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Integration of the Problem of Medical Ecology on the Level of the Highly Urbanized Region

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ABSTRACT

The urgency of the analyzed issue is due to the study of the basic issues of medical ecology: the dynamics of demographic indicators, the correlation of somatic and reproductive public health, depending on the influence of physical factors of the urban environment on public health on the basis of medical and geographic mapping. The article aims at the analysis of the environmentally determined disorder of the urbanized territory. The leading approach to the study of the issue of medical ecology is a medical and geographical mapping, which allows identifying the most affordable and common areas of multi-component medical and environmental maps. While analyzing the impact of various aspects of the environment on human health, the priority is given to risk factors that directly lead to the emergence of diseases. The contents of the article may be useful to justify the choice of the rational approach to public health as a redistribution mechanism to reallocate the space of ecological niches.

KEYWORDS
Demographic situation dynamics, medical ecology, medical and geographical cartography, reproductive health, state of environment

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Introduction

Medical ecology (ecological medicine) is a comparatively new direction of the medical science at the intersection of medicine and ecology, "complex scientific discipline studying all the aspects of environment influence on the man's health" (Reymers, 1990) making focus on the environment illnesses, people interaction and the environment in the sphere of people's health as well as interaction of the environment risk factors and people's health. Medical ecology (ecological medicine) as the synonym of the medical aspects of anthropo-ecology

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(Agadzhanyan, Nikityuk & Polunin, 1995) – the section of ecology and the direction in the modern prophylactic medicine analyzing the ties and the dependence of the people's health and health problems on the factors of the natural, social and technogenic environment.

According to the existing concept (Stozharov, 2008) there are certain differences between traditional medicine and ecological medicine (Table 1). In addition, traditional medicine is aimed mainly at identification and treatment of specific aggravated illnesses or symptoms of chronic diseases. The process of diagnostics and treatment is the following:

taking anamnesis (all the data collected during medical examination by the way of asking a patient or people possessing information about their illness);

physical examination of a patient;

laboratory and instrumental research;

formulation of diagnosis;

treatment: medical treatment, surgery, radiotherapy, psychotherapy, etc.

Table 1. The main differences between traditional and ecological medicine

Factors	Medicine	
	traditional	ecological
Man's health concept	It considers healthy organism state in the absence of diagnosed disease.	It determines healthy organism state only in case of optimal organs and systems functioning.
Approach	Insufficient tailor-made	Taking into account biochemical and immune individuality of a patient
The influence of the environment	Not taking ecological factors into consideration	Taking the effects of xenobiotics, physical factors, and so on into consideration.
Treatment	Using unified treatment schemes	Strictly individualized treatment

Source: The Main Indicators of the Samara Region Health Care System in 2009-2013: Reference book. Edited by G.N. Gridasova (2014), Statistics of Population Health and Health Care in the Samara Region in 2006-2008. Edited by G.N. Corchagina et al. (2009).

Materials and Methods

In the 90-s in the Russian Federation there were two possibilities to study the territorial distribution of illnesses. The first one was to study the problem using the state statistics which became open for general use from the beginning of "perestroika". As the result a number of bulletins, reviews and atlases on medical and ecological problems were published. The second possibility was the use of the data collected on some environmentally disadvantaged cities using the automated state information system (ASIS) "Health". The data from these two sources were not the same.

They complemented each other. The state statistics included the data concerning the whole population and within the frame of ASIS "Health" there were studied groups of people living in "dirty" and relatively "clean" areas of industrial centers with hazardous industries. Nowadays ASIS does not work and we can use only official statistics. In spite of many disadvantages of the medical

statistics (in particular, the absence of etiopathogenetic disease differentiation), it displays the quality of the environment more adequately than the official data on the status of later received on the basis of the instrumental assessment (Krasnoschekov & Rozenberg, 1994).

This confidence is based on the fact that a large group of diseases is connected directly with the environment that allows their use as an environment quality indicator (and its various aspects). These are, first of all, pathological conditions caused by endemic geochemical features (proliferative lesions of the thyroid gland, Cashin-Bek disease and so on), climatic factors and regional biocenological characteristics (many parasitic diseases, gaffskaya disease), variability of infectious agents in the environment (for example, virus influenza) , etc. Another large group of pathological processes is associated with industrial activity, with the limited area of influence and the influence on a small contingent of people working in adverse conditions. The third group of diseases occurs under the influence of social causes and population interaction (mainly it is psychogenic pathology: cardiovascular, endocrine disorders, psychiatric disorders). As a "pathogenic" factors an ethnic factor can act (e.g. eating habits, raw fish and meat eating) and genotypic characteristics of populations (genetic abnormalities in alcohol oxidation). With regard to the health problems associated with ethnic peculiarities there are usually discussed disadaptative consequences as a result of lifestyle changes. The ethnic groups living in the extreme social environment may serve as an example. Finally, a large group of diseases, as well as the increase of overall sickness rate (often without sufficient factual justification) is directly associated with intensive water, air and soil pollution as a result of industrial activities. Each of these diseases is characterized by the features (spatial distribution, prevalence in the population, the range of nozological forms), but all of them are causally related to environmental factors.

The analysis of environmentally induced diseases of urbanized areas is complicated by:

significant fluctuations in intensity of environmental factor impact on limited areas (industrial areas);

high migration activity of city residents, a combination of occupational hazards influence and residential area pollution;

presence of multi-component pollution, often with different effect of individual factors;

The lack of information on cumulative effect and influence of low doses of most pollutants.

This is not a complete list which is provided only to illustrate the difficulties that arise in the analysis of sickness rate in terms of ecological position - establishment of certain features is in most cases only the pretext for serious research. A number of difficulties in the analysis of diseases can be eliminated when comparing children and adult ones. Finally, purely ecological considerations can be made. The man is on the top of the trophic pyramid and acts as a predator of the highest level. And as anthropogenous impacts primarily "beat" the upper floors of the trophic pyramid, human population health state may be an acceptable indicator of the environment quality.

Some methodological approaches of medical ecology will be exemplified.

Results

Medical and ecological mapping

Medical and geographical mapping is one of the earliest directions of the modern ecological mapping (Keller & Kuvakin, 1998; Prohorov, 2003). Its foundations were laid in the 60 -s of the 20 th century. The first national experience in distribution mapping of diseases related to natural factors is the nosogeographical map of the USSR "Diseases with natural nidality" with the scale 1 : 25 000 000 compiled by B.V. Vershinskiy & V.K. Simonovich (1964). The map shows the association of complex diseases to specific natural areas. The method of qualitative background (for certain diseases saturation of colour corresponds to the level of sickness rate) as well as habitats and localized icons. As the basis the geobotanical map was taken as the nature of vegetation determines not only the distribution of epidemically and epizootically important species but also the peculiarities of the economic use of natural territorial complexes.

One of the most accessible and popular directions of making competent medical and ecological maps is a cartographic design of medical interpretation of already existing maps. In the analysis of various aspects of the environment impact on human health priority is given to the risk factors directly leading to the emergence of diseases. It should be noted also that lack of basic data, departmental disunity, uneven and incomplete medical and geographical study of different areas of the country are now the major obstacles for the development of medical and environmental mapping.

The development of computer technologies led medical and ecological (geographical) mapping to the new level. Designing new easy readable medical and ecological maps became one of the stages of visualization of the data bases and the part of GIS-technologies.

As an example of medical and ecological mapping let us consider one of the most widely spread ecopathological conditions- malignancies taking (in different years) the second or the third place among the causes of death. Although the reasons of cancer are still not clear the link with the quality of the environment is "visible". It was found out that the incidence of cancer is affected by solar radiation, penetrating radiation, air pollution, especially in combination with high humidity (smog), the density of population and urbanization as well as a number of ethnographic and social factors. There is experimental evidence of carcinogenic effect of many chemical compounds, both of natural and artificial origin. The great role is played by 3-4- benzopyrene appearing from combustion of organic fuel (it is accumulated in smoked food; great frequency of cancer in the Baltic countries is associated with this chemical compound). Recently nitroso compounds have attracted attention among carcinogens. Their predecessors are nitrates contained in the water and food (vegetables, milk and meat) and restoring in a human body to nitrites, 20 times more toxic than the parent compounds. Carcinogenic effect of nitrosamines occurs when the dosage is measured in "mcg per kg of body weight". Although it is difficult to make quantitative assessment of pollution impact on a cancer incidence because of many methodological limitations, mere presence of such relationship is obvious.

Before the 90s there were restrictions on the publication of information on a cancer incidence. Only in 1989 the first statistical digest "Malignancies in the USSR and the Union Republics". The information related to the relative incidence, not age-standardized, they do not take into account the changes in frequency of cancer due to the increase of older age population groups. However this indicator does not adequately reflect the current trends.

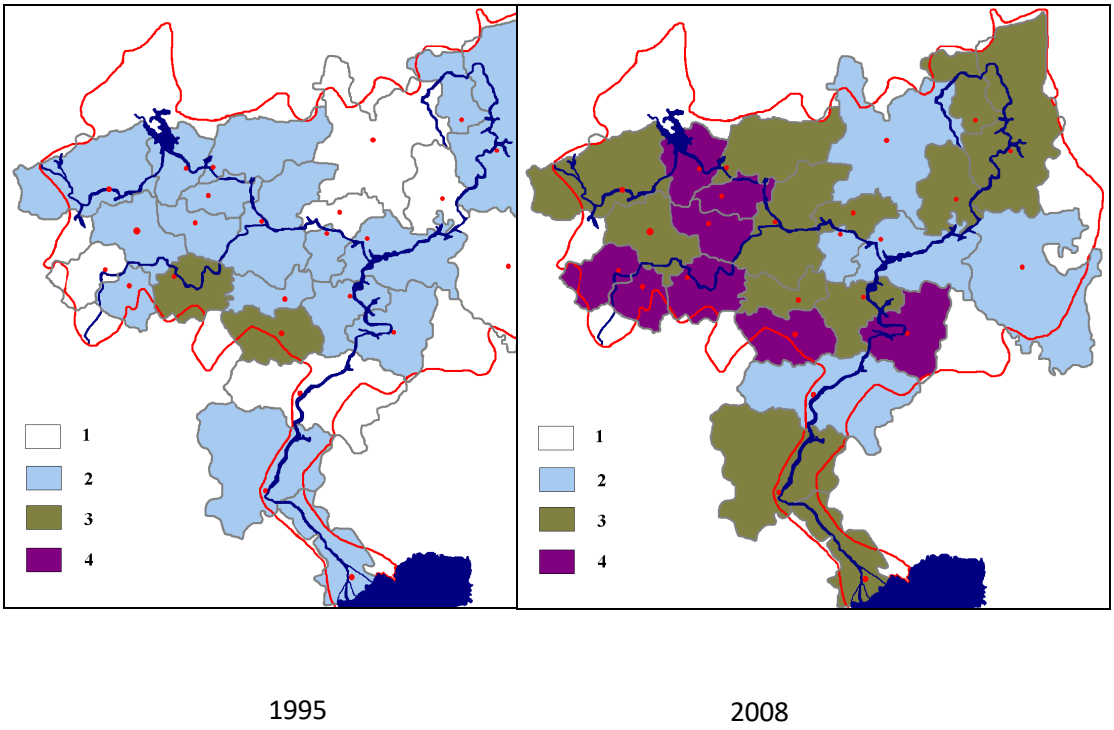

Figure 1. Presents medical and ecological map-schemes from the expert system REGION which makes it possible to make model and statistical analysis of the interrelation of cancer distribution and anthropogenic factors (Rozenberg, 2009). The rate of malignant diseases in the Volga Basin
Note: 1- up to 6 cases for 1000 people; 2 – 6-8; 3 – 8-10; 4 –more than10.
Source: The Main Indicators of the Samara Region Health Care System in 2009-2013: Reference book. Edited by G.N. Gridasova (2014), Statistics of Population Health and Health Care in the Samara Region in 2006-2008. Edited by G.N. Corchagina et al. (2009).

According to the data for the beginning of the 90-s malignancies of the Volga Basin adults were mostly distributed in Ryazan and the Orenburg Region (the average rate for grown-up people in Russia is 39 cases for 1000 people). The rate of malignant diseases was a bit lower in the Penza region and the Nizhniy Novgorod region, Moscow, the Moscow region, the Vladimir region and the Yaroslavl region. Malignancies of children were most frequent in the beginning of the 90-s in the Yaroslavl Region (3. 6; the average in Russia is 1.3 for 1000 people), in the Tambov Region (2.6), the Ivanov Region (2.4) and the Ryazan Region (2.3). In Povolzhye the highest rate of this pathology was revealed in the

Samara Region (2. 2). The most favourable situation in Povolzhye was in the republics of Tatarstan and Bashkortostan.

In 2008 the number of cancer diseases increased in absolutely all regions and republics of the Volga basin. The worst changes were observed in the Kaluga Region (for 125%); the significant increase of cancer cases took place in the Yaroslavl, the Vladimir, the Penza and the Samara Regions (about 50%).

The analysis of the reproductive health of the population of the Samara Region for the period of 1999-2012

The analysis of the demographic indicators of the Samara Region for the period of ten years (1999-2008) reflects the tendencies characteristics for the Russian Federation: the number of the population being stable (3189, people were registered in 1999 and 3172,8 people in 2008) the general coefficient of birth rate increased by 41,9% and that of death rate decreased by 6,1%. The coefficient of the natural growth of the population changed from -8.1 to -3.8 (Figure 2).

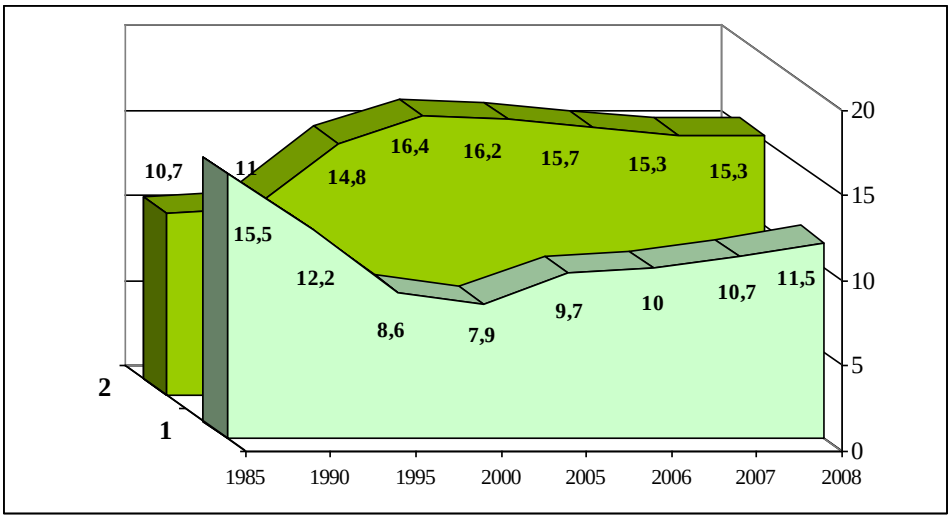

Figure 2. Dynamics of natural movement of the Samara Region population in 1985-2008*
*Note: 1- natality; 2 - mortality.
Source: The Main Indicators of the Samara Region Health Care System in 2009-2013: Reference book. Edited by G.N. Gridasova (2014), Statistics of Population Health and Health Care in the Samara Region in 2006-2008. Edited by G.N. Corchagina et al. (2009).

The dynamics of this coefficient testifies the positive tendency with significant decrease in 2011 to -2.9 and in 2013 –to -2.1.

In the figures 3 and 4 you can see the maps-schemes of distribution of death rate and birth rate on the territory of the Samara Region in 2008 (The Main Indicators …, 2006; The Main Indicators …, 2014).

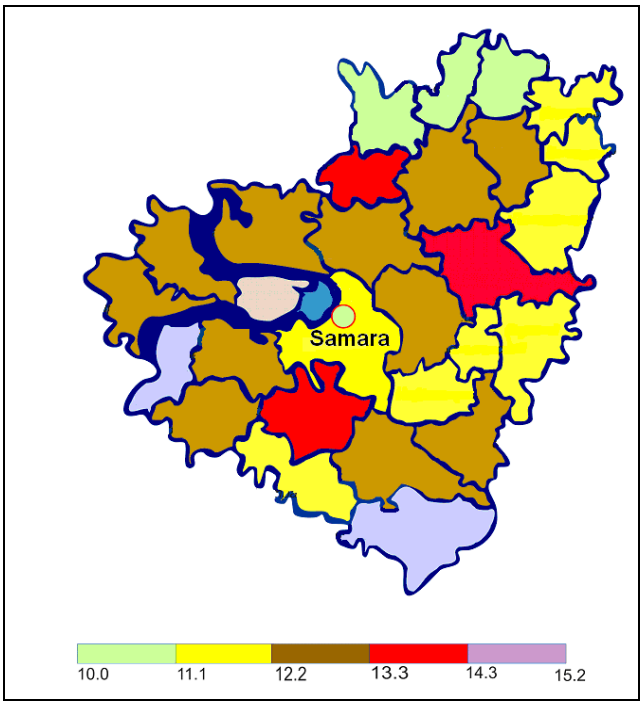

Figure 3. Birth rate in the Samara Region in 2008 (the total number of live births per 1,000 of the population per a year).
Source: The Main Indicators of the Samara Region Health Care System in 2009-2013: Reference book. Edited by G.N. Gridasova (2014), Statistics of Population Health and Health Care in the Samara Region in 2006-2008. Edited by G.N. Corchagina et al. (2009).

Among the positive tendencies in the reproductive women' behaviour for the period (1999-2008) is a significant increase of childbirths in the Region – by 7,8%, with the increase of the share of normal births (from 32.3% to 64,1%) and the number of second and third births (The Main Indicators …, 2006; Statistics of the Health …, 2009; The Main Indicators …, 2014).

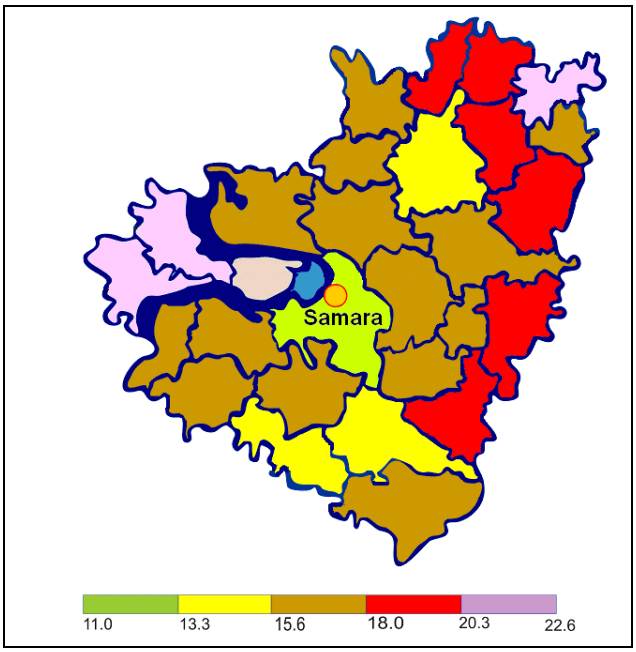

Figure 4. Death rate in the Samara Region in 2008.
Source: The Main Indicators of the Samara Region Health Care System in 2009-2013: Reference book. Edited by G.N. Gridasova (2014), Statistics of Population Health and Health Care in the Samara Region in 2006-2008. Edited by G.N. Corchagina et al. (2009).

The infant mortality rate fell by 3 times (32,7%) and was 6,8‰ in 2008 but there is a moderate increase in 2012 up to 7,0‰ which is stably lower than the average rates in the Russian Federation and in 2012 it was 8,6‰. The main causes of infant mortality are prenatal diseases, respiratory diseases, infectious diseases. Prenatal mortality has decreased by 38.2%. Maternal mortality has stabilized at 12.6 and 11.0 per 100 000 thousand live births. A steady decline of this indicator is noted: in 2012 to 7.7 and, respectively, in 2013 to the level of 5.1 (in the Russian Federation in 2012 it was 11.6).

The positive tendencies in the main demographic parameters for the studied period of ten years (1999-2012) are accompanied by a moderate growth of rates of diseases that affect the implementation of the reproductive function of adolescent girls and women of reproductive age. The statistics indicates low reproductive potential of the region due to the increased incidence of extragenital diseases, mainly for adolescents: 1882.8 per 1000 of adolescents in comparison to 2272 adults (The Main Indicators …, 2006; Statistics of the Health …, 2009; The Main Indicators …, 2014).

The disease indicators of the endocrine, nutritional and metabolic disorders for adolescent girls were higher than that of the adult female population (8153.1 and 8073.5 per 100 thousand persons).

The dynamics of the inborn anomalies and chromosomal abnormalities is characterized by moderate growth for both adolescents (from 2644.5 to 3091.1 per 100 thousand persons) and adult women (from 165.2 to 194.9 per 100 thousand persons); anomalies of blood circulation system prevail: 93.1 for

adolescents, 86.3 for adult women. The indicators of genitourinary system diseases were comparable - at the level of 2800-2900 (per 100 thousand persons). By 2008 the number of cases increased: for teenagers to 2845.8, for adults to 2851.7 (per 100 thousand persons). The gynecologic diseases indicators of teenage girls of the Samara Region fluctuated between 168.9 and 171.1 (per 100 thousand persons). The number of genital inflammatory diseases of the teenage girls was 2777.7, which is almost 1.5 times higher than in the group of women of childbearing age - 1912.8 (per 100 thousand persons). The maximum value of this indicator in the group of adolescent girls was in 2007 (3930.9), later (in 2008) there was noted its gradual decline to 2777.7 (per 100 thousand persons). In general, in these ten-year there was revealed a rapid growth rate of the indicator- 6 times.

The growth statistics of juvenile abortions demonstrates reproductive troubles in the region - for adolescents 10-14 years old (1.3 times), variability with a tendency to reduce for those who are pregnant for the first time (4.8 - in 2006, 3.8 – in 2008 per 1000 women 15-45 years old). Among complications during pregnancy (2008) anemia (38.3%), preeclampsia (20%), gestational pyelonephritis (22.5%) dominate. Noteworthy is the dynamics of individual pregnancy complications: anemia frequency decreased by 1.5 times (32%), diseases of blood circulation system – by 1.5 times (25.5%), the indicator of the diseases of the genitourinary system slightly increased (by 5%). The frequency of abdominal delivery increased by 7%.. The frequency of cesareans increased by 7%. Analyzing the risk of prenatal pathology of fetus and newborn, the prevalence of average level (61.7%) of its implementation - almost 2 times more than high (23,6%), and 4 times more than low (14.7%) can be noted that indicates the average risk of adverse outcome of pregnancy and childbirth.

Analysis of death number increase among the Samara Region population in August 2010

In the end of July and August 2010 in the Volga Basin (and even throughout the whole territory of the Central and Volga federal districts, and then in other regions of Russia) there was a difficult fire situation because of the extreme heat and lack of rainfall. According to the data of the Health Care Department of Moscow only on the 9th of August 2010 the mortality in Moscow reached the level of about 700 persons per day in comparison with usual 360-380 persons per day; ambulance calls increased up to 10 000 per day (usually - 7,5-8 thousand per day); the total number of hospitalizations increased by 10% and the number of hospitalizations of children - by 17%. The main reason for ambulance calls were cardiovascular disease (the number of apoplexies increased slightly, while the number of heart attacks even reduced), bronchial asthma, hypertension, problems with lungs. The number of deaths in the Volga Basin in August 2010 was more than 2 times higher than in August 2011; in the Samara Region – almost 3 times higher (Lifirenko, 2011; Lifirenko & Lifirenko, 2012); the number of deaths also sharply increased in Nizhniy Novgorod Region, Saratov Region, Volgograd Region and Moscow Region.

During the last years the main causes of deaths in both the Russian Federation and in all, without exception, subjects of the Volga Basin (on average 57% of the total number of deaths) are diseases of the blood circulation system (Lifirenko, 2011; Lifirenko & Lifirenko, 2012; Rozenberg, 2009). The year 2010 was not an

exception. However, when considering the causes of death in August 2010 in comparison with the same period of previous years (Figure 5) it becomes obvious that the proportion of deaths due to diseases of this class has risen particularly sharply (up to 70%).

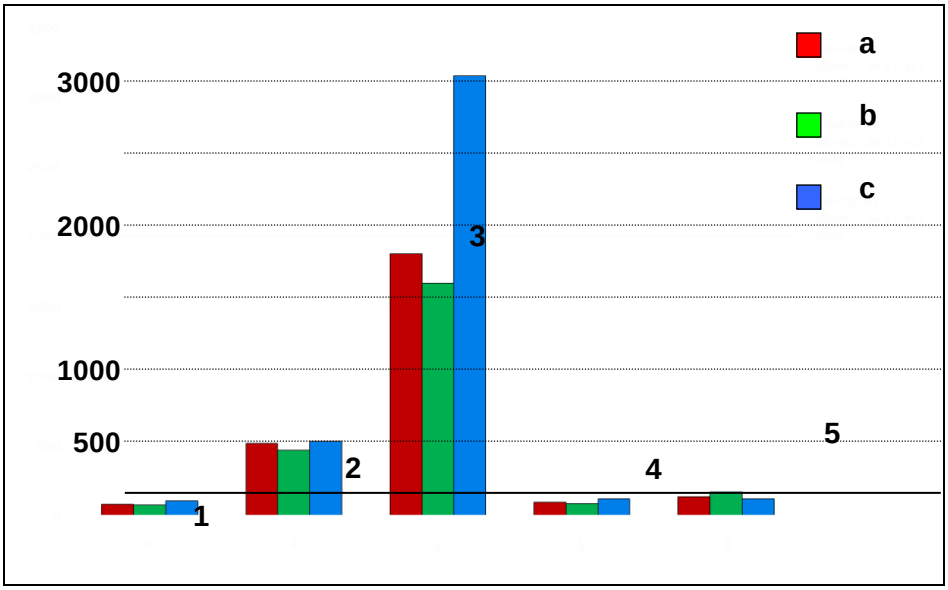

Figure 5. The distribution of the death causes among the Samara Region population (August)
Source: The Main Indicators of the Samara Region Health Care System in 2009-2013. Edited by G.N. Gridasova (2014).
Note: a - 2008; b - 2009; c - 2010; 1 - infectious and parasitic diseases; 2 -cancer; 3 - blood circulation system diseases; 4 -respiratory diseases; 5 - digestive diseases.

The dynamics of the death number in the Samara Region for 7 years since 2005 in August has more or less stable character (about 4 thousand people) with a significant growth in 2010 (Figure 6).

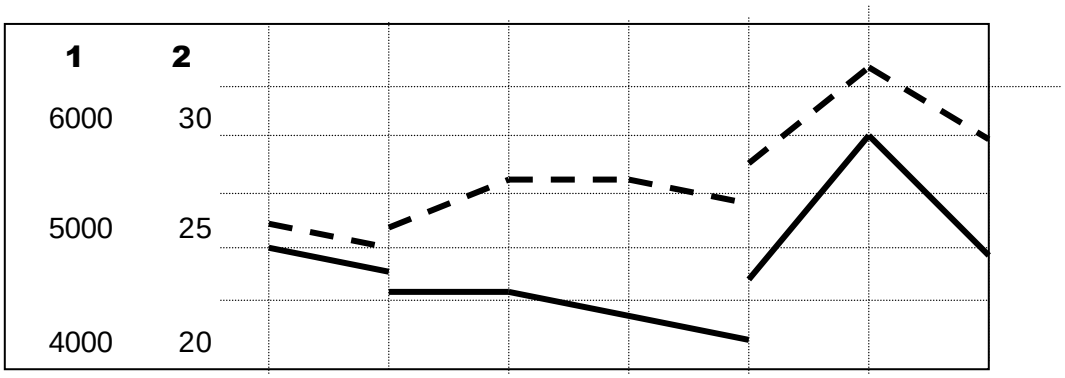

Figure 6. The death number in the Samara Region in August (full line) and the average air temperature in July-August (dotted line).

Physical factors of urban environment and their influence on health population

Togliatti is characterized by the number of large industrial enterprises, highly developed transport network, and high-density residential development. These and other factors have a significant impact on the environment both in the urban district and the surrounding areas. Recently the influence of physical pollution (noise, vibration, infrasound, electromagnetic fields, ionizing radiation and others) increased sharply in Togliatti. Employees of Togliatti State University under the direction of A. Vasilyev (2002, 2005) conducted comprehensive studies on monitoring and the influence of physical pollution on the population of Togliatti.

In particular, the main sources of noise in Togliatti are transport streams. In a number of areas there was significant excess of hygiene requirements. Most of them are in Central District and Komsomolsk District. The problem is compounded by the fact that a number of sites in residential areas are too close to the sources of sound and infrasound. Fig. 7 shows a map of sound levels in the settlement Shluzovoy (Gateway), Togliatti. At night the value of almost all measured points are higher than the normative which means extremely unfavorable acoustic situation at this time.

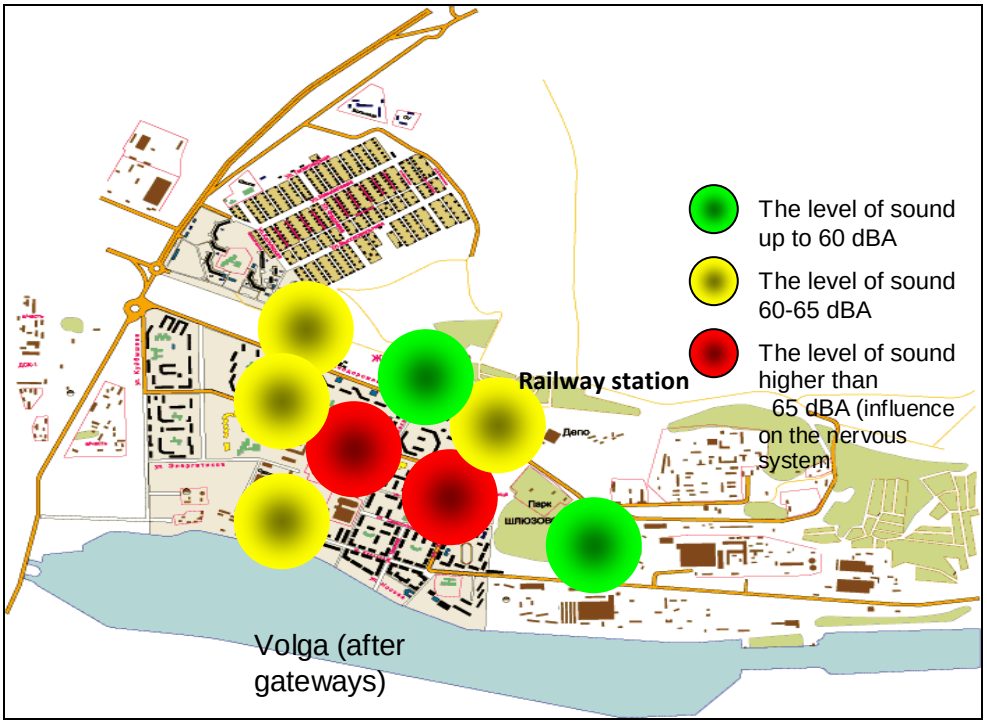

Figure 7. The map of the sound levels on the territory of the settlement Shluzovoy (Gateway), Togliatti (in dBA- acoustic decibels).
Source: G.S. Rozenberg (2009).

The collaborative research (Togliatti State University and EIVB RAS (the Russian Academy of Sciences) (Vasilyev et al., 2005; Vasilyev & Rozenberg, 2007) allowed estimating the impact of physical factors on the health of Togliatti population. In particular, the qualitative method of forecasting (questionnaire-expert forecast) by interviewing the residents of Komsomolsk district of Togliatti

helped to evaluate the comfort of living depending on the age and sex of the respondents and "noise pollution" (see figure 8 and 9).

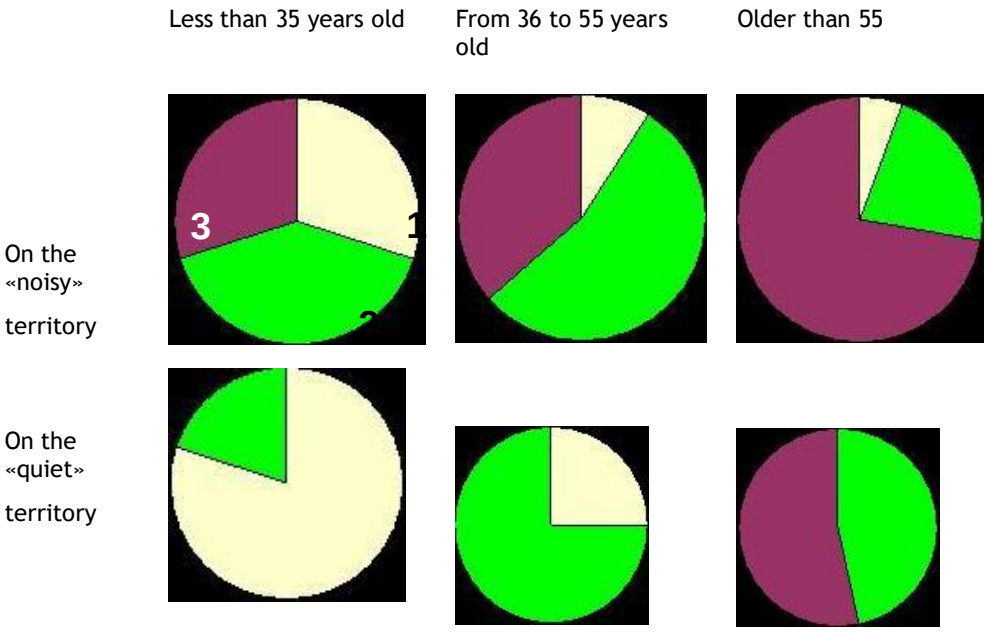

Figure 8. The estimation of living comfort of (age structure; 1 –good, 2 –satisfactory, 3 – bad).
Source: G.S. Rozenberg (2009).

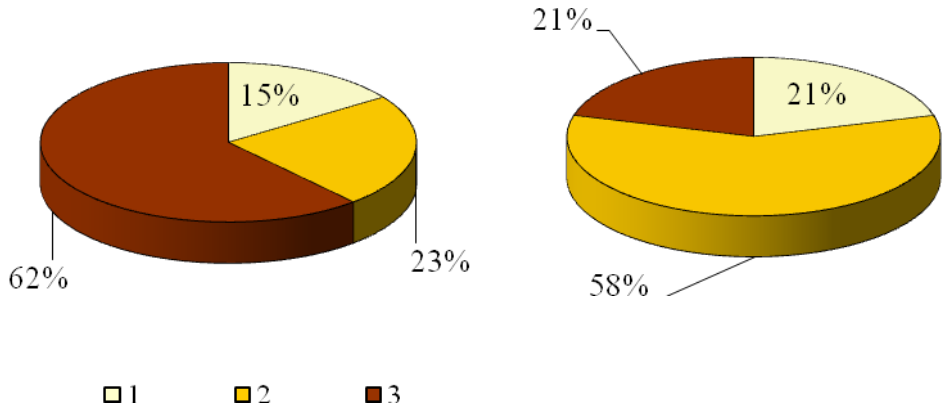

Figure 9. The estimation of living comfort (gender structure)
Note: 1 – good; 2 – alright; 3 – bad.
Source: G.S. Rozenberg (2009).

The following conclusions were made after the interviewing:

The older the person the worse is the attitude to the acoustic pollution;

Women are much more sensitive to noise than men;

The more the person lives on the noisy territory the more often comfort level is estimated as bad or satisfactory;

respondents who estimate their state of health as bad have more negative attitude to noise pollution.

Besides, the influence of "electromagnetic pollution" on the health of Togliatti population was proved as well (Rozenberg, Lifirenko & Kostina, 2007; Zibarev, Kudinova & Lifirenko, 2012).

Discussions

On the parameters of medical ecology in terms of human ecology

Human ecology is the science dedicated to the relationship of a man and human communities with the environment in various aspects (biological, social, economic, technical, and so on.); it is aimed at determining optimal conditions of human existence including its impact limits on the environment. This science originated and developed at the intersection of many scientific disciplines working closely (especially biology and ecology followed by geography, demography, sociology, history, psychology, medicine, economics, civil engineering, etc. Medical Science in the system is represented by the general and municipal hygiene, the organization of health, epidemiology, etc.

The first article on human ecology in the national scientific literature appeared in the mid 60-s of the last century. The book of V.P. Kaznacheev (1983) was of fundamental importance for the development of human ecology in our country; the works of B.B. Prokhorov (2003), Y. Pivovarov (2004).

Human health (health of the population) is a statistical concept characterized by the complex of demecological indicators among which the following are the most important (Ilyinyh, 2005; Rozenberg, 2009):

birth rate – is measured by the number of newborns per 1000 people of the population per year [for the Volga Basin: 1985 – 15.5; 2000 – 8.2; for Russia: 1985 – 16.6; 2000 – 8.7; 2013 – 13.3];

death rate (including infant mortality – children up to 1 year old) – is measured by the number of deaths per 1000 people of the population per year [for the Volga Basin: 1985 – 11.3; 2000 – 17.0; for Russia: 1985 – 11.3; 2000 – 15.6; 2013 – 13.1];

average life expectancy - the number of years that the average representative of the generation will live assuming that representative mortality of this particular generation at his/her transition from one age group to another one is equal to the current level of mortality in these age groups .; in the history of mankind this figure has increased from 21-23 to 80 and more [for the Volga Basin: 1985 – 69.8; 2000 – 65.1; for Russia: 1985 – 69.4; 2000 – 65.3; 2013 – 70.8];

population growth [for the Volga Basin: 1985 – +4,2; 2000 – –1,5; for Russia: 1985 – +5,3; 2000 – –6.9; 2013 – +0.2];

age and gender structure of the population;

physical development;

sickness rate [per 1000 people of the population per year; for Russia, 2012 – 1604.2; with the diagnosis set for the first time– 796.9];

disability [per 1000 people of the population per year; for the Volga Basin, 2012 – 98.2; for Russia, 2012 – 92.2].

Conclusion

The conclusion can be drawn on the basis of researching some medical ecology problems in terms f human ecology. Human ecology as an integrating science includes medicine in the part concerning public health (the health of the population) (Krasnoschekov, 2012). The population health can be defined as the absence of mass illnesses – epidemic diseases, epizooties and epiphytes. Mass diseases are the major factors of mortality and act as a mechanism of evolution - natural selection by the vector "resistance – sensitivity" to the various pathogenic factors of the environment. This mechanism is one of the ways to implement the micro-evolutionary processes which is reflected in the West in the formation of so-called "Darwinian medicine". In this respect population health is the object of study not only of medical workers but also biologists and ecologists.

A complex approach to the study of the environmental effects impact on human health has always been a characteristic feature of medical geography inherited by medical ecology (Keller & Kuvakin, 1998). Such disciplines as environmental physiology, environmental toxicology, environmental epidemiology, environmental health, environmental and psychiatry geo-hygiene developed due to ecologization of medical and biological sciences. This list is to be continued.

Like G.P. Krasnoschekov (2012) population health can be viewed (from ecological point of view) as sinecological mechanism of releasing ecological niches (changing the structure of sickness rate, for example, the occurrence of AIDS as the result of eliminating traditional epidemic diseases - plague, smallpox, leprosy (Supotnitskiy, 1997) and as a regulator of the biological diversity of human populations (growth of systemic diseases "diseases of civilization" prevail) [human disease resulting from scientific and technological revolution, industrialization and urbanization: cancer, mental, endocrine, metabolic, digestive and respiratory diseases], and psycho-emotional disorders (Chumakov, 2000).

"In an effort to save anthropogenic systems a man is doomed to struggle with life in all its manifestations. In the twentieth century a powerful industry of toxic chemicals and drugs production was created for these purposes. Initially the situation seemed to be very simple and the destruction of certain "harmful" species seemed to be enough. But in the middle of the twentieth century it was proved that the bacteria can horizontally transfer chromosomal fragments from one cell to another one with a change of the genetic code of the recipient cell. This mechanism <...> provides a much more rapid evolutionary time for prokaryotes. Experimental data confirmed the spread of parasites resistant to highly effective in the recent past drugs" (Krasnoschekov, 2012).

In the 21st century the role of environmental medicine (Ausubel, 2004) as a special branch of health (doing no harm to the environment and improving the population health) is increasing. The microbiologist R. Dubos (1965) believed that "the role of a biologist is in studying the nature of the "human raw material" and mechanisms that each person uses to create himself (his own

empirical individuality). This role has become increasingly important as a human life is increasingly determined by the profound influence of technologies and, consequently by increasing of the distance from the evolutionary experience" (Dubos, 1965). Prevention and care are the first "line of defense" of environmental medicine.

Disclosure statement

No potential conflict of interest was reported by the authors.

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