PECULIARITIES OF CENTRAL HEMODYNAMICS AND PARAMETERS   
OF ERYTHROCYTES UNDER EXPOSURE TO EXTREME PROFESSIONAL FACTORS

N. Y. Vlasenko, \*I. I. Makarova

Tver State Technical University; \*Tver State Medical University, Tver, Russia

*The aim:* to study the peculiarities of central hemodynamics and erythrocyte parameters under the influence of extreme occupational factors in firefighters with different lifetimes in the Federal Fire Service (FPS) of the Ministry of Emergency Measures for the Tver Region. *Methods:* 240 firefighters (age 25­47 years) were divided into three groups depending on the length of service: 1­6, 7­15, 16­25 years. Parameters of central hemodynamics were determined at the beginning of the working day shift according to the method of tetrapolar thoracic rheography. The absolute content of red blood cells in capillary blood was counted using a blood analyzer. Special techniques were used to determine deformability of their membrane. *Results:* most hemodynamic parameters deviated from the statutory values in the first group in comparison with other groups. This was regarded as an imbalance between the volume­time indeces of the blood circulation and the organism’s needs under conditions of extreme occupational stress. Gradual formation of an adequate hemodynamic profile was detected with an increase in the length of service. This allows us to conclude about the mobile and reactive nature of hemodynamic changes in the body. Expressed hematologic changes, manifested in a decrease in the erythrocyte membrane deformability and increase in its rigidity, were found in the third group. The observed patterns at the last stage of the service probably reflect the conservative nature of negative shifts development. *Conclusion:* comparison of the dynamics of physiological changes in firefighters­rescuers of three groups with different service life in the Ministry of Emergency Measures revealed the reactive nature of hemodynamic changes and the conservative nature of hematological manifestations.

**Keywords:** volume­time indices of blood circulation, deformability of the erythrocyte membrane, fire­rescuers, extreme working conditions

THE INFLUENCE OF MOTOR TRANSPORT EMISSIONS ON MORBIDITY   
AND HEALTH RISK OF THE POPULATION OF TYUMEN City

N. A. Litvinova, \*S. A. Molotilova

Tyumen Industrial University, Tyumen; \*City polyclinic N 5, Tyumen, Russia

*The aim* of the work is to study the dynamics and structure of morbidity among children (under 14 years), adults (over 18 years) and the possible impact of concentrations of motor transport emissions on the morbidity of people living in the study area of Tyumen city, as well as the assessment of carcinogenic risks from inhalation of chemicals in ambient air from road transport. *Methods*. Field observations of average annual concentrations of emissions (carbon oxide (II), nitrogen dioxide, soot, suspended solids, formaldehyde, lead) were taken from highways with traffic volume 3000 vehicles/hour of the Kalinin district of Tyumen city, the principle of operation of devices ­ electrochemical. The measurements were carried out during 6 years in autumn­winter and spring­summer periods, 4 times a day. Priority substances, constituting more than 90 % contribution to total mass emissions of the area were selected for the analysis. *The results* of correlation analysis of the influence of air quality on the morbidity of children and adults in the area was carried out and the values of the total carcinogenic risk (4,872·10­1 for adults, 1,796 for children under 14 years) and non ­ carcinogenic risk (23,28 for carbon oxide (II)) were calculated. A strong relationship was established between the annual concentrations of vehicle emissions and respiratory diseases (children r = 0,894; p = 0,04; adults r = 0,920; p = 0,027) and neoplasms (children r = 0,970; p = 0,006; adults r = 0,921; p = 0,026). Most of all, 51 % of the total index of danger are diseases associated with the respiratory system, 48,9 % ­ diseases of the cardiovascular system, the rest fall on the Central nervous system and eye diseases and its subordinate apparatus. *Conclusion*: The risk of respiratory diseases and diseases of the cardiovascular system is extremely high in Kalinin district of Tyumen city and urgent measures are needed for its reduction. The risk of development of diseases of the Central nervous system is minimal.

**Key words:** transport, emissions, air, morbidity, correlation, risk

THE ISSUES OF MANAGEMENT AND DEVELOPMENT OF HUMAN RESOURCES   
FOR HEALTHCARE. INTERNATIONAL EXPERIENCE

O. Kudelina, \*E. Killyakova

Siberian State Medical University (SSMU), Tomsk, Russian Federation;   
\*University of New South Wales, Sydney, Australia

A literature review on the issues of management and development of human resources for health care that are currently occurring with managers of medical organizations in different countries. The review includes materials available in Scopus, Web of Science, WHO (IRIS) and OECD (iLibrary) databases through 2010­2017. Influence of economic crisis is discussed in terms of state health care policy and solutions on workforce optimization. Strategies to solve problems related to workforce security, personnel management and patient satisfaction have been analyzed, implemented both by health care workers and managers and by the international community. The strengthening of human resources in different countries is carried out through various methods, the main task of which is to correlate the supply of workforce with the needs of the population through competent planning at all stages of the life cycle of human resources, increasing productivity, developing leadership and stimulating workers. Authors’ model of balanced development of human resources for health to improve health care efficiency takes into account interests, motivation and needs of health care system and medical professionals. While keeping the balance of these stakeholders interests, opportunities open up to increase the availability of medical services with a reasonable balance of financing and labor costs.

**Key words:** human resources for health, health care policy, workforce management, medical professionals, efficiency, universal health coverage

The Dynamics of Personal Self­Actualization Indices   
in the Transitive Society

1V. A. Uryvaev, 2V. A. Mazilov, 3I. G. Senin, 2Yu. N. Slepko, 1V. V. Zolotareva

1Yaroslavl State Medical Universityl; 2K. D. Ushinsky Yaroslavl State Pedagogical Universityl;   
3P. A. Demidov Yaroslavl State University, Yaroslavl, Russia

*The aim* of the study is to reveal the influence of psychosocial factors, which are known under the umbrella notion “perestroika (rearrangement) of the Russian society” in modern science on personal characteristics of young people and to give the quantitative assessment of this influence. First of all, we have assessed the dynamics of self­actualization values as a crucial factor in the formation of personalities in youth days. *Methods*: the E. Shostrom’s Personal Orientation Inventory (the POI) and R. Cattell’s Personality Factor Questionnaire (the 16­PF). We have compared two groups of subjects: the second year medical students born in 1973 (n = 88, the “pre­perestroika generation”) and in 1997 (n = 140, the “post­perestroika generation”). *Results*. We have revealed that the indices of accepting self­actualization values (the SAV scale of the POI test), empathy to the feelings and needs of other people (the Fr POI scale), freedom in spontaneous responding (the S POI scale) as well as some other indices were significantly higher in the “post­perestroika generation”. The number of correlations between the SAV scale of the POI test and the scales of R. Cattell’s Personal Questionnaire has doubled. However, we have found the signs of soft maladaptation in the problems of time relationships (the Ti/Tc РOI). *Сonclusions*. The values of personal self­actualization in the “post­perestroika generation” have strengthened its strategic role and became more “ecological” with respect to personality (more accelerated in the structure of personality traits). Assurance degradation in the experience of the whole time perspective as well as impairment in ability to accept one’s points of weakness have become a kind of payment of for these changes (the Sa POI scale). Overall, we have revealed the positive influence of the “perestroika” processes in the Russian society on the formation of young people’s personality.

**Key words:** transitive society, perestroika, personality, youth, self­actualization

CEREBRAL ENERGY EXCHANGE AS A MARKER OF ADAPTIVE   
HUMAN REACTIONS IN NATURAL CLIMATIC CONDITIONS   
OF THE ARCTIC ZONE OF THE RUSSIAN FEDERATION

1,2A. V. Gribanov, 2 N. Yu. Anikina, 1,2A. B. Gudkov

1Northern (Arctic) Federal University, Arkhangelsk; 2Northern State Medical University, Arkhangelsk, Russia

*The aim* of the work was to fix changes of cerebral energy processes in the adaptive reactions of the human CNS in conditions of the Arctic zone of the Russian Federation. *Methods*. The energy state of the brain was analyzed in different age groups (795 people in total), constantly living in the Arctic zone of the Russian Federation: children 7­10 years old, young people 18­20 years old, elderly people 60­70 years old. Cerebral energy processes were estimated according to the data of the level distribution of the direct constant potential (DC potential) by means of the five­channel hardware­software complex "Neuro­KM". Besides, the level of constant potential was tested in young people (18­20 years) arrived from India to study in the northern university. The reaction of constant potential level on local cooling was determined both in Indian students and students­northerners at the initial training. *Results*. It was revealed that adaptive reactions of distribution of the brain constant potential level in climate and geographical conditions of the region were characterized by unidirectionality and lack of action specificity, both in natural, and in the simulative conditions irrespective of the age, sex and northern length of service. At the same time reorganization of energy processes finds the reflection in high amplitude of DC potentials of a brain, violation of the dome principle and formation dominance of right hemisphere, both in people constantly living in these territories, and in migrants. Similar changes also happened in local cooling test. *Conclusion*. Changes of the cerebral energy processes reflecting adaptive reactions of CNS of the person, in particular, distribution of DC potential in a cerebral cortex can be considered as "syndrome of the adaptive surplus of cerebral energy exchange".

**Key words:** Arctic zone, climatic and geographical conditions, central nervous system, cerebral energy metabolism, distribution of the direct current potential of the brain, cerebral energy expense

NEUTROPENIA'S FORMATION AS A CONSEQUENCE OF NEUTROPHIL MIGRATION ACTIVATION IN ALMOST HEALTHY PEOPLE IN THE NORTH

S. N. Balashova, L. K. Dobrodeeva

Federal Center for Integrated Arctic Research Russian Academy of Sciences, Arkhangelsk, Russia

*The aim*: to establish the causes of neutropenia formation in almost healthy people living in the North. *Methods*. The research was conducted with respect for the main standards of biomedical ethics. For performance of a goal two groups of the examined persons were allocated: with a neutropenia (<2,0 × 109 Cells/l) and with the physiological level of neutrophils in a peripheral blood (2,5­5,0 × 109 Cells /l). In the blood smears painted according to Romanovsky­Gimza leukogram, neutrogram, monocytogram, lymphocytogram and phagocytic activity of neutrocytes were studied. Determination of cytokine concentrations of interferon­gamma (IFN­γ) and granulocyte colony­stimulating factor (G­CSF) in serum was performed by enzyme­linked immunosorbent assay. Normality testing of quantitative indicators distribution was carried out using the Shapiro­Wilk test. The reliability of the differences between the groups was assessed using the Student's t­test and using the nonparametric Mann­Whitney method. *Results*. In the examined people, the frequency of neutropenia recording is 12,98 ± 0,27 %. It has been established that apoptosis of circulating neutrophils did not play a major role in the formation of neutropenia in the inhabitants of northern territories. With neutropenia, the content of segmented neutrophils is reduced, the frequency of detecting a shift to the left is higher (41,18 ± 3,75 versus 28,09 ± 0,84 %). In parallel with neutropenia, the monocyte and lymphocyte content decreases against the background of increased concentrations of IFN­γ and G­CSF. *Conclusions*. Neutropenia in the inhabitants of northern territories is a consequence of increased activity of migration processes of blood cells. Reduction of the neutrophilic granulocyte content in the peripheral blood initiates the activation of neutrophil proliferation and their antibody­dependent cytotoxicity.

**Keywords:** neutropenia, monocytes, lymphocytes, cytokines, cell migration, North

A COMPREHENSIVE ASSESSMENT OF THE CARDIOVASCULAR SYSTEM   
OF SPORTSMEN­SKIERS IN THE WINTER PERIOD OF PREPARATION   
FOR THE COMPETITION

B. F. Dernovoy, \*V. I. Prosheva

Medical­Sanitary Unit of Ministry of Internal Affairs of Russian Federation in Komi Republic, Syktyvkar;   
\*Institute of Physiology, Komi Science Centre, the Russian Academy of Sciences, Syktyvkar, Russia

*The aim* of the work is to study the long­term effect of intense sports loads on the human circulatory system. *The method* of echocardiography, electrocardiography, recording of arterial pressure and electrochemiluminescent study in the blood serum of B­natriuretic peptide was used to carry out a complex evaluation of the cardiovascular system in seventeen highly skilled skiers in winter, during high physical activity, in preparation for the competition. *Results.* It was found that the subjects at rest had reduced blood pressure and lowered heart rate to 53 beats per 1 minute. Tricuspid regurgitation from 1 to 1.5 degrees was registered in all athletes. It was found that the free wall of the left ventricle of the subjects in the systole thickens by 26% more than the hypertrophied interventricular septum. An increase in the level of B­ natriuretic peptide in the blood of athletes has not been revealed. *Conclusion*. The results obtained show that the cardiovascular system of skiers during the winter, in the period of preparation for the competition, is characterized by eccentric left ventricular hypertrophy, reduced barrier function of the tricuspid valve, a large contribution of the free wall to left ventricular contractility, a marked influence of the vagus on the SA node and the tone of the resistance vessels, the absence of an increase in the basal secretory function of cardiocyte in response to intracardiac hemodynamic loads.

**Key words:** heart athlete's, tricuspid valve, natriuretic peptide

VISUALIZATION OF BIOMEDICAL DATA USING R

1V. L. Egoshin, 2S. V. Ivanov, 3N. V. Savvina, 4S.B. Kalmakhanov, 3,5A. M. Grjibovski

1Semey State Medical University, Pavlodar Campus, Pavlodar, Kazakhstan; 2I. P. Pavlov First St. Petersburg State Medical University, St. Petersburg, Russia; 3North­Eastern Federal University, Yakutsk, Russia; 4Al­Farabi Kazakh National University, Almaty, Kazakhstan; 5Northern State Medical University, Arkhangelsk, Russia

The paper presents basic principles of using R software for visualization of biomedical research data. Basic types of graphs and algorithms for graph creation are presented. Specification of using different graph types in implementation of different data types is described.

**Key words:** statistical analysis, visualization, graphs, R