necrosis. Burn disease - versatile functional disorders of the internal organs and systems of the whole organism, due to extensive (more than 10-15% of the body surface) and deep burns. Four periods are distinguished in the development of a burn disease: burn shock, general toxemia, septicotoxemia, and convalescence. Overheating (hyperthermia) is a temporary passive increase in body temperature due to the accumulation of excess heat in the body (with difficulty in heat transfer processes and the action of high ambient temperatures). Acute overheating of the body with a rapid increase in body temperature and prolonged exposure to high ambient temperatures can cause heat stroke. Thermal shock death occurs from paralysis of the respiratory center.

2.5. Social factors of the Lipetsk region: housing, industrial premises, contacts of people, water supply, clothing, food.

According to the Law of the Lipetsk Region dated December 25, 2006 No. 10-OZ (as amended on October 29, 2018) “Strategy for the socio-economic development of the Lipetsk Region for the period until 2024” [7] on social factors (housing, production facilities, people's contacts, water supply, clothing, food and others) the most close attention is paid, because they play a special role for humans in the formation of ecopathology - diseases caused by environmental risk factors. The region is a leader in housing construction in the Russian Federation. Since 2006, housing commissioning has increased 3.4 times, 12.5 million square meters have been commissioned. m. According to the commissioning of housing per capita in 2018 (0.94 sq. m), the region takes 3rd place among the constituent entities of the Russian Federation and 2nd place in the Central Federal District (CFD). Over 5.1 billion rubles were allocated for the resettlement of citizens from emergency housing in 2008 - 2018, 160.7 thousand square meters were eliminated. m of emergency housing, 10.5 thousand people were relocated to comfortable housing. Providing the population of the region with quality drinking water is one of the priority areas of the socio-economic development of the region. In 2008 - 2018, 666 km of water supply networks were built, reconstructed and thoroughly repaired, 157 wells were put into operation. As of 01.01.2018, about 1.1 million people (96.8% of the total population) in the region were provided with high-quality drinking water with a centralized water supply system. The share of the poor in the region is one of the lowest in the Russian Federation - 9.1% (2018 - 4 place in the Central Federal District and 7 in the Russian Federation).

The indicators formed against this background are presented in the tables (demographic indicators - Table 1, average life expectancy - Table 2).

| Table 1. Demographic indicators. |       |       |       |
|----------------------------------|-------|-------|-------|
| fertility                        | 11.4  | 10.0  | 9.5   |
| death rate                       | 15.2  | 14.7  | 14.3  |
| natural decline                  | -3.8  | -4.7  | -4.8  |
Table 2. Average life expectancy.

|          | 2014  | 2015  | 2016  | 2017  | 2018  |
|----------|-------|-------|-------|-------|-------|
| men      | 64.5  | 65.26 | 65.98 | 66.74 | 67.57 |
| women    | 76.68 | 76.77 | 77.11 | 78.01 | 78.01 |
| whole population | 70.6  | 71.07 | 72.62 | 72.46 | 72.88 |

Despite a slight improvement in the demographic situation (decrease in mortality, increase in the number of births, increase in average life expectancy to 72.88 years), the population continues to decline due to natural decline - 4.8 per 1000 population. Migration processes only partially compensate for the natural loss of the population. A decrease in the working-age population is projected. According to the forecast, by 2024 it will decrease by 10 thousand people or by 2% compared to the level of 2018. The observed decrease in the number of young people aged 20 to 30 years will lead to a decrease in the quality of labor potential of the region. Having a high technogenic load, the number of doctors in the region is 33.9 per 10 thousand inhabitants (59th place in the Russian Federation). According to the provision of primary care doctors and doctors-diagnosticians, the region occupies 78 and 73 places in the Russian Federation, respectively. The mortality rate in the region is one of the highest in the Russian Federation. There is a need for provision of places in preschool organizations for children under 3 years old. In secondary schools, 11% study in the 2nd shift, which does not meet sanitary standards and the level of safety. The level and quality of life of rural residents lag behind the standard of living of the urban population. Problems remain in the development of engineering infrastructure, providing rural people with access to healthcare and education institutions, improving transport accessibility, as well as providing housing for agricultural workers and rural social workers, including young professionals.

The Lipetsk region due to the large technogenic load refers to the regions with high environmental tension. In terms of wastewater pollution, surface water bodies occupy 8th place in the Central Federal District and 39th in the Russian Federation; atmospheric air - 1 place in the Central Federal District and 13 in the Russian Federation. This is due to the high level of industrial and agricultural production. The anthropogenic impact on the environment is increasing year by year. The cities of Lipetsk, Lebedyan, Dankov, Yelets are experiencing the greatest load. The most acute environmental problems in the region are: air pollution from stationary and mobile sources; water pollution; imperfection of the waste and production waste management system; lack of a system for the deep processing of production and consumption waste, the introduction of recycling technologies.

The environmental conditions are affected by the sanitary condition of forest stands damaged by pests and forest diseases.

3. Conclusion
As shown in the study and in the presented results, the directions of work of the Lipetsk region's management are built rationally, taking into account the region's capabilities in relation to the fight against ecopathology. Currently (from January 01, 2019), the work is being carried out in accordance with presidential decree No. 148 of may 07, 2018. 204 “on national goals and strategic objectives for the development of the Russian Federation for the period up to 2024”, by the decision of the Council under the President of the Russian Federation for strategic development and national projects of 24 December 2018 (Protocol No. 16), which approved the passport of the national project “Healthcare”. The structure of the national project includes 8 Federal projects. Lipetsk region participates in 7 projects (with the exception of the project “Development of a network of national medical research centers and introduction of innovative medical technologies”). Financial support for the implementation of the regional program "health" is 16,437. 5 million rubles. In order to ensure the availability of medical care and improve the efficiency of medical services, in accordance with the decree of the Government of the Russian Federation of December 28, 2012 No. 2599-R, the government of the Lipetsk region of April 30, 2013 No. 2599-R, the government of the Lipetsk region of April 30, 2013 No. 2599-R, the government of the Lipetsk region of April 30, 2013 No. 213, the state program "development of
healthcare in the Lipetsk region” was approved. The implementation period of the 2013 program is 2024. As part of the event, children's polyclinics and children's polyclinic departments of state medical organizations in the Lipetsk region are already equipped with medical devices in order to bring them into compliance with the requirements of the order of the Ministry of health of the Russian Federation dated 03.03.2018 No. 92N “on approval of the Regulations on the organization of primary health care for children”.

4. The confirmation
The study was confirmed and supported by information on the most significant achievements in the field of healthcare: the interdepartmental project “Healthy Region”, c. Oncodesant preventive actions for adults have been carried out in municipal districts of the region. 120 Cardiodesant preventative campaigns have been organized, the Healthy Heart Day campaign is being implemented in all outpatient facilities of the Lipetsk Region for adults, a number of follow-up procedures have been implemented for certain adult groups the early diagnosis of chronic noncommunicable diseases, the coverage of the population with preventive examinations for tuberculosis (by all methods) amounted to about 90% of the total population of the region, primary medical care is organized on the basis of 31 medical organizations in 75 medical specialties, 34 emergency medical units are functioning. The organization of work of healthcare institutions in the Lipetsk Region is constantly being improved, the principle of patient orientation is increasingly being introduced into the corporate culture and value system of medical organizations. One of the areas of development is lean manufacturing, the implementation of which has begun in a number of clinics in the city of Lipetsk and the region. Specialized medical care in the region is organized on the basis of 38 inter-municipal centers for the most important medical profiles. As part of the development of specialized and high-tech medical care in the region, a set of measures has been implemented to reduce mortality, improve and introduce new medical technologies. On the basis of public-private partnership in the region, a nuclear medicine center operates. In order to strengthen and update the material and technical base of healthcare institutions, overhauls at 35 facilities in 26 medical organizations were completed. In accordance with the order of the Government of the Russian Federation dated 03.03.2018 No. 370-r, as part of the implementation of measures for the acquisition of mobile medical complexes for providing medical care to residents of populated areas with a population of up to 100 people, 3 mobile medical complexes equipped with medical devices were purchased. In 2018, 3 medical organizations participated in the implementation of the activities of the Accessible Environment subprogramme of the state program of the Lipetsk Region “Social Support for Citizens, Implementation of the Family and Demographic Policy of the Lipetsk Region” In 2018, the fleet of the region was replenished with 10 new class “B” ambulances and 1 class “C” ambulance. Based on the GLONASS system, 167 operated ambulances are tracked. As part of the development of health informatization in the region, a regional information and analytical medical system (RIAMS) has been introduced, consisting of 28 modules. The measures of social support for certain categories of citizens are preserved. The implementation of these measures allowed to ensure in 2018 an increase in the life expectancy of the population up to 72.88 years (according to estimates), a decrease in the mortality rate from all causes by 3.0% (14.3 per 1,000 people) [8].

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