Health condition of Siberian population (medical ecological analysis)

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ABSTRACT

Objectives. The aim of the investigation is to show, with the help of various scientific approaches, the Siberian population’s state of health for the last years. Method. On the basis of results of a large cycle of population investigations of people in different zones of Siberia - shift workers, inhabitants of ecologically adverse regions, schoolchildren in sensitive periods of development - we discovered disorders of adaptive processes that are accompanied by a decrease of mental stability, readjustment of physiological regulation mechanisms and exhaustion of functional reserves of the organism. Results and conclusions. The significant changes registered everywhere of the condition of health of the adult and children population in the centres of ecological risk and trouble call more and more urgently for considering the condition of health an economic category, and the quality of health of the population a limiting factor of the strategy of social-economic development of the territories of Siberia.

Key words: Siberian population, pollution, ecological conditions, chronic psychoemotional stress, psychosomatic diseases, morbidity and death.

INTRODUCTION

The aim of the article is to show, with the help of various scientific approaches, the Siberian population’s state of health for the last years. Special attention is given to children’s health in different regions of Siberia in view of ecological pollution. The material of the article represents the review of the results taken partly from Statistical Bulletins of the Russian Federation (1998-2001), and partly from the material of the survey report of the president of the Siberian Branch of the Russian Academy of Medical Science, V.A.Trufakin, at the Session of the Russian Academy of Medical Science Meeting (2003).

MATERIAL AND METHODS

The focus of the study was people in different zones of Siberia, shift workers, inhabitants of ecologically adverse regions, schoolchildren in sensitive periods of development. Disorders of adaptive processes were discovered that are accompanied by a decrease of mental stability, readjustment of physiological regulation mechanisms and exhaustion of functional reserves of the organism.

RESULTS

The conditions of life of people in Siberia differ essentially from those of the population of the European part of Russia. What factors reduce the level of medical safety of life of the population in eastern territories? Adhering to the classification dividing these factors into external (exogenic) and internal (endogenic, constitutional) it is possible to group them as follows.

Exogenic factors. The climate - geographical factors: a significant percentage of high latitude territories; long-term influence of low temperatures; disturbances of light mode. Ecological: prevalence of extracting industries, extreme working conditions of large groups of the population; high concentration of high industrial activity in the inhabited areas, high level of pollution of
zones where the population resides (80% of the population of the east of the country live in cities and areas officially recognized as unsuitable for residing because of ecological conditions) and the impact of nuclear tests and objects, radon, toxic substances of rocket fuel. Social factors: low incomes which do not allow paying for highly skilled medical care, high-grade balanced food or a comfortable standard of living. Chronic psychosomotic stress owing to uncomfortable living conditions and uncertainty in tomorrow results in deviant behaviour, suicides and psychosomatic diseases. Anthropoecological factors: shift-working conditions in many of the branches of industry dealing with raw material production. Medical factors: insufficient availability of qualified medical help owing to low density of the population and a lack of organization of a system of public health services. Focal infections. Biochemical provinces. Nutrition - unbalanced, deficient in protein, vitamins as well as macro- and microelements.

**Endogenic factors.** Genetic factors: presence of a native-born population of people of mongoloid parentage; a high level of crossbreeding of people of European parentage who have moved to the area; wide prevalence of allele variants of genes of predisposition to development of many socially important illnesses among practically healthy people. Factors of natural resistance are altered in comparison with the inhabitants of average latitudes (European part of Russia). During adaptation to the factors of the environment a formation of specific immunogenetic background and metabolic processes takes place.

In the 1990s the amount of inhabitants in territories of Siberia began to decline. Migration processes became less intensive, and the natural movement of the population began to show a negative trend. Further forecast of the population in Siberia is adverse. About 300,000 people die annually in the territories of Siberia, and the birth rate compensates only 65.0% of the deaths (Table I).

In Siberia the parameters of perinatal and infantile death rate are higher (Table II), and standardized factors of death from infectious and parasitic illnesses, illnesses of the cardiovascular system, respiratory organs, digestion, as well as accidents, poisonings and traumas are more prevalent (Table III). The analysis of the morbidity and death rate of the population as a whole in Siberia has also revealed a number of features: coefficients of death from external factors are higher than the average in Russia, and the death rate due to intoxication accidents and traumas as well as respiratory illnesses was especially high.

The results of complex clinical, hygienic and anthropoecological studies of the condition of health of the population testify that there is an expressed correlation between negative external factors, including degree of pollution of the environment, and an increase of frequency of the most widespread diseases. This concerns in par-

| Year | born | died |
|------|------|------|
| 2000 | 198  | 298.7|
| 2001 | 205.2| 301.8|

**Table I. Natural movement of people in Siberia (thousands people).**

| Area                  | Year | born | died |
|-----------------------|------|------|------|
| Russian Federation    | 2000 | 198  | 298.7|
| Siberian Federal District | 2001 | 205.2| 301.8|

**Table II. Infant mortality (for 1,000 newborns).**

| Area                          | 2000 | 2001 |
|-------------------------------|------|------|
| Russian Federation            | 15.3 | 14.7 |
| Siberian Federal District     | 17.6 | 17   |
| Far Fast Federal District     | 18.6 | 18.3 |

**Table III. Infant mortality according to the reasons of death in 1999 (for 1,000 newborns).**

| Reasons of death                                    | Russian Federation | West Siberia | East Siberia | Far East |
|-----------------------------------------------------|--------------------|--------------|--------------|---------|
| Diseases of respiratory organs                      | 21                 | 20.3         | 38.5         | 29.2    |
| Congenital anomalies                                | 38.7               | 33.9         | 42.9         | 41      |
| Single states appearing in perinatal period         | 71                 | 69.1         | 83.7         | 81.4    |
| Accidents, intoxications and traumas                | 11.2               | 14.5         | 16.9         | 19.4    |
ticular illnesses of the respiratory system, digestion, skin, allergic reactions and immunodeficient conditions, diseases of the blood and blood making organs, oncologic processes, complications of pregnancy etc (Figure 1).

In its most concentrated form and with the greatest intensity, all pollution got in the biosphere in a rather short period of time, in the case of many of the most dangerous pollutants within the last 50-100 years. Such a discrepancy between the sharply increased rates of pollution of the environment and historical opportunities for recreational restoration activity of ecological systems has resulted in a global decrease of reserve opportunities of natural processes.

In ecologically adverse conditions, the indicator age group with the most expressed changes in gene reactivity of an organism are children. We found (Figure 2) a decrease in the level of aerobic production of the body among city schoolchildren from the North of Tyumen district, having a different northern experience compared with the control group (schoolchildren the city of Tyumen).

It is detected that organism formation of migrant children, especially in crisis, during sensitive periods of individual development in the North of Western Siberia differs compared with children living in conditions of middle latitudes: a) as to physical development – evidenced by slowdown of growth rate, reduction of total body size and a strength of constitution and general delay of physical development. b) as to functional condition – evidenced by late pubescence, shift of vegetative balance to the side of intensification of sympathetic influences, low levels of aerobic balance. c) as to the main period of ontogenesis – in adolescence some disorders of main factors of growth and development are found in child-migrants of the North.

In Siberia, as well as in Russia, cardiovascular diseases are in the lead among the medical reasons...
for economic losses of the society, and influence all basic medical demographic parameters. To the present time our research have allowed to state that:

- besides well-known risk factors, of high importance for the population that has moved to the region are the specific determinants defining high cardiovascular morbidity;

- for the small native population, of basic importance is its intensive involvement in processes of urbanization of the region and its inability to lead a traditional way of life, which entails a really dramatic growth of cardiovascular diseases and their risk factors.

The industrial development of sparsely inhabited regions in Siberia has made it necessary to transfer workers to remote regions with extreme climatic conditions. The morbidity of expeditionary shift workers (interregional shift work with change of 4 time zones) is increased. An increase of quantity of illnesses of neurogenic aetiology is connected with the asynchronisation of functional systems. A high percentage of acute respiratory infections is conditioned by both decreasing of total resistance and by disorders in heat exchange processes between an organism and the environment because of interregional contrasts of climatic factors and seasonal inactivity of heat regulation mechanisms. With increasing work time a decrease of morbidity takes place from the 1st to the 5th year. After that we see an increase in the morbidity, which is probably connected with the exhaustion of the protective strength of the organism.

It is also possible to relate the problem of the influence of the geochemical environment on the development of pathologies to one of the rather important problems. There are convincing data about the role of infringements of the exchange of chemical elements in the pathogenesis of cardiovascular diseases. It is possible to believe that cardiovascular diseases and hypertension "are accompanied" by a failure of the homeostasis of microelements. A push towards this can be an unbalance of elements in the environment. In 1990-1997 epidemiological studies to reveal iodine deficiency diseases and to estimate the severity of iodine deficiency in Siberia and in the Far North were carried out according to WHO criteria. In the regions surveyed, the frequency of goitre varied from a heavy-degree goitre epidemic to a mild one. The frequency of iodine deficiency in Novosibirsk among younger schoolchildren was marked in 54 % of cases, and among school-children of senior grades in 39% of the cases. The preventive measures carried out in 1998-2000 normalized the situation: the frequency of general iodine deficiency has decreased in children 1.4-1.6 times. An analysis of deficiency of consumption of vitamins in the daily diet among the inhabitants of Novosibirsk has revealed a significant number of persons with deficiency of vitamin A and vitamins of the B group, and the situation did not change during 10 years.

Chronic psychoemotional stress results in heavy disorders in the psychoemotional sphere. Research has shown that the prevalence of depression symptoms in Siberia, according to the international criteria, is more than 20%. It is important that the prevalence of depression disorders in persons with chronic somatic diseases varies from 23% in the case of cardiovascular disease up to 60% in the post-insult period. The figures of prevalence of depression disorders in a village population are even higher: more than 30%. In village areas, a low level of medical help, social support and ignoring psychological problems support demoralization, alcohol abuse and

![Figure 3. Occurrence of suicides per 10,0000 people in the Tomsk district (West Siberia).](image)
alcoholic dependence, disregard for their own health and an increased level of aggression and suicide behaviour (Figure 3).

Studies of psychological development of children in East Siberia convincingly testify to a wide prevalence and constant growth of neurologic and mental disorders in all age groups (Table IV). The growth of pathologies with age was basically caused by an increase at a later age of a proportion of vegetative disorders, testifying to the presence of the constantly working adverse factors which break normal functioning of compensatory adaptive reactions in children, resulting in overwork of cerebral vegetative mechanisms and their failure with the development of subclinical and clinical manifestations. The data gathered exceed similar parameters of inspection seen in children in the USA, Canada, European countries and in the European part of Russia 2-2.5 times. This tendency will continue, specifying the adverse forecast for the coming years.

**Table IV.** Neuro-psychic health condition of children in East Siberia (%) compared with European countries.

|                        | European countries | Rural territories of Eastern Siberia | City in Eastern Siberia |
|------------------------|--------------------|--------------------------------------|-------------------------|
| Neurological disorders | 19.5               | 61.4                                 | 32.9                    |
| Neuropsychological symptoms | 20                | 43.5                                 | 29.9                    |
| Neurotic disorders     | 32.6               | 73.3                                 | 60                      |
| Risk of school dysadaptation and lack of progress | 25            | 53                                   | 42                      |

Comparative population and clinical immunogenetic studies have shown that the immunogenetic structure of a population is determined by its ethnogenesis, and is closely connected to features of the environment. Under the influence of these factors a reorganization of the HLA genetic fund of populations takes place. Most expressed dynamics of frequency characteristics are observed among those HLA characteristics which are connected to predisposition and resistance to development of secondary immunodeficiencies and autoimmune processes. So, the comparative analysis of immunogenetics of a structure of the population of eastern and western regions of Russia shows that the HLA genetic fund of the inhabitants of Siberia is characterized by a change of the ratio of genes of resistance and predisposition to development of basic immunopathological syndromes towards the prevalence of genes of predisposition.

**CONCLUSIONS**

The basic disorders caused by the external factors of health of the modern population of Siberia can be grouped as follows.

First, an increase of cases of complications of pregnancy and delivery, spontaneous abortions, inherent anomalies of development and genetic defects, perinatal pathology, prenatal and perinatal mortality.

Secondly, an increase of morbidity of children (especially at an early age), chronic illnesses of respiratory and digestive organs, bronchial asthma and other allergic diseases, swelling processes, illnesses of the kidneys, liver, blood, and also an increase of parameters of children’s mortality.

Thirdly, an increase among the adult population of oncological processes, occupational diseases and latent chronic poisonings, secondary immunodeficiencies and allergic reactions, chronic diseases of respiratory organs and the circulatory system, illnesses of the liver and blood, depression, which as a whole also have an essential contribution towards reducing the lifetime of the population due to earlier deaths; an increase of mortality from traumas, poisonings and suicides.

Thus a significant part of the Siberian population can be considered to have formed a condition which can be appraised as a condition of "incomplete adaptation".

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