HUMAN ADAPTATION TO radioactive   
contamination of a territory

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*The aim* was to study effects of radioactive contamination of a territory on human adaptive mechanisms with special emphasis on cardiovascular risk factors. The adaptive reactions of the human body as a result of long radiation exposure were studied by analyzing heart rate variability and blood pressure. *Methods*: A sample consisted of 944 residents of the Urals region. Of them, 223 lived in the Techa River basin, into which liquid radioactive waste materials were released, 587 lived in the zone of the East Ural Radioactive Trace (EURT), and 134 residents lived in a non­polluted area. Short electrocardiograms (100 R­R intervals) were recorded. Continuous data were analyzed using Scheffe test two­way analysis of variance. Proportions were analyzed using tests assuming binomial distribution. *Results*: Heart rate variability and blood pressure were chosen as indicators of adaptive reactions of the human body. Substantial proportion of the population living in radioactive contaminated areas is in the state of the stress, as expressed by the deviation from the normal values of SI (at 52.2 % of the sample), SDNN (at 58.1 % of the sample), and from the normal values of VBI (at 42.7 % of the sample). Mean values of SI among residents of the Techa River basin were significantly different from the corresponding values among study participants from other territories. *Conclusions*: We observed significant effect of radioactive pollution on the state of adaptation mechanisms of the Urals region population. It is shown that regulatory system is in stress at significant part of population living in radioactive contaminated territories.

**Key words:** adaptive reactions of the human body; radiation exposure; heart rate variability; stress index; standard deviation of the NN interval; vegetative balance index

Risk­based approach to improve workplace health in non­ferrous metallurgy located in the Arctic zone of Russian Federation

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*Objective*: To assess the work­related health risk and to determine the attributable fraction due to exposure to the occupational hazards as well as the total burden of related diseases and its temporal trends in non­ferrous metallurgy located in the Arctic zone of the Russian Federation. *Methods*: The results of mandatory medical examinations of 5006 workers engaged in the pyrometallurgic and electrolytic departments of nickel and copper have been analyzed. The disability adjusted life years lost, (DALY) due to diseases having a stable and statistically significant relationship with occupational hazards has been determined. *Results*: 53 % of the total number of employees are occupationally exposed to nickel and copper compounds, including 50.9 % those exposed to unacceptable nickel air concentrations, 9.2 % to copper air concentrations and 19.9 % to dust of mixed composition. At the same time, the relative risk of the occupational diseases turned out to be the most significant among workers employed in the nickel­electroplating department (NED) ­ 6.78, and the lowest was in workers employed in copper department. The prevalence rate of work­related diseases at NED had been declining by 27.8 % from 2006 to 2015, in the pyro­refining department ­ by 26.8 %, and among workers who have periodic exposure to these metals ­ by 24.1 %. *Conclusion*. The most exposed groups are workers employed in the pyro­refining and nickel­electroplating departments. The use of a risk­based approach to the development of the health preventive measures allowed achieving a significant reduction in the incidence rate of work­related diseases, including that in NED workers by 2.1 times, among workers of pyrometallurgical refining by 17.8 %, including among males ­ by 5.0 % in men, and by 2 times in female workers.

**Key words:** Arctic zone of the Russian Federation , сopper­nickel industry, work­related diseases, risk­based approach to health promotion

AGE­RELATED CHANGES IN HEART RATE VARIABILITY AMONG RESIDENTS   
OF THE RUSSIAN NORTH

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In this paper we present new models of homeostasis as uninterrupted and chaotic changes of functional systems parameters of human body. *The aim* of the study is to establish the statistical and chaotic patterns of age­related changes in heart rate variability of residents of the North of the Russian Federation. *Methods*. The main outcomes variable was R­R interval measured using pulse oximeter "ELOKS­01". Data on other cardiovascular system functional parameters were also obtained. The new approach for the analysis we present is based on calculation of coordinates *xi* which are included in a common vector *x(t)*. The new presentation of complex systems evolution for aboriginal residents and newcomers was presented. We studied permanent female residents of the Ugra region and newcomers. *Results*. The result of the study showed that according to a new theory of chaos­self organization there are substantial differences between dynamics of quasi­attractors of cardio­vascular system of newcomers. Age­related changes in the area of ​​quasi­attractors demonstrate significant changes that satisfy the condition of a two­fold change in R­R intervals with age. Many people surveyed after 55 years give an increase in their quasi­attractor, which is inconsistent with the dynamics of change in the area of ​​quasi­attractor S from time T for Khanty women and does not guarantee real longevity. The dynamic is not typical for normal aging changes of functional system parameters *xi* (especially R­R intervals *xi(t)*). *Conclusions*. It is established that these quasi­attractors decrease with age (their area S), which is typical for the parameters of the R­R intervals. The dependence of the rate of age evolution of R­R intervals for aboriginal women is obtained, which can be used as a standard of normal aging of the human body in the Russian North.

**Key words:** evolution, quasi­attractor, functional systems of the organism, cardiovascular system

TEMPORAL TRENDS IN THE PREVALENCE OF DIFFERENT SOMATOTYPES   
AMONG SCHOOLCHILDREN IN AN URBAN AREA OF BELARUS

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*Objective*. To assess changes in the prevalence of different somatotypes among schoolchildren in an urban Belarusian area. *Methods*. Somatometric examinations were performed among schoolchildren in a city of Gomel, Belarus, during 2010­2012 (287 boys and 269 girls) and the findings were compared to the results of a similar study performed in 1998­1999 (383 boys and 414 girls). The identification of somatotypes was performed according to a new quantitative method. Changes in the prevalence of different somatotypes were studied by comparisons of proportions calculated for the two time points. *Results*. Boys examined in 2010­2012 in comparison with the peers examined in 1998­1999 at the end of puberty have a statistically significant increase in their number with a mezosomic type due to a significant decrease in number of those who belong to mezoleptosomic somatotype (р = 0,001). Over a decade significant changes in the frequency rates of somatotypes among girls were found in the 17­old age group who revealed a statistically significant increase of the number of the school girls examined in 2010­2012 with mezosomic (р = 0,004), as well as mezohypersonic (р = 0,004) types and a decrease in those with leptosomic (р = 0,040) one in comparison with their peers examined at the end of the 20th century. *Conclusion*. We observed an increase in the occurrence of mesosomal somatotype among schoolchildren of both sexes due to a decrease in the number of those belonging to leptosomal types. Significant changes in the frequency of occurrence of different somatotypes were more often detected among boys suggesting greater degree of influence of changing external factors on their bodies compared to girls.

**Key words:** dynamics, schoolchildren, somatotype

COMFORT AND AESTHETICS OF THE LIVING ENVIRONMENT AS A DETERMINANT   
OF AN INDIVIDUAL’S PHENOTYPIC AND SOCIAL STATUS

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*Aim* ­ to study direction and magnitude of associations between indices of comfort and aesthetics of living environment and selected population characteristics as well as indicators of the somatotype, psychological and social status of a person. *Methods*. An expert assessment of the aesthetic nature of the environment was carried out and the comfort of the human environment in 13 regions using data from the National Atlas of Russia. A list of indicators of the social status of the population in the same regions was selected using the data form the Federal State Statistics Service. Standard indicators of the somatotype, psychoemotional state, level of prosociality and severity of various vectors of behavioral and social activity in 1 471 people, men and women, aged 18­28, permanently living in the selected regions, were assessed. *Results*. According to the majority of indicators of the psychological and social status of the population, there is a unidirectional dependence of their manifestation on the comfort and aesthetics of the environment.   
At the same time, we observed inverse association between economic activity (p = 0.051), behavioral activity (p = 0.019) and prosocial behavior (p = 0.025) and the aesthetic characteristics of the living environment. Among the indicators of social status, significant associations were found between with the comfort of the habitat and population density (p = 0.001), migration attractiveness of the region (p = 0.002), average age (p = 0.025), and quality of life (p = 0.032). Statistically significant inverse relationship was observed between divorce rate and comfort of the environment (p = 0.021). *Conclusions*. We observed several significant associations between indicators of comfort and aesthetics of the environment and phenotypic and social status of individuals. Further research is needed to corroborate our findings in other regions.

**Key words:** population ecology of a person, aesthetics of the natural environment, comfort of habitat, environment factors of phenotype formation, factors of social status formation

SCIENTIFIC PREDICTION OF MAGNESIUM OXIDE NANOPARTICLES TOXICITY   
AND ASSESSMENT OF ITS HAZARD FOR HUMAN HEALTH

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*Aim*: To study biological effects of magnesium oxide nanoparticles on human health. *Methods*: Toxicity and potential hazards of magnesium oxide nanoparticles exposure was performed using mathematical models containing data on physical, chemical, molecular biological, biochemical, cytological and ecological properties with calculation of coefficients of hazard (D) and incompleteness of data evaluation (U) of magnesium nanoscale. Size and shape of the nanomaterial were defined using dynamic laser light scattering and scanning electron microscopy. Surface area was determined by the Brunauer, Emmet and Taylor method. *Results*: Magnesium oxide nanoparticles have a size of 5­100 nm and specific surface area of 64,5 m2/g. They are insoluble in water, can have hydrophobic or hydrophilic properties and have an effective positive charge. They can generate reactive oxygen species, damage DNA, interact with protein structures, destroying cell membrane, cause mitochondrial dysfunction, morphological changes and cell death, impact on proteomic and metabolic profiles, increasing the concentration digestive enzymes, carbohydrates, amino­ acid and fatty acids. Besides, the material under investigation has such long­term effects of action: allergenicity, mutagenicity and embryotoxicity. D­coefficient was 1, 872. *Conclusions*: Magnesium oxide nanoparticles have a high degree of potential hazard for human health. The results warrant toxicological studies and assessment of toxicological­hygienic characteristics of magnesium oxide nanoparticles at various routes of intake for development of effective measures to prevent negative effect of magnesium oxide nanoparticles on human health.

**Key words:** nanoparticles, magnesium oxide, potential hazard, toxicity, human health

ASSESSMENT OF TEMPORAL TRENDS OF MALIGNANT NEOPLASMS   
INCIDENCE USING MULTIVARIABLE STATISTICAL ANALYSIS

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The article presents the results of the assessment of the trends of malignant neoplasms incidence in Russian regions using multivariable statistics. The study was performed using cluster analysis and panel data models for the data on cancer incidence for all 78 Russian regions for the period from 2005 to 2015. RStudio package was used for all calculations. Data on all independent variables were collected from the official state statistics. Cluster analysis and modeling methods taking into account the panel structure of data makes it possible to study associations between environmental indicators and the incidence of cancers or so­called oncoepidemiological process. The proposed method of multivariable analysis of medical and statistical indicators contributes to the field of data processing for medical and environmental monitoring.

**Key words:** multidimensional statistical analysis, malignant neoplasms, panel data models, cluster analysis

RESEARCH ELECTRONIC DATA CAPTURE (REDCAP) FOR BUILDING AND MANAGING DATABASES FOR POPULATION­BASED BIOMEDICAL STUDIES

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The paper presents the main principles of applying Research Electronic Data Capture (REDCap) system to data collection and data storage in population­based biomedical studies. Advantages and limitations of using REDCap as well as possibilities for obtaining intermediate reports, descriptive statistics and data management are presented from the point of view of research project logistics using the Eastern Siberia PCOS Epidemiology & Phenotype (ESPEP) population­based study as an example.

**Key words:** information system, electronic medical data capture, Research Electronic Data Capture (REDCap), PCOS epidemiology study

ROLE OF SOCIAL ENVIRONMENTS FOR SCREENING OF THE ELDERLY   
MENTAL HEALTH IN THE CONDITIONS OF THE RUSSIAN ARCTIC ZONE

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The share of the elderly population in Russia has been growing in recent years, which necessitates the search for new ways to improve the efficiency of medical, psychological and social services to assess the mental health condition of elderly people and directions of its preservation, taking into account national, historical features and social conditions. The aim of the study was the methodological substantiation of the use of new socially­conditioned approaches to ensure the early detection of mental disorders in the elderly in the Arctic territories of Russia. Subjective and objective difficulties of detection of mental disorders and specific “stresses of old age” reducing the quality of life level are systematized. Four directions of activity on strengthening of elderly persons mental health taking into account social and demographic structure, cultural and gender traditions, special value of a family and the related relations and other specific features of accommodation in the conditions of the Arctic zone are proved: shift of emphasis in primary and secondary preventive and diagnostic activity from psychiatric services to doctors of primary link and specialists in the sphere of rendering social services; training in the use of specialists in screening tools; psychological preparation of the relatives of the possession of screening simplest methods for mental activity disorders in persons of advanced age; involvement in the care of older people with mental health problems members of the foster ­ adoptive families. The basic prognostic factors of preservation and strengthening of senior age group representatives of the mental health are defined. The great social importance of the introduction of early screening of changes in mental functions in the elderly to improve the integrative indicator of their quality of life as a level of comfort in interaction with the micro­social environment, in the framework of the implementation of the basic provisions of the concept of active and healthy longevity.

**Key words:** elderly persons, mental health, the role of social environment, Arctic territories, positive psychotherapy