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Federal budgetary institution of science «Federal Scientific Center medical and preventive risk management technologies public health» of the Federal Service for Surveillance in the Sphere of Protection Consumer rights and human well-being
Office of the Federal Service for Supervision of Consumer Rights Protection And Human Welfare in the Perm region
Russian Academy of Sciences, Section of Preventive Medicine, Department of Medical Sciences
Federal State Budgetary Educational Institution of Higher Education
«Perm State Medical University named after academician E.A. Wagner»
Ministry of Health of the Russian Federation

WITH THE PARTICIPATION OF
RISE, Specialized Group on Environment and Neurology of the World Federation of Neurologists, University of Strasbourg (France), University of Oregon (USA), Uppsala University (Sweden)

HEALTH RISK ANALYSIS – 2021
ENVIRONMENTAL, SOCIAL, MEDICAL CARE AND BEHAVIOURAL ASPECTS
AND RISE-2021 MEETING ON ENVIRONMENTAL HEALTH

Dedicated to the year of science and technology in the Russian Federation

XI all Russian scientific and practical conference with international participation

Abstracts

(Perm, May 18–20, 2021)

Edited by Professor A.Yu. Popova, Academician N.V. Zaitseva

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Proceedings of the XI All-Russian Scientific and Practical Conference with International Participation «Health Risk Analysis – 2021 with the International Meeting on Environment and Health RISE-2021» summarize the scientific and practical experience accumulated by the conference participants in the field of ensuring the sanitary and epidemiological well-being of the population. The conference is dedicated to the Year of Science and Technology in the Russian Federation and pays significant attention to the implementation of national projects and the tasks set in the President's Address to the Federal Assembly.

The conference materials highlight the legal and current methodological aspects of health risk analysis, introduce Russian and international experience, assess the sanitary-epidemiological and medical-demographic problems of the regions at the present stage, including during the COVID-19 pandemic. It contains the results of the development of a risk-based model for organizing control and supervisory activities (priority for the safety of consumer products), including in the context of digital transformation. In the works of domestic and foreign scientists, the experience of risk assessment in hygienic and epidemiological research, in occupational health, and in the process of obtaining education is summarized. A number of articles contain the results of the stages of implementation of the national projects «Ecology» and «Demography». Methodological approaches to mathematical modeling of systems and processes, prevention of health disorders associated with heterogeneous risk factors are described.

A significant part of the articles reflects issues related to the assessment of the impact of physical factors (noise, electromagnetic radiation) in the conditions of intensive development of large cities and agglomerations. A separate section is devoted to chemical-analytical and information-program support for health risk assessment, medical and biological aspects of the impact of risk factors on human health. An assessment of the effectiveness of medical-preventive technologies is given.

In general, the materials of the conference contain the results of research and methodological developments that are relevant for the practical activities of the service when conducting hygienic investigations, research, examinations. The experience of the territories can be used to solve a number of tasks at the regional and municipal levels in the field of ensuring the sanitary and epidemiological well-being of the population and protecting the rights of consumers.

The materials are intended for specialists and organizations of the Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rospotrebnadzor) system, research institutions, educational institutions of higher education in the medical and preventive direction, students, graduate students, doctors and specialists working in related fields of science and practice.

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To the organizers and participants of the XI All-Russian Scientific and Practical Internet Conference with International Participation «HEALTH RISK ANALYSIS – 2021. External, social, medical care and behavioral aspects»

Dear Colleagues!

On behalf of the Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing, I greet the organizers and participants of the XI All-Russian Scientific and Practical Internet Conference with International Participation «HEALTH RISK ANALYSIS – 2021»!

This year, the conference is being held in the Year of Science and Technology and, at the same time, in a difficult sanitary and epidemiological situation and the COVID-19 pandemic. In this regard – the problems of developing the fundamentals and best practices of assessment and management of external environmental, industrial, social and other risks to public health come to the fore. The strategic directions of the Federal Service's activities remain: the development of science-intensive methods of socio-hygienic monitoring, the prevention of the consequences of the negative impact of chemical, physical, biological, including infectious factors, on health, containment and prevention of sanitary and epidemiological threats.

One of the most urgent directions of activity of the Service and its scientific organizations is further improvement of methodological risk-based model of control and supervisory activities, formation of the concept of «supervision of the future», development and introduction of modern, including remote, control and monitoring technologies to ensure sanitary and epidemiological welfare of population and protection of consumer rights.

The active work of Rospotrebnadzor on the implementation of national and federal projects is aimed at ensuring the tasks of improving the quality of life of the population of Russia, increasing healthy longevity and living standards of citizens, increasing the number, reducing mortality, ensuring the chemical and biological safety of the country's population. Currently, within the framework of the federal project «Strengthening public health» of the national project «Demography», the main efforts of Rospotrebnadzor are focused on creating a system of motivating citizens to a healthy lifestyle, including healthy and safe food, to improve the quality of life of current and future generations. A system of monitoring of the actual nutritional status of various population groups and, first and foremost, schoolchildren has been successfully organized, linking the state of health with the structure of nutrition and the quality of food products; scientific and methodological centers on healthy nutrition are operating. Regional and municipal programs to improve the health of the population are being developed, and the equipment base of testing laboratory centers is being modernized.

In the implementation of the measures of the federal projects «Clean Water» and «Clean Air» of the national project «Ecology», the system of social and hygienic monitoring is being improved with an in-depth assessment of the quality of air and water, a comprehensive analysis of the impact of environmental factors on health.

The development of a unified information analytical system of the the Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing is

in its active phase. The task of digitalizing all areas of Rospotrebnadzor's activities, creating an integrated data accounting system and operational analysis of situations with the use of modern information technologies at different levels of the management vertical is posed and solved.

In 2021, Rospotrebnadzor continues to develop and strengthen cooperation with international scientific organizations and departments of foreign states responsible for ensuring the sanitary and epidemiological well-being of the population of their countries. The exchange of experience, familiarity with new scientific developments and best practices will undoubtedly ensure more effective work in the field and the close interaction of specialists of different profiles and activities.

The most important task is to attract talented youth to the field of science and technology, to increase the participation of the professional community in the implementation of the Strategy for the scientific and technological development of the Russian Federation. The Competition for the Works of Young Scientists and Specialists of Rospotrebnadzor, held within the framework of the conference, is one of the elements of solving this problem. Communication of high-level professionals with those who are just starting their career, allows you to quickly and deeper understand the specifics of working methods, to see the prospects for their scientific and personal growth.

Your conference is being held in a difficult epidemiological situation in the Russian Federation. Analysis of problems and ways out of the situation, identification of factors that increase epidemic risks, assessment and improvement of the effectiveness of preventive measures, including mass vaccination – all these are areas of current research and discussion.

I am sure that during the conference there will be an interested and in-depth consideration of all the stated topics and a constructive exchange of views of scientists and practitioners.

I wish the conference success and fruitful work and productive discussions to the organizers and participants.

Head of Federal Service of the
Russian Federal Service for Surveillance on
Consumer Rights Protection and
Human Wellbeing,
Chief State
Sanitary Physician of the
Russian Federation  A.Yu. Popova

Section I

Legal and up-to-date methodological aspects of health risk analysis in providing sanitary and epidemiological well-being

RISK-ORIENTED SANITARY-EPIDEMIOLOGIC SURVEILLANCE: PROSPECTS GIVEN DIGITAL TRANSFORMATION

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It is shown that prospects for further development of risk-oriented sanitary-epidemiologic surveillance involve moving focus from field inspections onto remote control and substantially enhanced science-intense uninterrupted multi-variant analysis of data sets collected and accumulated digitally. This analysis is to be performed within an intellectual information system for remote surveillance which is now being developed by Rospotrebnadzor. This system uses the following initial data: documents with information on objects that are subject to surveillance (in data formats that can be read by a machine); data from remote control devices and devices that fix parameters of any activity under control; data obtained with other information systems. Information processing involves using up-to-date procedures for mathematical analysis, mathematical modeling, and artificial intellect including artificial neuron networks. This intellectual system uses results obtained via control and surveillance activities and data on adjourning processes and phenomena that, among other things, have cause-and-effect relations with facts of violations; the system provides adequate decisions taken as per results obtained via control activities as well as information and analytical support for a wide range of decisions taken in health protection sphere and providing sanitary-epidemiologic welfare of the population.

Key words: risk-oriented surveillance, remote control, digitalization, intellectual information system.

TOPICAL ISSUES OF STATE SANITARY AND EPIDEMIOLOGICAL REGULATION IN THE REPUBLIC OF BELARUS

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The object of research was the national system of state sanitary and epidemiological regulation.

The goal is to conduct a systematic analysis of the national system of state sanitary and epidemiological regulation, taking into account the membership of the Republic of Belarus in integration formations.

The right to health protection is enshrined in a number of normative legal acts that constitute national legislation. At present, the legislation of the Republic of Belarus does not contain

a single codified act regulating relations in the field of sanitary and epidemiological welfare of the population. In this regard, the legal regulation of relations in the field of sanitary and epidemiological welfare of the population is complex.

State sanitary and epidemiological regulation is one of the tools for ensuring the sanitary and epidemiological well-being of the population. Taking into account the adoption of the Decree of the President of the Republic of Belarus of November 23, 2017 No. 7 «On the development of entrepreneurship», as well as the development of the law of the Eurasian Economic Union, a number of new legislative acts have been adopted in the Republic of Belarus in recent years, regulating the issues of ensuring the sanitary and epidemiological well-being of the population.

According to the Treaty on the Eurasian Economic Union of May 29, 2014 in order to ensure the sanitary and epidemiological well-being of the population, the authorized bodies in the field of sanitary and epidemiological well-being of the population carry out state sanitary and epidemiological supervision (control) in accordance with the legislation of the Member States and acts of the Commission. Improvement legislation should be based on international obligations, not create additional barriers for business entities and ensure national interests.

The system of state sanitary and epidemiological regulation includes the following elements: legal regulation, institutional structure, law enforcement practice.

Key words: state sanitary and epidemiological regulation, scientific validity, risk assessment, legislation of the Eurasian Economic Union.

DYNAMICS OF CHANGES IN THE STRUCTURE OF SANITARY IMPROVEMENTS TO WORKING CONDITIONS IN MINERAL MINING ENTERPRISES BEFORE AND AFTER THE IMPLEMENTATION OF A RISK-BASED APPROACH INTO THE ACTIVITIES OF ROSE CONSUMPTION

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The object of the research is the acts of inspections of enterprises for the extraction of minerals in the territory of the Perm Territory for 2013–2019.

The purpose of the study is to determine the structure of violations of sanitary requirements for working conditions at mining enterprises in the Perm Territory before and after the introduction of a risk-based approach to the activities of Rospotrebnadzor.

Materials and methods. The structure of violations of sanitary requirements for working conditions at mining enterprises was investigated in the context of articles of Federal Law No. 52-FZ and production factors. The contribution to the overall structure of violations was determined using standard methods of analysis, including the Student's t-test.

Main results. It was found that the number of violations of sanitary requirements for working conditions at mining enterprises since the year of transition of sanitary and epidemiological supervision to a risk-based approach (2017) significantly ($p < 0.05$) decreased by 2 times: from 62 violations to 2013–2016 up to 31 in 2017–2019 The number of violations decreased, mainly due to a decrease in the number of violations of requirements for the maintenance of production and household premises (by 4.04 violations), lighting (by 3.10 violations), ventilation (by 2.22 violations), chemical factor (by 1, 19 violations). Accordingly, in the period 2017–2019. the contribution of violations of the requirements for the maintenance of production and household premises (4.44 times), ventilation (3.74 times), illumination (2.74 times), the chemical factor (1.79 times) in the structure of violations decreased, while the contribution of violations of the requirements for overalls and PPE increased (4.38 times), noise (1.66 times). The decrease in the number of violations of sanitary requirements for working conditions at mining enterprises and the level of occupational morbidity confirm the feasibility of introducing the methodology for assessing the risk to public health, including workers, in the activities of Rospotrebnadzor.

Key words: sanitary requirements, working conditions, workers, mining, sanitary and epidemiological supervision.

INFLUENCE OF REGULATORY GUILLOTINE ON ESTIMATION OF ELECTROMAGNETIC RADIATION OF RADIO FREQUENCIES FROM BASE STATIONS OF CELLULAR COMMUNICATIONS

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The regulatory guillotine, carried out in 2021, along with the benefits for the country's economy, introduced a number of difficulties in the work of laboratories. The article considers the regulatory documents used in the control of electromagnetic radiation of the radio-frequency range, which have been affected by it.

The composition of the equipment for base stations of cellular communication is indicated, the features of modern communication equipment that affect the need for measurements at workplaces are described. Indicated are the normalized indicators characterizing the electromagnetic field of the radio frequency range at workplaces and in the surrounding area.

The canceled and newly introduced documents are presented, as well as possible ways of monitoring the electromagnetic radiation of the radio frequency range. It is shown that the ability to control is not lost.

Key words: electromagnetic radiation of radio frequencies, calculation of energy exposure, base station, workplaces, impact on the population.

JUSTIFICATION OF REGULATIONS FOR THE CONTENT OF CHEMICALS IN THE ATMOSPHERIC AIR DURING CHRONIC ADMISSION USING HARMONIZED METHODOLOGICAL APPROACHES

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Based on the results of the study, the key elements of the methodological approaches used to substantiate the norms and standards for atmospheric air quality, taking into account the chronic intake in the Russian Federation and foreign countries, were identified, and the degree of their harmonization was assessed. It was found that in a number of elements the methods are not harmonized or only partially harmonized. In accordance with the results obtained, harmonized methodological approaches have been developed that can be used to substantiate the average annual hygienic standards for the content of chemicals in the ambient air, which will allow them to be used as criteria for assessing health risks from chronic inhalation exposure.

Key words: average annual MPC, hygienic standards, risk criteria, harmonization, atmospheric air.

TO THE QUESTION OF IMPROVING THE SUPERVISION MEASURES OF THE OFFICE OF ROSPOTREBNADZOR IN THE CHELYABINSK REGION IN THE PART OF IMPLEMENTATION OF THE FEDERAL PROJECT «CLEAN AIR»

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The presented article discusses the issue of improving the assessment by the Rospotrebnadzor Administration in the Chelyabinsk region of certain works aimed at achieving the target for reducing the total volume of pollutants in the atmospheric air of populated areas within the framework of the Federal Project «Clean Air» of the national project «Ecology».

The purpose of the study is to analyze and assess the content of chemicals in the atmospheric air, and improve the comprehensive plan of measures to reduce emissions of pollutants into the atmospheric air.

Inconsistencies in regulatory requirements were identified. Within the framework of the project, the planned reduction in the total volume of emissions for the period of 2024 in Chelyabinsk is 3.92 % of the 2017 level (12.69 thousand tons), in Magnitogorsk it is 8.27 % of the 2017 level (287.993 thousand tons). tons), which does not allow reducing the target indicator of the federal project to 22 %; when calculating the reduction in emissions, the implementation of measures for the reclamation of urban landfills was not taken into account, and the volumes of emissions from transport were not taken into account; the proposed measures do not take into account the priority reduction of the most dangerous and toxic substances typical for atmospheric air pollution.

One of the reasons for the insufficient assessment of the effectiveness of the planned measures specified in the comprehensive plans is the lack of performed calculations to assess the risk to human health, there is no detailed calculation for each pollutant emitted into the atmospheric air from a specific source.

It was revealed that the hygienic standards of pollutants in the air were exceeded in terms of ethylbenzene, toluene, benzene, which are observed at route posts located at the intersection of major highways. The excess of specific substances phenol, benzo (a) pyrene and naphthalene indicates the presence of emissions from industrial enterprises.

When enterprises implement measures to reduce emissions of pollutants into the air and carry out continuous monitoring of the quality of atmospheric air in populated areas, as well as carry out work to assess the risk to public health, it is planned to assess the economic efficiency of each performed measure.

Key words: «Clean Air» project, atmospheric air, comprehensive plan, social and hygienic monitoring, risk assessment.

PROTOCOL ON WATER AND HEALTH AS A POTENTIAL TOOL TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS FOR WATER SUPPLY, SANITATION AND WATER PROTECTION

S.I. Sychik, E.V. Drozdova, I.A. Prosviryakova, A.N. Gankin, A.E. Pshegroda, A.V. Firago, T.Z. Surovets, V.A. Zankevich

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The Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes, adopted in London on June 17, 1999, thanks to a mechanism for setting targets and reporting successfully tested over 20 years, is one of the tools to achieve the Goals. Sustainable development until 2030 in the field of water supply, sanitation and water protection in the European region.

Key words: sustainable development, Protocol on Water and Health, targets, water supply, sewerage, protection of water resources.

REQUIREMENTS FOR HYGIENIC SAFETY OF MATERIALS IN CONTACT WITH FOOD PRODUCTS

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The relevance of this study is due to global trends aimed at abandoning the use of plastic packaging and replacing it with biodegradable ones. The creation and use of bioplastics from renewable natural resources will not only improve the environmental situation, but also contribute to the transition to a circular economy model, which is an important priority in the economic development of the state. However, at present, aspects of the safe use of new types of polymers – biopolymers, as materials in contact with food products require additional study. One of the promising biodegradable materials for the manufacture of packaging is polylactide, a condensation product of lactic acid, which is obtained as a result of fermentation from renewable plant sources.

The aim of the work was to study and hygienically evaluate the levels of migration of individual chemicals from a sample of polylactide film intended for contact with food products. In finished extracts, the amounts of chemicals controlled in polyolefins (classical polymers, based on oil raw materials) were determined. According to the results of the study, the migration of dioctyl phthalate into a 3 % solution of acetic acid was 0.16 mg/dm^3, the migration of acetone into a 2 % solution of citric acid and isopropanol into a 0.3 % solution was 0.1 mg/dm^3. Migration of methyl methacrylate, ethyl acetate, butyl acetate, benzene, methanol, propanol, isopropanol, butanol, isobutanol, dimethyl terephthalate, dimethyl phthalate, diethyl phthalate, dibutyl phthalate into the used model media was not detected. The hygienic assessment of the data obtained did not reveal any excess of the permissible migration amounts established for the investigated substances.

Key words: materials in contact with food products, packaging, safety, polymeric materials, polylactides.

ISSUES OF HYGIENIC SAFETY OF FOOD PURPOSE POLYMER MATERIALS

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The object of research is polymeric materials intended for contact with food – from the experience of many years of work.

The purpose of the research is to study the laws governing the migration of substances from polymeric materials, due to the formulation and production technology; in toxicological experiments, the study of various aspects of the biological action of extracts from polymeric materials.

The studies used sanitary-chemical methods, biochemical, toxicological methods, methodological approaches to studying the possibility of reducing the time of chronic experiments. Based on the results of the work, methodological documents were prepared, the timing of accelerated toxicological experiments was scientifically substantiated, and new polymeric materials were introduced into practice.

Key words: fluoroplastics, polyolefins, organosilicon materials, hygienic safety, hygienic assessment.

THE USE OF CLUSTERING METHOD TO ASSESS FOOD CONSUMPTION STRUCTURE TO ASSESS RISK ASSOCIATED WITH ANTIBIOTIC RESIDUAL QUANTITIES

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This article presents the results of using the clustering method to assess the structure of food consumption in order to assess the risk associated with antibiotic residues.

The purpose and objectives of the study. Apply a cluster analysis method to assess the structure of food consumption in order to assess the risk associated with antibiotic residues, develop a working algorithm.

Materials and methods. The data for the assessment are obtained from the study of actual nutrition by analyzing the frequency of food consumption. The consumption of dairy and meat products potentially containing residual contaminants was assessed; 583 questionnaires were processed. Statistical processing of the obtained data was carried out using the Statistica 10.0 package.

Results. The processing of data on food consumption can be carried out using the method of cluster analysis, one of the advantages of which is the ability to identify typologically homogeneous groups of consumers with similar diets. The calculation of statistical indicators for homogeneous groups makes it possible to determine the most realistic model of consumption of food products containing residual amounts of antibiotics, which makes it possible to assess exposure and quantitative risk. To carry out statistical processing of data from studies of food consumption, a working algorithm is proposed, including the determination of typological homogeneous groups of food consumption using the cluster analysis procedure and the K-means method, assessing the quality of the classification results using the adjusted R-square method, determining statistical indicators for homogeneous groups. According to the results of the study, the most realistic models of consumption of dairy and meat products that can be used to calculate exposure and assess the risk associated with residual amounts of antibiotics were found in the first and third clusters, where moderate consumption with a predominance of meat food was found in the first cluster (94 questionnaires), with a predominance of dairy – in the third cluster (104 questionnaires); the median consumption of dairy and meat products in the first cluster was 115.9 g/day and 240.4 g/day, in the third – 192.4 g/day and 91.7 g/day, respectively.

Key words: consumption, dairy products, meat products, clustering method.

STUDY OF NITRATE CONTENT IN VEGETABLES TO ASSESS POPULATION HEALTH RISK

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The aim of the study was to study the content of nitrates in vegetable products consumed by the population of the Arkhangelsk region.

Materials and methodologies. To study the content of nitrates in vegetables, the database of the FSFHI «Center for Hygiene and Epidemiology in the Arkhangelsk Region» for 2008–2018 was used. Nitrate concentrations were analyzed in 11 groups of vegetable products: zucchini, white cabbage (late and early), potatoes, leafy vegetables, feather onions (open and protected ground), onions, carrots (late and early), cucumbers (open and protected ground), sweet peppers (open and protected ground), beets, tomatoes (open and protected ground). A total of 4058 samples were analyzed. The median (Me), 95 % confidence interval for Me, and 90th percentile (P90) were used to describe nitrate content. The Kruskal-Wallis test was used to compare nitrate concentrations in vegetables depending on the place of production.

Results. At the median concentration level and P90, the highest nitrate content was found in beets (338 and 1306 mg / kg, respectively), zucchini (319 and 1144 mg / kg, respectively), early white cabbage (206 and 705 mg / kg, respectively) and late white cabbage (179 and 440 mg / kg, respectively). At the level of median values of nitrates, no excess of maximum permissible concentrations (MPC) was established. At the P90 level, an excess of the MPC was found in zucchini by 2.9 times and in cucumbers grown in the open field – by 1.9 times. The content of nitrates in zucchini and potatoes grown on the territory of the Arkhangelsk region turned out to be 1.5–2.6 times lower than in vegetables grown in other regions of Russia, the CIS countries and far abroad ($p = 0.001–0.047$). The results obtained showed the need for constant monitoring of the safety of vegetable products, bringing to the public the recommendations for cooking vegetables to reduce the content of nitrates in them and strengthening control when using mineral fertilizers.

Key words: vegetables, nitrates, monitoring, food safety.

THE METHODOLOGICAL APPROACHES FOR SELECTING PRIORITY FOODSTUFFS FOR FURTHER IDENTIFICATION OF POTENTIALLY HAZARDOUS UNINTENTIONALLY PRESENT CHEMICALS

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In the European Union, a risk assessment has been under consideration for several years for substances that are identified in food research that do not have hygienic standards, but which may be potentially hazardous. This issue is also relevant for the Russian Federation, as many chemicals are capable of migrating into food at different stages of food production, packaging, and transport. The aim of the study was to develop methodological approaches for selecting food products for further testing for potentially hazardous unintentionally present chemicals. In order to achieve this objective, the method of study and critical analysis of the domestic and foreign regulatory framework as well as relevant scientific sources regarding methodological approaches to the study of food choice issues and methods of determining unintentional chemical impurities in foodstuffs has been applied. Due to the lack of uniform requirements for the selection of priority food products for the determination of potentially dangerous chemicals in both Russia and the European Union, an algorithm for the selection of food products for the identification of unintentionally present chemicals in it is proposed, and criteria for the adequacy of the choice of food products are established. According to the proposed choice criteria, the priority product group was milk and dairy products in terms of milk. After applying the criteria to establish a priority food product within the group, whole drinkable milk was identified as a priority food product to further identify and assess the potential hazard of unintentionally present chemicals.

Key words: methodological approaches, food products, group of food products.

JUSTIFICATION OF THE PERMISSIBLE DAILY DOSE OF PHTHALATES IN ADMISSION WITH MILK AS A CRITERION OF ENVIRONMENTAL SAFETY

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Phthalates, phthalic acid esters are actively used in the production of PVC-materials in order to make them strength and flexibility. They might migrate from them to the environment. Phthalates have an adverse effect on the human body in relation to the hormonal system, liver, kidneys. What is more, they may have a systemic effect. The analysis of phthalates migration from

polymer packaging into food products is of the greatest interest for the research. They remain the main source of several phthalates in the human body. When it comes to the intake of phthalates into the human body, we emphasize milk, which is one of the most frequently consumed foods by the population. In the the EAEU countries, the phthalates migration is regulated without considering the eventual health risk. In this regard, it is of use to develop hygienic standards taking into account the public health risk criteria. The development of permissible daily exposure (PDE) is one of the stages when creating the standards. The permissible daily exposure to phthalates intaking with milk as per the health risk criteria was specified according to the methodology of the Eurasian Economic Union and included the following steps: analysis of relevant information for the hygienic assessment of the phthalates impact; the selection of starting points and modifying factors for the PDE calculation; establishing the permissible daily exposure to phthalates; assessment of milk consumption (in total, the survey involved 30 children aged 7–17 years as the most sensitive group of consumers included in further research). As a result, the maximum permissible level can be calculated using the PDE, which ensures the absence of harmful phthalates effects at the level of 0,001 mg/kg per day.

Key words: milk, phthalates, rationing, permissible daily dose.

IMPLEMENTATION OF TASKS UNDER THE FEDERAL PROJECT «STRENGTHENING PUBLIC HEALTH» OF THE NATIONAL PROJECT «DEMOGRAPHY» IN THE REPUBLIC OF BASHKORTOSTAN IN 2019–2020

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The article focuses on the implementation of the goals and activities of the federal project «Strengthening Public Health» of the national project «Demography» in 2019–2024 in the Republic of Bashkortostan.

The purpose of the study.

1. Assessing the availability to the population of domestic food products that contribute to the elimination of macro- and micronutrients deficiencies, by surveying retail trade organisations in cities, municipal districts, urban-type settlements and settlements of the Republic of Bashkortostan (hereinafter – RB);

2. Monitoring the nutritional status of pre-school and school-age children by parents together with children in different age groups;

3. Determination of quality indicators of food products through laboratory research, tests of food products manufactured in the Russian Federation (hereinafter – RF) and RB in retail food trade organisations.

4. Assess labelling (labels and/or inserts) of samples for compliance with regulations.

Key words: federal project «Strengthening Public Health» of the national project «Demography», accessibility, food quality, strengthening public health.

ORGANIZATIONAL AND METHODOLOGICAL APPROACHES TO REDUCING MORTALITY IN PERSONS OVER WORKING AGE

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Despite numerous studies dedicated to the possibility of reducing mortality in older age groups, no effective approaches to significantly reduce mortality in this population have been developed so far. At the same time it is authentically established that mortality among older people is reliably growing and depends on age, sex, socio-hygienic, economic, medical-biological, production, behavioral factors, medical care. The cardiovascular diseases (AH, CHD, myocardial infarction), diabetes mellitus, cancer, and infectious diseases, chronic obstructive pulmonary disease, bronchial asthma lead to a high mortality rate among people over the working age. Mortality in older age groups from cardiovascular disease is 57.1 %, cancer 16.3 %, acute cerebrovascular disease 34.5 %, external effects trauma 13.2 %, diabetes 3.5 %, ischemic heart disease 50.0 %.

At the end of the 2000s, programs to reduce mortality were developed in various regions of our country. These programs have had the effect of curbing the intensive growth of mortality in the population. However, these programs did not have a significant effect on reducing the overall mortality rate and proved ineffective. At the same time, it should be said that in the Republic of Tatarstan, the creation since 2008 of 17 centers for the treatment of acute cerebral circulation disorder has led to a decrease in mortality by 12 %.

There is no evidence in the literature about the existence of effective programs to reduce mortality among people over working age. The lack of effective programs to reduce mortality in the elderly population is due to the complex nature of this problem and requires a systematic approach, the involvement of administrative bodies of state power, sanitary service, life support system (LSS), health care system (HSS), medical organizations (MO), and educational institutions to solve this problem.

Key words: mortality of persons over the working age, economic, environmental risk factors, health protection system, regional program.

ALTERNATIVE METHODS OF RESEARCH ON THE SANITARY-EPIDEMIOLOGICAL STATE OF THE TECHNOLOGICAL ENVIRONMENT OF FOOD PRODUCTION FACILITIES

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The object of the study was samples taken from various objects of the environment of food production.

The aim of the work was to study environmental objects of food production with ATP – luminometry and develop an algorithm for its use.

Researches of wash-offs from technological equipment, hands of personnel and overalls were carried out. A comparison of the values of the ATP luminometer (RLU) with the obtained values of the number of microorganisms was carried out during the cultivation of inoculations of wash-offs on a nutrient medium prepared in the laboratory and on ready-made commercial substrates (CFU / 100 cm^2).

Key results. It is recommended to apply ATP bioluminescence in addition to visual inspection to monitor the overall hygiene level to obtain information on the cleanliness level in the test environment. To use this method as an intervention tool for identifying and eliminating the causes of surface contamination, it is necessary to develop a hygienic standard that determines the limit values of ATP in wash-offs. The RLU limit value level can be pre-determined for each object using classical microbiological methods by the food manufacturer and tracked over time during the implementation of the production safety control programs in the food enterprise.

When using the ATP bioluminescence method during the operation of a food enterprise, it is recommended to control surfaces that are not in contact with food, but are closely adjacent to surfaces in contact with the product.

Key words: wash-offs, microbiota, ATP, luminometry, food production.

SCIENTIFIC JUSTIFICATION AND APPLICATION OF EXPOSITION AND EFFECT BIOMARKERS IN THE SYSTEM OF PROVING THE CAUSE OF HARMFUL IN THE IDENTIFICATION OF AN UNACCEPTABLE RISK CAUSED BY ENVIRONMENTAL FACTORS

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The elements of scientific and methodological approaches proposed for solving the problems of establishing cause-and-effect relationships of health disorders in identifying an unacceptable risk due to the impact of environmental factors of various origins are presented. The existing experience and the results of our own scientific research allowed the development of a biomonitoring system, including biomarkers of exposure and effect, designed to form an evidence base for causing harm to human health under the negative impact of environmental and industrial chemical factors in the micro- and nano-range. The scientific substantiation of the developed methodology is based on the principles of evidence-based medicine, epidemiological analysis, theoretical knowledge and is consistent with international risk assessment practice.

Key words: unacceptable risk, environmental factors, biomarkers of exposure and effect, cause-and-effect relationships, harm to health.

MOBILE PHONES AT SCHOOL AS A RISK FACTOR OF HEALTH DISORDERS IN THE CONDITIONS OF THE MODERN EDUCATIONAL ENVIRONMENT

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The article provides data from the results of a study conducted in 2020 in order to monitor the introduction of restrictive measures on the use of mobile communication devices by schoolchildren. The study included 2 stages of a sociological survey, an assessment of the dynamics of visual impairment, mental performance, psychoemotional state, physical activity in children of the two observation groups. The assessment of the risk of health disorders in the group using mobile phones was carried out using the odds ratio method. It was found that the risk of pathological refractions in the control group was significantly higher than in the observation group only in subgroups of children with normal vision and premyopia; the odds ratio in the group with myopia was less than one. When assessing the chances of a decrease in mental performance in dynamics by the last lesson, it was found that the risk of a decrease in mental performance in terms of "work efficiency" in the group of children using mobile phones at school is 2 times higher than in the observation group. The odds ratio analysis found that children without mobile phone use during the school day were 1.8 times more likely to have high levels of anxiety than children without mobile phone use during the day. The results of the final stage of monitoring can serve as evidence of the influence of prolonged use of mobile phones at school on an increase in the risks of visual impairment, decrease in mental performance, attentiveness, and a decrease in the motor component of the students' regime during recess.

Key words: mobile phones, health risks, odds ratio.

Section II

International meeting RISE–2021. Sanitation and epidemiological situation, health risks during the COVID–19 pandemic

OBSERVATIONS AND QUESTIONS ABOUT THE COVID-19 PANDEMIC

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Seventeen months after the January 30, 2020 declaration by the World Health Organization of a Public Health Emergency of International Concern (PHEIC) regarding the spread of COVID-19, SARS-CoV-2 had infected over 145 million humans worldwide and killed more than 3 million. We critically examine information on the origin of the virus, when and where the first human cases occurred, and the differential clinical presentations of COVID-19 that affected choice of treatment. The official patient Zero is said to have been hospitalized in Wuhan, Hubei province, China, on December 8, 2019. We have reviewed the pandemic spread outside China according to the first reported cases in several countries. We stress the importance of SARS-CoV-2 virus or its RNA detection, the only methods that bring etiological certainty. Retrospective analyses have established previous viral circulation, notably in France, Italy and USA. The knowledge of such a virus circulation in China would have been of major scientific importance, as it would have contributed to the identification of the origin of SARS-CoV-2. Coronavirus presence in fauna (bats, pangolin) and animal farms (e.g., mink) has been documented, but although likely, one (or several) of these animals is at the origin of the human pandemic remains disputed. We present two contamination models, the spillover versus the circulation model; the latter brings some interesting hypotheses about previous SARS-CoV-2 virus circulation in the human population. An additional concern are the differences in the clinical description of COVID-19. The age distribution of hospitalized patients at the start of the epidemic differed between China and in the USA-EU; Chinese hospitalized patients were notably younger. Early Chinese publications did not describe anosmia-dysgeusia, which became later a cardinal symptom of COVID-19 in Europe and USA. The prominent endothelial involvement linked with thrombotic complications was discovered late and, therefore, anticoagulant therapies were markedly delayed.

Key words: SARS-CoV-2, patient zero, zoonotic disease, autopsies, clinical presentation, hyposmia/anosmia.

NEUROLOGICAL INVOLVEMENT AND SEQUELAE OF COVID–19

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Major differences in the risk of acquiring, and death rates from, COVID-19 are evident across the world. As of early March 2021, the reported average global fatality rate (2.22 %) was 58 % higher in Peru and 58 % lower in Taiwan. The explanation for divergent rates of COVID-19 infection is likely multifactorial: population age, density, acquired immunity to prior coronavirus infection, differential infection with SARS-CoV-2 variants, biological and sociological factors linked to risk of infection, and face-masking practices, among other factors, notably differential governmental responses prior to and during the pandemic (J. Reis et al., *this meeting*). While neurological manifestations (reduction/loss of smell and taste, altered mental status, meningitis, seizures, myelitis) may present in COVID-19, cardiovascular (e.g., multiorgan failure, arterial and venous stroke) and pulmonary dysfunction usually dominate the acute phase of illness. While entry of SARS-CoV-2 into the brain is proposed to occur via the olfactory nerve and other routes, including the blood-brain barrier, the virus may be undetectable in brain tissue post-mortem amid evidence of multifocal microvascular injury with fibrinogen leakage, perivascular activated microglia, macrophage infiltrates, and hypertrophic astrocytes. Neuronophagia may be present in the olfactory bulb, substantia nigra, dorsal motor nucleus of the vagal nerve, and the medullary center responsible for spontaneous rhythmic breathing. Spinal cord, cranial nerve, peripheral nerve and muscle lesions may also occur. A significant percentage of patients (females>males) develops post-acute sequelae ("long-haul COVID-19") marked by relapsing and remitting symptoms (e.g., headache, fatigue, exercise intolerance, hypotension, cognitive problems, mood disorders, dysautonomia, sleep-wake disturbances) that can persist for many months. Long-haul COVID-19 affects both adults and children, including those who had mild acute illness, and may pose higher risks of death. Rarely, children develop brain and organ inflammation (cytokine-mediated multisystem inflammatory disease). The risk of longer-term changes in brain function of children and adults is unknown, but there is special concern for those with persistent hyposmia/anosmia because, in other settings, this symptom can herald onset of progressive neurodegenerative disease. Standardized multidiscipline assessment and ongoing tracking are needed for COVID-19 patients, to include accessible biomarkers of brain integrity, clinical examination and imaging, and post-mortem biospecimen analysis. Prudence demands measures to lower the risk of infection, global immunization, public health measures and health services preparation for potential delayed/long-term effects of COVID-19, including neurological and neuropsychiatric sequelae.

Key words: SARS-CoV-2, brain, long-haul COVID-19, hyposmia/anosmia.

IMPACT OF THE NOVEL CORONAVIRUS INFECTION COVID–19 ON MENTAL HEALTH: PROBLEMS AND SOLUTIONS

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The report will highlight the results of international research on the mental health impact of the novel coronavirus pandemic. Biological, social and psychological risk factors for the development of mental disorders during a pandemic will be discussed. Special attention will be paid to the problem of the bi-directional relationship between the new coronavirus infection and mental disorders, as well as its importance for organizing assistance in the context of the COVID-19 pandemic.

Key words: mental health, brain disease, COVID-19.

IMPACT OF THE FIRST COMPLETE LOCKDOWN IN 2020 IN FRANCE ON THE HOSPITAL ADMISSIONS OF STROKE AND TIA

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Background. COVID-19 pandemic have reduced hospital admissions of non-COVID-19 emergencies. Stroke and TIA admissions decreased with COVID-19 pandemic in all developed countries. The first total lockdown in France from 17 march to 11 may 2020 was associated with a decrease of hospital admissions of stroke and TIA. The deepness of the decrease varied according developed countries. But data are lacking about the trends of the recovery after the end of the lockdown of stroke and Transient Ischemic Attacks.

Objectives. We aimed to evaluate the impact of the COVID-19 pandemic on the trends of hospital admissions before, during and after the end of the lockdown in France (17 March to 11 May 2020).

Methods. Two French contrasted regions in which COVID-19 spread at different rates were evaluated. Administrative data were provided by the French National Hospital Discharge Data Base and the National Committee for Data Protection.

Hospital data. Two contrasted regions were studies: Grand-Est region (5.5 million inhabitants, 111 hospitals and 15 706 patients with COVID-19 infection) and Occitanie (5.9 million inhabitants, 121 hospitals and only 4 075 patients with COVID-19 infection.

All patients from all the public and private hospitals, were collected, from January to June 2020 including the lockdown (17 March – 11 may 2021) compared with similar data from 2017, 2018, 2019.

Codes for Ischemic Stroke were I63 and I64, for Hemorrhagic Stroke (I60, I61, I629) and TIA (G45).

Statistical analysis. Fischer-exact test (qualitative variables) and student t test, Mann-Whitney U test (quantitative variable) were used.

Results. We observe a significant decline in hospitalization rates for stroke/TIA in the most affected region during April 2020 compared with previous years, contrasting with no significant decline in the least affected region.

To the opposite, we observed a fast catch-up of the rate of hospital admissions in the most affected region contrasting with the slower rebound in the least region.

Discussion. Our results demonstrate a significant drop in stroke / TIA hospitalization during the lockdown as well as in literature (drop between 25 % and 48 %), with a fast drop in Grand-Est (the most affected region) and slow drop in Occitanie (the least affected region). For the first time, we report a fast and significant recovery after the end of the lockdown in affected Grand-Est but not in Occitanie.

The causes of the drop are multiple. Priority to COVID-19 patients, risk of exposure to COVID-19 in hospitals, public message to stay at home to avoid additional pressure on hospitals and health care workers, death at home, misdiagnosis in emergency room, a possible decrease of incidence rates due to the decrease of Air Pollution, a major factor of stroke.

The consequence of the drop may be severe: no access to active treatments (thrombolyse and mechanical thrombectomy), premature death, severe complications, no access to secondary prevention.

The possible mechanisms of the speed of the post-lockdown catch-up are the fact that stroke/TIA need emergency care, a decrease of the hospital pressure was observed and the speed of the catch-up depends on the deepness of the drop as our work seems to observe.

Further works to evaluate the outcome of the patients are necessary with stroke/TIA who did not access to hospital, to recommended emergency care and to secondary prevention, disparities in the intensity of COVID-19 infection and the role of the decrease of air pollution.

Key words: stroke, Transient Ischemic Attack, lockdown, hospitals admission, COVID-19.

STROKE AND STROKE RISK FACTORS AS DISEASE BURDEN

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Stroke is the most common cause of disability and death in the world. Cardiovascular disease rates increase with age (10.9 % for 20–30 ages and 85.3 % for older 80 ages). Coronary heart diseases is the leading cause of deaths attributable to cardiovascular diseases in the United States, followed by stroke, high BP, HF, diseases of the arteries, and other cardiovascular diseases. The report on the global burden of neurological disorders showed that burden consists of 35.7 % hemorrhagic stroke, 22.4 % ischemic stroke. Seven health metrics are important and strategic to prevent cardiovascular disorders; Healthy diet pattern, sufficient physical activity, smoking, BMI, cholesterol level, blood pressure, fasting blood glucose. These metrics include also health behavior (diet quality, PA, smoking, BMI) which are as important as health factors (blood cholesterol, BP, blood glucose). There is a strong protective association between ideal cardiovascular health metrics and many clinical and preclinical conditions including premature all-cause mortality, stroke, CVD mortality, ischemic heart disease mortality, HF, deep venous thromboembolism, and pulmonary embolism. Atrial fibrillation, metabolic syndrome, renal failure, sleep apnea are important risk factor which is modifiable, treatable. Air pollution was reported as an increasing and very important risk factor for stroke. COVID-19 have been reported as another new stroke risk factor during the pandemic. Future targets must include each cardiovascular health metric to decrease stroke risk burden and stroke risk.

Key words: Cerebrovascular disease, COVID-19, disease burden, environmental, prevention, risk factors, stroke.

RISK FOR COVID-19 IN PATIENTS WITH MS IS ASSOCIATED WITH IMMUNOTHERAPY

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Immunomodulatory drugs are important to control disease activity in relapsing remitting multiple sclerosis (MS). Anti-CD 20-therapy is one of such medications. In Sweden extensive off label prescription of rituximab (RTX) in MS has been documented and prescribed in more than half of all MS patients. The rationale for increasing prescription of RTX was

previous data from phase II and observational studies supporting high efficacy and safety, in addition to the financial aspect. We report national data on RTX use and risk for severe COVID-19 in MS patients.

Method. The Swedish National MS Registry (SMSreg) aims to cover all patients with MS in the country, (n = approximately 18 0000, Jan. 2021). After the start of the COVID-19 pandemic in Sweden, a new section to register clinical and demographic parameters in COVID-19 infected patients was established.

Results. As reported from the SMSreg, nearly 1 % of the Swedish 5927 RTX-treated MS patients had been hospitalized for COVID-19 (as of the 25th of January 2021) and adjusted analyses showed a 2–3 fold risk increase ($OR = 2.89$, $p = 0.001$) for hospitalization in anti-CD20 treated patients. A change of praxis was introduced in spring 2020 resulting in a majority of patients receiving RTX infusions with extended intervals.

Conclusion. Exposure to immunomodulatory therapy for chronic diseases can change during a pandemic, the effects of which are difficult to foresee.

MENTAL HEALTH OF MEN OF WORKING AGE ASSOCIATED WITH THE NEW COVID-19 CORONAVIRUS INFECTION

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In order to study the mental health of men of working age who had contracted the new coronavirus infection COVID-19, we conducted neuropsychological testing of 60 patients aged 34 to 57 years, using specialized questionnaires to assess the psychoemotional state, sleep disorders, and cognitive functions. It is found that the main neuropsychiatric manifestations in COVID-19 survivors are asthenoneurotic, dissomnic, and obligate cognitive-mnemonic disorders. Therapeutic and prophylactic recommendations for the optimization of mental health disorders in the survivors of coronavirus infection using psychotherapeutic treatment and methods of psychological and functional rehabilitation are offered.

Key words: mental health, psychoemotional disorders, new coronavirus infection, neuropsychological testing, working age.

OCCUPATIONAL PATHOLOGY IN THE BASHKORTOSTAN REPUBLIC DURING THE CORONAVIRUS PANDEMIC

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The COVID-19 infection as a new disease of the occupational etiology among medical workers has led to a change in the statistical indicators and structure of occupational morbidity. In order to study the reasons for the change in the structure of occupational morbidity, an analysis of the newly identified occupational pathology in the Republic of Bashkortostan was carried out on the basis of acts on the case of occupational disease and registration form No. 30 for 2020.

Results. There was a change in the structure of occupational pathology in the Bashkortostan Republic due to the emergence of a new coronavirus infection for the first time in all years of observation, which brought a group of diseases from the impact of an industrial biological factor to a leading position. The difficult epidemiological situation resulted in a dramatic decrease in the diagnosis of other forms of occupational pathology.

Key words: occupational diseases, new coronavirus infection.

HYGIENIC ASSESSMENT OF PROFESSIONAL HEALTH RISKS OF MEDICAL WORKERS OF AN EMERGENCY CARE UNDER THE COVID–19 PANDEMIC

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The COVID-19 pandemic has drawn attention to the problem of creating a safe working environment in the medical environment from the standpoint of a risk-based approach. Medical workers of the field teams of ambulance stations (EMS) are particularly susceptible to contact with the causative agent of COVID-19.

The aim of the work was to analyze the professional risk of infection with COVID-19 of medical workers of mobile ambulance teams.

Materials and research methods. A comprehensive assessment of occupational risk was carried out on the basis of categorizing the risk by classes of working conditions, a biomedical assessment of the incidence of COVID-19 taking into account the category of disease severity, epidemiological data on the degree of association of infection of employees with professional activity by calculating the relative risk and etiological proportion, mortality and underlife rates. …

The established exposure of the biological factor, in particular, contact with SARS-CoV-2, belonging to the II pathogenicity group, allows us to determine the class of working conditions of the studied group of workers by the biological factor as harmful of the third degree. The causal relationship of health disorders of emergency medical workers with work is determined as almost complete,

as a result of which the detected cases of infection can be considered as professional. The established class of working conditions by the biological factor, the index of occupational diseases, laboratory materials confirming the infection of workers with SARS-CoV-2, as well as the results of the analysis of morbidity and epidemiological data allow us to determine the category of occupational risk as high (intolerable), according to the weight of evidence as proven … The occupational risk of SARS-CoV-2 infection is pronounced for the staff of the intensive care teams compared to other profiles. Higher individual risks of infection are present in workers aged 51–55 years and with 11–25 years of work experience.

Key words: occupational risk, COVID-19, healthcare workers, ambulance.

IMPLEMENTATION OF CONTROL OF COMMUNITY FACILITIES DURING THE PERIOD OF COVID–19 NEW CORONAVIRUS INFECTION IN THE CITY OF MOSCOW

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The object of the study is the activities of the Office of Rospotrebnadzor in Moscow in 2020 on the implementation of federal state sanitary and epidemiological supervision over public facilities, aimed at reducing the incidence of the new coronavirus infection COVID-19 in the city of Moscow.

The aim of the study is to analyze specific control (surveillance) mechanisms that made it possible to achieve a statistically significant decrease in the incidence rate in Moscow by the end of 2020; assessment of the effectiveness of these control (supervision) mechanisms; development of a universal algorithm for control (supervision), which consisted of a number of typical mechanisms, applicable in the event of new sanitary and epidemiological challenges.

Key words: Moscow, new coronavirus infection COVID-19, public utility facilities, supervision, control, Rospotrebnadzor.

COMPLIANCE WITH BIOSECURITY REQUIREMENTS FOR REDUCTION THE RISK OF DIAGNOSTIC WORK WITH SUSPECTED SARS–COV–2 VIRUS (COVID–19) MATERIAL

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The state of biological safety has been analyzed to reduce the level of risk at various stages of the practice of diagnostic studies in laboratories of various levels of protection in the context of the COVID-19 pandemic caused by the SARS-CoV-2 The purpose of this work is to determine and

analyze the level of risk at each stage of the work with the material suspicious of the content of the coronavirus, to identify and assess their positive and negative points.

The main **method** was epidemiological analysis followed by evaluation. The results of the work identified the most dangerous phases of this work. Ways to improve laboratory practice have been suggested: extending biological safety requirements, making them compulsory not only to laboratories, but also to clinical (infectious and somatic) hospitals, which would significantly reduce the risk of possible contamination of medical specialists; organizing training in biological safety for medical practice specialists not only for laboratories, but also for medical institutions, having developed a separate advanced training program for this purpose; involve specialists in biosafety, molecular biology, epidemiology, medical science and other biomedical and engineering specialties in the program; consider developing sanitary and epidemiological rules on safety in patient care for medical specialists working in clinics and hospitals.

Key words: coronavirus infection, risk, biological safety, laboratory diagnostics.

ETIOLOGICAL STRUCTURE OF THE DOMINANT PATHOGENS OF OPPORTUNISTIC RESPIRATORY TRACT INFECTIONS IN THE HIV–INFECTED POPULATION

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It is generally accepted that the rate of HIV infection is determined by CD4+ cell counts and viral load, with the potential for disease progression determined by the co-infection with multiple pathogens being an important factor. The current study established the pattern of dominant infectious agents of opportunistic infections using 96 samples of biological material obtained from HIV-infected injecting drug users who presented with a clinical and radiological picture of lower respiratory tract infections.

The material of the study was a smear from the oropharynx, sputum and blood serum of these patients. The analysis of the microbiological study of the discharge of the respiratory tract showed that at the first stage, microorganisms of the genus *Streptococcus* and *Neisseria* are in the lead in the frequency of detection, the strains of the genus *Staphylococcus* are in the second stage. The significance of priority strains in the leading pathogen table is completed by *Candida albicans* fungi. The identification of gram-negative microorganisms showed that *Escherichia coli* and *Klebsiella sp*. accounted for the largest proportion. The leader in the frequency of detection of antibodies in blood serum is *Mycoplasma hominis.*

Key words: HIV infection, opportunistic diseases, opportunistic microflora, fungi of the genus *Candida.*

Section III

Sanitary, medical and demographic problems of the regions at the present stage

TO THE QUESTION OF THE INFLUENCE OF PESTICIDES ON THE ORGANOLEPTIC PROPERTIES OF WATER AND THE PROCESSES OF SELF-CLEANING OF WATER BODIES

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Information on the MPC (TAC) value and the limiting hazard sign is important for the analysis of the hazard of chemicals in water of water bodies for the health of the population, serves as the basis for the development of preventive measures to ensure safe conditions for water use by the population. For the purpose of specifying the possible adverse effects of the influence of chemicals on the hygienic conditions of water use of the population, information is needed on the entire spectrum of the effects of chemicals on water quality indicators.

The object of the study was the formulations and active ingredients of pesticides. The study of their influence on the organoleptic properties of water and the general sanitary regime of the reservoir was carried out in accordance with the current methodological guidelines for the hygienic regulation of chemicals in the water of water bodies. The research results included the threshold concentrations of formulations and active ingredients of pesticides in terms of the effect on odor, color and foaming of water, biochemical oxygen consumption and the concentration of mineral nitrogen in water.

It is concluded that the use of databases to analyze the results of studies of the "concentration – effect" relationship with the presentation of data on the nature of the dependence of water signs on the concentration of pesticides increases the reliability and accuracy of substantiating their threshold concentration in water for various limiting signs of harm.

Key words: organoleptic, general sanitary, threshold concentration, pesticides, pesticide active ingredient, water bodies.

MODERN EPIDEMIOLOGICAL FEATURES AND ASSESSMENT OF THE REAL RISK OF MALIGNANT MALIGNANCES IN THE POPULATION OF AN INDUSTRIAL CITY

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The article presents the results of the retrospective and prospective analysis of the frequency, structure and dynamics of the incidence of malignant neoplasms (MN) in the city of Taganrog, Rostov region, carried out in the course of social and hygienic monitoring for the period 2006–2020. A comparative analysis of oncological morbidity was carried out on the basis of calculating the indicators of real (epidemiological) risk and calculated regional assessment criteria for the urban population. Studies of the structure of potential risk factors for malignant neoplasms of priority localizations for the city population have been continued. For this purpose, on the basis of information from a specialized database of personalized registration of patients with colon cancer for the period 1988–2019 using multidimensional statistical methods – factor analysis and hierarchical cluster analysis of correlations – analytical procedures for structuring and classifying the initial information were performed.

Key words: social and hygienic monitoring; malignant neoplasms; risk assessment criteria; risk factors; factor analysis; cluster analysis.

ASSESSMENT OF THE REDUCTION OF THE PROJECTED LIFE EXPANSION OF THE REGIONS OF THE RUSSIAN FEDERATION BASED ON EVOLUTIONARY APPROACHES

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The article examines the influence of an unbalanced diet on the change in life expectancy. Increasing the life expectancy of the country's population is one of the most important tasks of any state in the world. Adjusting your diet, increasing the proportion of fruits and vegetables in your diet, and reducing fatty and salty foods can significantly extend life expectancy. As a result, based

on data on the structure of nutrition and morbidity in the regions, obtained from open sources of the Federal State Statistics Service, mathematical models were built using evolutionary approaches. The reduction in projected life expectancy is calculated based on the difference between the projected age at death without exposure and subject to exposure to a lifestyle factor. For each region, the value of the change in the predicted life expectancy was found and the share of the contribution of unbalanced nutrition was determined by classes of diseases. The regions closest to the optimal nutritional structure and, as a consequence, the least decrease in the predicted life expectancy were: Astrakhan and Magadan regions, Chukotka Autonomous Okrug and Khabarovsk Territory. The food structure most distant from optimal values is observed in the Republic of Ingushetia. The decrease in the projected life expectancy in the Republic of Ingushetia is 23 months. Diseases of the circulatory system are the main contributors to the reduction in life expectancy, the increase in which is caused by a high proportion of foods with a high glycemic index and low consumption of fruits and vegetables.

Key words: nutrition, life expectancy, modeling, evolution of disorders.

THE EXPERIENCE OF A SYSTEMATIC ANALYSIS OF THE PRIMARY INCIDENCE OF MALIGNANT NEOPLASMS (ON THE EXAMPLE OF THE IRKUTSK REGION)

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Purpose – to develop and test an algorithm for identifying zones and risk factors of malignant neoplasms (MNO) on the example of the Irkutsk region.

The studies were carried out according to the data of social and hygienic monitoring, which include information: on the pollution of the environment with chemical carcinogens, on the radiation doses of the population due to radon (f. No. 4-DOZ); on the levels of primary morbidity (form No. 7 – 2003–2019) and annual reports of medical organizations «Main indicators of the work of medical organizations in the Irkutsk region» (2016–2019).

A comprehensive analysis of the primary incidence of malignant neoplasms (MNO) of the population of urban and rural areas of the Irkutsk region was carried out in retrospect. The analysis included 37 localizations of malignant neoplasms in accordance with ICD-X. The territory of the Irkutsk region was considered in the context of existing administrative units: 10 cities and 27 districts, including cities and rural settlements

On the basis of a systematic analysis of data on environmental factors and indicators of the incidence of cancer, some features have been identified. The priority localizations included in the 1st cluster in terms of morbidity are widespread among the entire population of the Irkutsk region, and the most significant differences were the frequencies of cancer in the following localizations: the colon (ranks 1–2) and the mammary gland (ranks 1–3), in this regard, at the next stages of research, it is necessary to assess the risk factors that are typical for residents of industrial cities and most areas of the Irkutsk region, but not typical for the central regions of the Irkutsk region, including ethnic, lifestyle and others. The highest levels of relative risk were

noted in industrial centers exposed to carcinogens, typical for vehicles, non-ferrous metallurgy, chemical industry, and energy. For the territory of the Irkutsk region, an important factor is the emission of radon into residential and public buildings.

Key words: Malignant neoplasms, risk factors, chemical carcinogens, radon, morbidity.

PECULIARITIES OF MORTALITY OF THE POPULATION IN CITIES OF THE FAR NORTH (ON THE EXAMPLE OF NIZHNEVARTOVSK AND YAKUTSK)

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One of the most acute social problems in the Russian Federation is the high mortality rate of the population from non-communicable diseases, primarily from diseases of the circulatory system and oncological diseases. In order to propose effective measures to reduce the risk of their development, it is necessary to identify the main risk factors for health disorders, the nature of these disorders and the most vulnerable groups of the population. Unfavorable climatic conditions are one of such factors that significantly affect the level of morbidity and mortality of the population. It is known that in the harsh conditions of the Far North, the incidence of respiratory and circulatory diseases increases. To assess the contribution of climatic, environmental, and socio-economic factors to mortality in the cities of the Far North, data for the cities of Nizhnevartovsk and Yakutsk were analyzed. It is shown that in Nizhnevartovsk there is an increased (compared to Yakutsk) mortality of men from cardiovascular diseases in the age group up to 45 years, in the absence of differences in mortality of women. At the same time, Nizhnevartovsk has a higher standard of living, less severe climatic conditions and lower air pollution. Consequently, the economic, climatic and environmental conditions of living in the cities of Nizhnevartovsk and Yakutsk cannot determine the revealed differences in the mortality of young men. The increased mortality of young men from cardiovascular diseases in Nizhnevartovsk may be due to the high level of employment of this population group in hard work in the open air at oil and gas fields. At the same time, in Yakutsk, the mortality rate of both men and women in older age groups from cerebrovascular and oncological diseases is higher than in Nizhnevartovsk, which may be due to a combination of the following factors: higher rates of outflow of the population from Nizhnevartovsk at retirement age, more severe climatic conditions and more dangerous composition of atmospheric pollutants in Yakutsk.

Key words: mortality, causes of death, the Far North, cardiovascular diseases, oncological diseases.

MORTALITY OF WORKING-AGE POPULATION IN MOSCOW

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This study **aims** at assessing the level and dynamics of the mortality of working-age population living in Moscow and at analyzing its major causes, structure as well as the degree of economic loss due to premature mortality of the population.

Materials and methods. Based on the data (form C51) from the Department of the Federal State Statistics Service for Moscow and Moscow region (Mosstat) the mortality rate of working-age population was analyzed.

We deal with the data of the long-term dynamics of the mortality of working-age population living in Moscow, its structure and causes. The highest death rate was observed in the period of 1992–1996. Then it stabilized and decreased in dynamics. Circulatory system diseases, neoplasm, traumas and poisonings, digestive organs diseases and some infectious and parasitic diseases are the leading causes of mortality among working-age citizens of Moscow. Despite a decrease in the mortality rate, there has been an increase in mortality from infectious diseases, endocrine system diseases, mental disorders, diseases of the nervous system and sense organs, circulatory diseases and external causes - injuries and poisonings. The economic loss due to premature mortality was estimated. Such diseases as heart and vascular system diseases, injuries and poisonings, neoplasms lead to the economic loss to a large extent.

Key words: mortality, working-age population, dynamics, structure, causes of death, economic loss.

ON THE RESULTS OF EPIDEMIOLOGICAL MONITORING OF RISK FACTORS FOR CHRONIC NON-COMMUNICABLE DISEASES IN THE NIZHNY NOVGOROD REGION IN 2020

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In 2020, the third stage of epidemiological monitoring of risk factors for NCDs to implement action 5 «Identification and prevention of risk factors for major chronic non-communicable diseases (NCDs) in primary health care institutions of the Nizhny Novgorod region for 2013–2020» of subprogram 1 «Prevention of diseases and formation of a healthy life-

style. Development of health care» of the State Program «Development of Health care of the Nizhny Novgorod Region until 2020» approved by the decree of the Government of the Nizhny Novgorod Region dated 26/04/2013 No. 274.

The population of the region aged from 25 to 64 years was chosen as the object of the study. The total number of people examined amounted to 1887. We used survey as the research method. The data of objective medical observation are not considered in this article. The nurses were involved in the work as interviewers- employees of medical organizations, in the service area of which epidemiological monitoring was carried out.

Main results of the study are as follows:

– as for nutrition, there was observed irrational attitude towards the use of sodium chloride towards increasing; vegetable food having a high fiber content – towards decreasing, as well as sugar – towards overconsumption;

– the lifestyle of the examined persons (two-thirds) was characterized as low-activity. However it should be noted that two-thirds spent more than 30 minutes walking every day;

– less than a quarter of those examined persons smoked at the time of the study. However more than half consumed alcoholic beverages with varying regularity;

– respondents considered their own health to be poor and satisfactory; chronic bronchitis was registered most often in the surveyed patients among the diseases.

Thus, an effective tool for finding changes in the prevalence of risk factors of chronic non-communicable diseases has been developed and implemented. It enables us both to evaluate the effectiveness of preventive measures implemented in the Nizhny Novgorod region and correct them.

Key words: epidemiological monitoring, chronic non-communicable diseases, risk factors.

MALIGNANT NEOPLASMS IN THE SVERDLOVSK REGION AS A PRIORITY PROBLEM OF RISK MANAGEMENT

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The high incidence of malignant neoplasms (MNO), significant difficulties in early diagnosis, mortality, high cost of treatment and rehabilitation determine the particular relevance and social significance of this pathology. The article describes the experience of analyzing the oncological situation in an industrial region. In the Sverdlovsk Region, a system of measures is being implemented to manage risks (including carcinogenic ones) to public health from the influence of socio-economic and sanitary-hygienic risk factors. Based on the analysis of data on morbidity and mortality from malignant neoplasms, indicators of the impact of environmental factors of the population (formed within the framework of the federal information fund for social and hygienic monitoring), program-targeted planning is carried out, the development of common goals and objectives to ensure sanitary and epidemiological well-being and management of carcinogenic risks for public health. This system covers risk management measures aimed at pollution source, transmission routes and exposed population. Statistical indicators of morbidity and

mortality from malignant neoplasms are calculated, as a rule, for the region and large cities, while morbidity and mortality rates may differ for individual territories of the region. The analysis of the oncological situation in the region and its individual territories allows us to adjust the complex of measures for the management of carcinogenic risks, taking into account the characteristics of municipalities.

Key words: Malignant neoplasms, mortality, morbidity, risk management, social and hygienic monitoring.

FEATURES OF MORBIDITY OF CHILDREN LIVING IN THE TERRITORIES IN THE ZONE OF INFLUENCE OF NON–FERROUS METALLURGY ENTERPRISES

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The article presents the results of a study conducted to study the structure of the incidence of children 4–7 years old living in residential areas in the zone of influence of enterprises producing non-ferrous metals. The objects of the study were samples of atmospheric air and drinking water, data from primary medical documentation and clinical and laboratory examinations of the child population. The groups were formed taking into account the proximity of living and staying in educational institutions from the source of anthropogenic pollution. The observation group included children (130 people) living in close proximity to industrial enterprises (up to 6,5 km), the comparison group included children living in a recreational area (51 children). On the basis of the conducted research, data were obtained indicating the formation of residential areas where the multiplicity of exceeding the MAC for suspended substances, fluoride compounds, formaldehyde, phenol in atmospheric air is from 1,89 to 43,6 times, and in drinking water-from 1,25 to 42,2 times for aluminum, nickel, and manganese. The content of chemical compounds (aluminum, copper, chromium, nickel, phenol, formaldehyde and fluoride ion) in the biological media of the children of the observation group was up to 4.2 times higher than that of the children of the comparison group. The incidence of diseases of the respiratory system, blood diseases, hematopoietic organs and disorders involving the immune mechanism, diseases of the digestive, musculoskeletal and nervous systems in children living in the zone of technogenic influence, from 1,4 to 7,0 times higher than similar indicators of children living in the territory of relative sanitary and hygienic well-being. A direct probabilistic causal relationship has been proved between the frequency of registration of the detected pathology and the concentration in biological media of chemicals (aluminum, copper, chromium, nickel, phenol, formaldehyde, and fluoride ion), tropic to the organs of the respiratory, digestive, nervous, and musculoskeletal systems.

Key words: child population, morbidity, production of non-ferrous metals, environmental objects.

COMPARATIVE ANALYSIS OF CHILD AND ADOLESCENT INCIDENCE IN THE POPULATION OF GEOCHEMICAL PROVINCE WITH DIFFERENTIATED LEVEL OF TECHNOGENESIS

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Purpose of the work: a comparative study of the incidence of the child population of the geochemical province of the Republic of Bashkortostan, living in territories that differ in the level of industrial production. for the period 2000–2019 by retrospective analysis of official data from the Ministry of Health of the Republic of Bashkortostan. There is a more intensive increase in the incidence of adolescents 15–17 years old compared with the incidence of children from 0 to 14 years old. The first three places in the structure of the incidence of children and adolescents in 2019 were occupied by diseases of the respiratory system, trauma and poisoning, and diseases of the digestive system. A higher contribution to the primary morbidity of adolescents was revealed in areas without pronounced technogenesis for diseases of the genitourinary system, ear and mastoid, blood, hematopoietic organs and certain disorders involving the immune mechanism.

Key words: children, adolescents, morbidity, geochemical province

USE OF SOCIAL AND HYGIENIC MONITORING DATA TO ASSESS THE QUALITY OF DRINKING WATER

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Regulation of drinking water quality is the most important area when protecting the public health. The results of systematic laboratory studies within the framework of social and hygienic monitoring (SGM) and production control conducted by resource-supplying organizations are sources of drinking water quality. However, the further development of the SGM system depends on a number of legislative, organizational and technological, financial and economic issues. For example, outdated information platforms not meeting the modern requirements for collecting and storing SGM data and ensuring interdepartmental interaction.

The study **aims** at analyzing the possibility of using information on the water quality of centralized cold water supply systems collected during social and hygienic monitoring to assess the implementation of the Federal Project "Clean Water" on the example of the Jewish Autonomous Region.

We used the results obtained during the laboratory studies devoted to assessing the water of centralized cold water supply systems in settlements of the Jewish Autonomous Region. Our research was carried out in the framework of the SGM and was based on information provided by the federal information fund of the SGM under the section "Drinking water of centralized household and drinking water supply systems" for 2018–2020. We used methods of system and content analysis.

In 2020, we studied 41 settlements. At that, only 7 meet the requirements. In these regions, 2.5 % of region's residents live. The main reason leading to poor-quality of drinking water is the non-conformity in terms of microbiological indicators. Another reason is the presence of inorganic substances exceeding the hygienic standards. As a rule, we observed an exceess of MAC regards silicon (up to 2.2 times), manganese (up to 36.6 times), iron (up to 65.8 times) and nitrates (up to 3 times). To assess the compliance of drinking water quality with hygienic standards, a unified method for data collection in all control points not taking into account their location is required for inclusion in the information base, since the existing materials collected using SGM do not make it possible to obtain good conclusions regarding the water quality of centralized cold water supply systems.

Key words: social and hygienic monitoring, water of centralized water supply systems, Federal Project «Clean Water», information fund.

PRIORITY FACTORS OF DRINKING WATER OF CENTRALIZED DRINKING WATER SUPPLY SYSTEMS THAT FORM A RISK TO PUBLIC HEALTH VOLGOGRAD REGION

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The object of the study is the dynamics of indicators of drinking water in centralized water supply systems, some indicators of morbidity in the population of the Volgograd region.

The aim of the study is to conduct a hygienic assessment of the priority risk factors of drinking water for the health of the population of the Volgograd region.

Materials and methodologies. In the course of the study, a hygienic analysis of drinking water quality indicators of centralized drinking water supply systems was performed according to the data of the statistical form No. 18 "Information on the sanitary state of the Volgograd region" and the regional information fund for socio-hygienic monitoring of the Volgograd region. To identify the possible impact of water quality on public health, there were used correlation analysis method and the risk assessment methodology in accordance with R 2.1.10.1920-04 "Guidelines for assessing the risk to public health from exposure to chemicals that pollute the environment".

In the dynamics of the period 2018–2020, there is an increase in the specific weight of water samples from the distribution network of centralized water supply that do not meet the hygienic requirements for sanitary and chemical indicators from 4.3 % to 9.7 %. Priority pollutants that exceed the hygienic standards in the region are iron, chlorides, sulfates, ammonia, nitrates, chloroform, and residual free chlorine. The correlation analysis of the data on the morbidity of the population of the Volgograd region revealed statistically significant links of medium and weak strength between the concentration of iron in drinking water and morbidity: diseases of the skin and subcutaneous tissue among children and adolescents; diseases of the endocrine and immune systems among adolescents. The calculations performed by using the risk assessment methodology revealed the absence of a potential risk of adverse effects from the action of certain substances. However, an increased risk ($HI > 1$) was identified with simultaneous exposure to a group of substances for the child population in some municipal districts, with the greatest share of the risk being caused by chloroform and fluoride (in one district of the region).

Key words: drinking water, hygienic standards, public health risk.

FLUORINE CONTENT IN DRINKING WATER AND CARIES HAZARD IN THE POPULATION OF THE MOSCOW REGION

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The intake of fluoride into the human body with drinking water is one of the most effective ways to prevent caries, especially in children, and its deficiency in drinking water is one of the main causes of this disease. Therefore, the assessment of caries hazard of drinking water on the one hand is necessary to determine the safest sources of water supply to the population, and on the other hand to understand the relevance of other methods of caries prevention. Having determined the purpose of the study ranking of the territory of the Moscow region on the index of caries was an assessment of the content of fluorine in 1034 underground water sources in cities and rural settlements of the Moscow region, a method for calculating the index of caries hazard of water sources in the territory, ranking of administrative territories of the Moscow region on the degree of caries hazard of drinking water sources, taking into account hydrogeological zoning. It is shown that on the territory of the Moscow region the sources of drinking water supply in terms of the index of caries danger belong to the low-risk class, identified areas of priority for the prevention of caries in children.

Key words: hydrogeological area; drinking water; underground water sources; fluorine; caries.

A STUDY OF ADHERENCE TO HEALTHY EATING AMONG YOUNG PEOPLE

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This article presents the results of an assessment of adherence to healthy eating in young people. We have carried out a comparative analysis between vocational students and university students on the principles of healthy eating and on awareness of the need to observe these principles. Comparative characterization of adherence to healthy eating among girls and boys is presented, and awareness among pupils and students is assessed according to gender. We examine the main subjective reasons for low adherence to healthy eating according to those who were surveyed.

Key words: principles of healthy nutrition, awareness, pupils, students.

FEATURES OF THE QUALITY OF LIFE OF PATIENTS WITH MODERATE AND SEVERE BRONCHIAL ASTHMA

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Moderate and severe bronchial asthma have a significant impact on the lives of patients and their relatives and reduce their quality of life. The symptoms of bronchial asthma can lead to a deterioration in the physical, emotional and social aspects of patients' lives. We analyzed the quality of life of 174 patients with moderate and severe bronchial asthma who were inpatient treatment for an exacerbation of the disease. The quality of life due to the results of the questionnaire, using the SF-36, has been assessed. A natural decrease in the quality of life in all parameters with age has been determined. The relationship between the vital activity and mental health of patients. It also identified gender differences in the impact of physical activity on the performance of daily work has been identified.

Key words: severe and moderate bronchial asthma, quality of life.

PREVALENCE OF DECREASED BONE MINERAL DENSITY IN PUPILS OF GENERAL EDUCATION SCHOOLS

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Inadequate bone mineral density (BMD) is one of the leading places of school-associated pathology. The ultrasound osteodensitometry is a low-cost, noninvasive and non-competitive method for early diagnosis of decreased BMD

In order to study the frequency of decreased BMD in pupils of secondary schools, we assessed bone density by ultrasound osteodensitometry. The study was performed on 84 boys and 85 girls between 7 and 17 years of age. The pupils were divided into 6 observation groups based on gender and age. Considering the presence or absence of signs of decreased BMD, a comparative assessment of the structure of concomitant pathology was conducted.

The prevalence of reduced BMD among general secondary school pupils ranged from 28 to 65 %, depending on the age and gender of the pupils. In elementary school the proportion of girls with inadequate BMD was 1.8 times higher than that of boys (32 and 60 %; $p = 0.01$), in basic school, the low BMD was found with a similar frequency (65 and 53 %; $p = 0.2$), and among high school pupils, boys were 2 times more prevalent than girls (60 and 28 %; $p = 0.02$). In children with inadequate BMD, deforming dorsopathy was diagnosed 1.4 times more frequently (62 and 44 %; $p = 0.04$), myopia 2 times more frequently (26 and 13 %; $p = 0.04$), and functional dyspepsia 1.6 times more frequently (42 versus 26 %; $p = 0.02$).

The frequency of low bone mineral density among schoolchildren reaches 65 %. It is necessary to expand the use of ultrasound osteodensitometry in order to determine in a timely manner BMD in pupils.

Key words: pupils, bone mineral density, osteodensitometry.

HOW NOISE AFFECTS HUMAN HEALTH

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This article discusses the effects of noise on humans, measures to protect against noise, and analyzes of noise studies. This topic is relevant in connection with the progress in the technical industry, as a result of which the noise exposure to humans increases, which negatively affects our body. Noise has a detrimental effect on humans; it is an aggressive irritant to the human central nervous system and harms the body. The solution to this problem is to establish sanitary standards for noise sources.

Key words: noise irritating effect, auditory sensitivity, adverse living conditions from exposure to noise, noise control.

HYGIENIC ASSESSMENT OF TRANSPORT NOISE IN THE ADMINISTRATIVE DISTRICTS OF THE CITY OF MOSCOW

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The work is devoted to the study of traffic noise on the territory of residential buildings in all administrative districts of the city of Moscow. Instrumental measurements of noise levels have been carried out. Based on the results of field studies, the maximum and equivalent noise levels were assessed for compliance with sanitary and hygienic standards, and a relationship was established between the results obtained and conditions such as the type of highway, the presence of green spaces between the selected control point and the noise source, the presence or absence of noise protection screens. As a result of the study, the most unfavorable administrative districts of the city of Moscow in terms of noise impact factor were identified.

Key words: noise, transport, hygienic assessment.

NOISE OF TRANSFORMER SUBSTATIONS. SANITARY AND HYGIENIC CONTROL OF PENETRATING NOISE LEVELS. PROBLEMS OF REDUCING NOISE LEVELS TO PERMISSIBLE SANITARY STANDARDS

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This article is devoted to the problems of noise reduction penetrating from transformer substations into adjacent buildings. The article describes the paths of noise propagation and possible noise and vibration protection measures to reduce the penetrating noise. The acoustic efficiency of noise protection measures is considered. An example of the implementation of noise-vibration protection measures is considered.

Key words: noise of transformers, noise and vibration protection measures, vibration mountings, structure-borne noise, measurements of noise levels, permissible noise levels.

COMPARATIVE HYGIENIC ASSESSMENT OF PHYSICAL FACTORS OF NON-IONIZING NATURE AFFECTING STUDENTS

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The object of the research is the classrooms of two general educational institutions, one in the city of Perm, the second in the city of Kungur, Perm Territory.

The purpose of the study is to conduct a comparative hygienic assessment of the levels of non-ionizing physical factors affecting students in the educational process.

The method of field observations, analytical method, comparative analysis method were used in the work. Measurement and assessment of noise impact, illumination levels, illumination pulsation coefficient, electromagnetic radiation, air ionic composition of air were carried out. In each object, 5 classrooms were examined (10 in total, of which 8 classrooms for theoretical studies – 4 in each object and 2 computer science rooms – 1 in each object). The measurements were carried out on the basis of regulatory and methodological documents in the field of sanitary and epidemiological well-being of the population. The results obtained were compared with the standard indicators. Also, a survey of teachers was carried out, and an assessment of the time of exposure of the studied factors (timing).

In general, during the hygienic assessment, despite the presence in the educational institution of Perm in comparison with the educational institution in Kungur, a greater number of sources of non-ionizing electromagnetic radiation, no pronounced deviations from the standard values of the levels of the studied physical factors in both studied objects were found.

Key words: physical factors, electromagnetic radiation, training place.

Section IV

Health risk analysis in hygiene studies

ASSESSMENT OF INHALATION EXPOSITION BY POLYAROMATIC HYDROCARBONS OF THE ADULT POPULATION OF THE CITY OF MINSK

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Polyaromatic hydrocarbons (PAHs), which have carcinogenic properties, enter the human body through alimentary and inhalation routes. In this work, the inhalation exposure of PAHs (naphthalene, 2-methylnaphthalene, acenaphthene, phenanthrene, anthracene, pyrene, benz(b) fluoranthene, benz(k)fluoranthene, benz(a)anthracene, dibenz(a,h)anthracene, indeno(1,2,3-cd) pyrene, benz(a)pyrene). The concentration of PAHs in the ambient air did not exceed hygienic standards. Median values of the concentrations of naphthalene, 2-methylnaphthalene, phenanthrene, anthracene, pyrene, benz(b)fluoranthene, benz(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene in atmospheric air, taking into account the simulation, they amounted to 0.80 ng / m^3, acenaphthene – 2.20 ng / m^3, benzo(a)pyrene – 0.17 ng / m^3. The inhalation exposure of PAHs for acenaphthene was 628.6 ng / kg bw / day, and for naphthalene, 2-methylnaphthalene, anthracene, pyrene, benz(b)fluoranthene, benz(k)fluoranthene, dibenz(a,h)-anthracene, indeno(1,2,3-cd)pyrene varied from 0 to 457.1 ng / kg bw / day, phenanthrene – from 171.4 to 457.1 ng / kg bw / day, benzo(a)pyrene – from 0 to 942.6 ng / kg bw / day. Considering the high hygienic significance of PAHs with carcinogenic properties, for these substances, it is necessary to develop an algorithm for a comprehensive assessment of PAH exposure, taking into account the inhalation and alimentary routes of intake.

Key words: atmospheric air, polyaromatic hydrocarbons, carcinogenic substances, pollution, risk assessment.

DUST POLLUTION OF ATMOSPHERIC AIR AS A HEALTH RISK FACTOR

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The pollution of the urban area's atmospheric air by solid dust particles poses a high risk to the health of the exposed population. Numerous studies have shown that the severity of exposure to dust particles depends on the chemical composition and fraction size. Particles with a diameter of less than 10 microns are particularly dangerous to health.

Complex studies of the solid component of atmospheric air were carried out on the example of three central districts of Perm. The studies included: determination of the concentration levels of suspended substances – PM_{10} and $PM_{2.5}$, study of the component composition of the selected sam-

ples, profile formation of dust pollution of atmospheric air, determination of the morphological properties of particles.

The established profile of dust particles of the studied fractions was characterized by a wide range of chemicals, including: oxides of iron, calcium, silicon, aluminum, etc.

The results obtained indicate the need to monitor both the total amount of dust contained in the atmospheric air and marker indicators including PM10 and PM2. 5.

Key words: atmospheric air, component composition, suspended substances, PM_{10}, $PM_{2.5}$, monitoring.

QUANTITATIVE ASSESSMENT OF CAUSE–AND–EFFECT RELATIONSHIPS BETWEEN EXPOSURE TO CHEMICALS IN ENVIRONMENTAL OBJECTS AND HEALTH DISORDERS OF THE POPULATION LIVING IN THE IRKUTSK REGION

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The article deals with the results of the epidemiological analysis of morbidity according to the data of the appealability for medical care of children and adults living in the Irkutsk region for 2019. Reliable cause-and-effect relationships have been established between the effects of chemical factors in the objects of the environment and the indicators of morbidity of the analyzed population for a number of disease classes. Based on the results obtained, the risks to public health are calculated.

Key words: epidemiological assessment, population health, habitat, chemicals, causal relationships

RESULTS OF OPTIMIZATION OF THE AIR QUALITY MONITORING SYSTEM FOR ASSESSING EXPOSURE DURING THE IMPLEMENTATION OF THE FEDERAL PROJECT "CLEAN AIR"

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The object of the study is the results obtained during the implementation in 2019 and 2020 in the cities participating in the federal project (FP) "Clean Air" and the possibility of implement-

ing the task set before Rospotrebnadzor to improve the system of social and hygienic monitoring (SHM) in cities participants of the federal project "Clean Air".

The purpose of the study is to analyze the results of the optimization of the SHM system for the quality of atmospheric air in terms of the formation of monitoring programs.

Methods and approaches used. The main approach in the implementation of the federal project "Clean Air" in 2019 and 2020. consists in analyzing the results of monitoring the quality of atmospheric air in the cities participating in the FP. An assessment is made of the possibility of using the obtained data of laboratory monitoring of atmospheric air quality for solving the tasks of the SHM and for the implementation of measures provided for by the FP "Clean Air").

Main results. The analysis of: updating the lists of priority chemicals controlled in the ambient air; optimization of the location of the air quality control posts during the maintenance of the SHM; improving air sampling programs.

An analysis of the quality of atmospheric air in the territories of the cities participating in the FP showed that the optimization of the management of SHM gives positive results and expands the possibilities of their use in hygienic diagnostics (assessment of the sanitary epidemiological situation according to all approved hygienic standards, including the average annual). The solution of the tasks assigned to the service allows to achieve the expected effect – monitoring characterizes the potential impact on public health of atmospheric pollution in 12 participating cities of the FP and will allow assessing the health risks of the population, as well as assessing the effectiveness of measures carried out within the framework of the Clean Air FP.

The results obtained make it possible to recommend the introduction of unified scientific and methodological approaches to optimizing the SHM system, taking into account the experience gained in the territories of 12 participating cities, as well as assessing and managing health risks in other territories of the Russian Federation.

Key words: risk assessment, public health, priority emissions, summary calculations, monitoring.

THE MAIN RESULTS OF THE COMPLETED PROJECTS ON HEALTH RISK ASSESSMENT IN A NUMBER OF CITIES PARTICIPATING IN THE FP «CLEAN AIR» (LIPETSK, CHEREPOVETS, NOVOKUZNETSK, OMSK)

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The object of the study is the results obtained in the course of implementation in 2020 in the supervised cities participating in the federal project "Clean Air" and the possibility of implementing the tasks assigned to Rospotrebnadzor to assess the effectiveness and efficiency of measures to manage health risks, reduce morbidity and mortality.

The purpose of the study is to analyze the results of assessing the risk to public health based on the data of summary calculations of air pollution in the cities of Cherepovets, Lipetsk, Omsk, Novokuznetsk as part of the federal project "Clean Air" (baseline, 2017).

Methods and approaches used. The main approach in the implementation of the federal project "Clean Air" in 2020 is to use the results of summary calculations of atmospheric air pollution, to obtain, on their basis, exposure levels and risks to public health. For the calculation of the effecting concentrations, the software product of the "Ecolog-Gorod" series was used.

Main results. Studies were carried out to assess the risk to public health based on the data of consolidated calculations of atmospheric air pollution in the cities participating in the federal project "Clean Air" (Cherepovets, Lipetsk, Omsk, Novokuznetsk) in 2017 before the start of the measures provided for by the Comprehensive Plans to Reduce emissions of pollutants into the air.

Based on the results of assessing the risk to public health on the basis of summary calculations of atmospheric air pollution. Cherepovets, Lipetsk, Novokuznetsk, Omsk established: priority compounds contained in industrial emissions, main industrial sources; the share contribution of industrial sources, vehicles and AIT to the formation of pollution levels on the territory of cities has been determined; identified the population exposed to unacceptable levels of risk; highlighted substances that should be taken into account when setting emission quotas.

Key words: risk assessment, public health, emission inventory, summary calculations, quotas.

HEALTH RISK ASSESSMENT OF THE POPULATION OF THE CHITA CITY (PARTICIPANT OF THE FEDERAL PROJECT "CLEAN AIR") BY EXPOSURE TO CHEMICALS POLLUTING THE ATMOSPHERIC AIR

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The assessment of the health risk of the population of Chita from exposure to chemicals that pollute the atmospheric air was carried out on the basis of the results of dispersion calculations. It was found that short-term inhalation exposure to chemicals on the territory of residential development in Chita forms unacceptable risks in relation to the respiratory system (up to 28.3 *HI*), development processes (27.1 *HI*), the immune system (more than 26.8 *HI*), the occurrence and development of systemic health disorders (more than 27.3 *HI*). The level of the total carcinogenic risk during prolonged inhalation exposure to chemicals in Chita does not exceed the acceptable level and is up to $5.74 \cdot 10^{-5}$. Unacceptable levels of chronic non-carcinogenic risk are formed in relation to the respiratory system (up to 3.74 *HI*) and developmental processes (up to 23.9 *HI*). According to the criteria of risk to the health of residents, a list of 15 pollutants has been formed, subject to systematic monitoring on the territory of Chita.

Key words: Public health risk, priority pollutants, Federal project "Clean Air", a comprehensive plan of measures to reduce emissions, emission quotas.

FUEL AND ENERY ENTERPRISES AS SOURCES OF POTENTIAL RISK OF HARM TO PUBLIC HEALTH

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The article presents a spatial-dynamic and structural hygienic assessment of the impact of the activities of thermal power facilities on the quality of atmospheric air and the formation of potential risks of harm to public health in the Siberian Federal District (SFD). It was found that the share of emissions of pollutants from stationary sources in the Siberian Federal District was more than 30 % of the total emission of stationary sources in the Russian Federation. The share of entities implementing this type of activity and belonging to extremely high and high (1 and 2, respectively) categories in terms of potential risk of harm in the Siberian Federal District is from 3.2 to 37.9 %. The indicator of the average potential risk of harm to health per one economic entity (Rlav) in the Siberian Federal District in the implementation of activities for "Provision of electricity, gas and steam; air conditioning" was $9.9 \cdot 10^{-4}$. The scale of impact (SoI) for economic entities implementing in the Siberian Federal District activities in the field of heat and power engineering of extremely high and high categories in terms of potential risk of harm, is in the range of 0.0076–0.61 and 0.00069–0.0067 million people, respectively, and the level of potential risk of harm to health (PR) for these categories of economic entities is $1.11 \cdot 10^{-3}$ – 0.17 and $1.0 \cdot 10^{-4}$ – $9.8 \cdot 10^{-4}$, respectively. It has been established that enterprises operating in the field of "Electricity, gas and steam supply; air conditioning "can form potential harm to human health in the form of the development of neoplasms ($Ul = 0.0089$), diseases of the endocrine ($Ul = 0.0066$), musculoskeletal ($Ul = 0.02$) systems, respiratory organs ($Ul = 0{,}0018$), circulation ($Ul = 0.0022$), digestion ($Ul = 0.0017$).

Key words: heat power plants, emissions, air quality, potential risk of harm to health, scale of impact

PUBLIC HEALTH RISK ASSESSMENT WHEN JUSTIFYING SANITARY PROTECTION ZONES OF SEWAGE TREATMENT FACILITIES

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This article presents the results of substantiating the optimal size of the sanitary protection zone for sewage treatment plants based on the assessment of the health risk of the population from exposure to pollutants and noise.

The purpose and objectives of the study. Justification of the optimal size of the sanitary protection zone for the sewage treatment plant, taking into account the results of the health risk assessment of the population living in the territories adjacent to the treatment plant.

Materials and methods. To carry out the research, the results of the analysis of the hygienic assessment of urban planning documentation, materials of the SPZ project, data on the technical characteristics of sources of pollutant and noise emissions, data on the applied technological processes, the qualitative and quantitative composition of emissions, data on the background concentrations of chemicals, the results of mathematical modeling (calculations dispersion of emissions) pollution of the territory in the area of the facility.

Methods used. Sanitary and hygienic method, method of mathematical modeling, risk assessment, statistical method.

Results. The calculations made allow us to recommend the establishment of a design SPZ for sewage treatment plants with a capacity of 97.6 thousand m3 / day, size 217–400 m, subject to confirmation by the results of analytical laboratory control of the accuracy of the level of safety for public health of the harmful effects of the object.

Key words: Sanitary protection zone, atmospheric air, public health risk assessment, sewage treatment facilities.

PUBLIC HEALTH RISK ASSESSMENT WHEN JUSTIFYING SANITARY PROTECTION ZONES OF SEWAGE TREATMENT FACILITIES

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Key words: Sanitary protection zone, atmospheric air, public health risk assessment, sewage treatment facilities.

ARSENIC IN DRINKING WATER AS AN INDIVIDUAL HEALTH RISK FACTOR

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The paper deals with the results of sanitary and chemical analyses of various sources of non-centralized and centralized water supply in several districts of the Saratov region for the period 2018–2021. It was found out that the arsenic content in them exceeds the permissible WHO standard up to 6 MAC. The percentage of excess amounts to 31. The examined areas were ranked according to the average arsenic content in drinking water. Based on these data, an assessment of the health harm from regular water consumption in the category of individually directed risks was made. The HQ index exceeded 1.0 in 27 % of the total samples.The results of the carcinogenic risk calculation showed some excess in 14 % of all samples in 12 sources.

The study aims at assessing the non-carcinogenic and carcinogenic risks to public health from drinking water not meeting the sanitary standards regards the arsenic content.

Tasks:

– Study of sanitary and chemical indicators of water sources in the Saratov region and the city of Saratov for the period 2018–2021.

– Calculation of the value of the individual non-carcinogenic and carcinogenic risk to the public health using regularly the specified water for drinking purposes.

Key words: social and hygienic monitoring, drinking water quality, arsenic, non-carcinogenic risk, carcinogenic risk, human health.

ASSESSMENT OF CARCINOGENIC RISK ASSOCIATED WITH INCREASED CONTENT OF 3,4–BENZ(A)PYRENE IN THE SOIL OF TAGANROGA CITY

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Pronounced destructive changes in soils are characteristic of residential areas of urban ecological systems formed within the boundaries of large industrial cities. High levels of super-toxicants and xenobiotics in soil, such as heavy metals and polycyclic aromatic hydrocarbons,

pose a high risk to the health of the urban population. The aim of this study is a comprehensive hygienic assessment of chemical soil contamination in the city of Taganrog, Rostov region with a population of about 250 thousand people for the period 2013–2020, including an assessment of the individual and population carcinogenic risk caused by the excess of 3,4-benz(a)pyrene determined by high performance liquid chromatography (HPLC). The work uses the results of studies of soil samples taken at fixed sampling points (residential areas near intersections with heavy traffic, recreation areas and the territory of preschool educational institutions), regulated by the regional standard for conducting social and hygienic monitoring. It was found that the priority pollutants for urban soils are 3,4-benz(a)pyrene, zinc and lead, with their share in Ksoil 55.25 %, 19.61 % and 7.04 %, respectively. At the same time, the excess of the MPC for the content of 3,4-benz(a) pyrene in the soil was recorded in 65.63 % of the studied soil samples at its average and maximum concentrations, respectively, 2.298 and 45.525 MPC. The performed assessment of the individual multi-route carcinogenic risk (CR) caused by 3,4-benz(a)pyrene contained in the soil indicates its high level ($2.4606 \cdot 10^{-3}$) with the priority value of the inhalation route of intake (94.84 %)…

Key words: social and hygienic monitoring; health risk; chemical pollution of soils; heavy metals; 3,4-benz(a)pyrene; assessment of carcinogenic risk.

ABOUT THE SAFETY OF FISH, FISH PRODUCTS AND OTHER AQUATIC ORGANISMS

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The issue of food quality is relevant in view of the food industry development, the introduction of new components in the food production technology, for example, sweeteners, new food additives, etc. More than 75 % of the world's fish production is used directly for food, and the level of fresh fish consumption is growing due to the other types of fish products (for example, canned fish). The factors mentioned above emphasize issue of studying the safety of this product type. It was found out that the hygienic requirements were not observed in terms of parasitological, physico-chemical and microbiological indicators in the most cases. The violation ratio amounts to 99.5 % of all violations. The samples of fish, fish products and other aquatic organisms meet the hygienic standards regards the content of nitrosamines and biphenyls. To determine the required minimum number of product samples in order to maximize the detection of non-standard samples, additional studies are necessary.

Key words: safety, fish, fish products, non-standard samples, laboratory supervision.

HETEROCYCLIC AMINES IN VIETNAMESE COOKED MEATS AND FISHES: PILOT LOCAL FIELD INVESTIGATION FINDINGS

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Heterocyclic aromatic amines (HAAs) are generated from the heating process of nitrogenous compounds due to the Maillard reaction. They are often found in cooked animal-origin food. Many HAAs are reported as carcinogenic and induce tumors at multiple sites in rodents. In this study, we have developed a simple and effective sample treatment for complex matrices like food matrices. The concentration of HAAs was measure by liquid chromatography coupled tandem mass spectrometer. The method was applied to estimate HAAs concentration in real samples collected from local markets in Hanoi, Vietnam. In this article, we have presented our results of the HAAs analysis in some types of cooked meat. Our project will extent further in the number of type of food, number of HAAs, and estimate the HAAs may contain in cooked food according to various ways of cooking.

Key words: Heterocyclic aromatic amines, HAAs, LC-MS/MS, cooked food.

ANALYSIS OF THE REGIONAL INCIDENCE OF THE BONE–MUSCLE SYSTEM OF CHILDREN (0–14 YEARS OLD) TAKING INTO ACCOUNT THE PURCHASING OF STUDENT FURNITURE

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To study the relationship between the purchases of student furniture carried out by the regions of the Russian Federation (2014–2016) and the dynamics of the incidence of the musculoskeletal system in children 0–14 years old (2009–2019).

Materials and Methods. A method for collecting data on purchases of school furniture from the official website of the Unified Information System in the field of procurement was developed and information was copied from the statistical collections "TsNIIOIZ" of the Ministry of Health of Russia for 2009–2019. Statistical data processing was carried out using Statistica Base:

time series analysis; comparison of groups of regions with "minimum" and "maximum" levels of primary and general morbidity by the nonparametric Mann – Whitney U test (for unrelated samples, $p < 0.05$); correlation analysis according to Spearman ($p < 0.01$).

Results. In the dynamics of general and primary morbidity, a downward trend was calculated; revealed the absence of statistically significant correlations between the number of purchases carried out by educational organizations for the period from 2014–2016, the number of items and the number of student furniture units with the levels of the overall incidence of diseases of the musculoskeletal system in children (0–14 years old).

Key words: school furniture, children's morbidity, musculoskeletal system, hygienic regulation.

QUANTITATIVE ASSESSMENT OF HEALTH RISKS BASED ON COMPUTER TESTING OF PHYSICAL AND MENTAL STATUS

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The principles and criteria for assessing risks to human health at different ages are considered using the developed computer programs, the mechanism of action of which is based on the following principles:

1) The use of screening methods for diagnosing the physical and mental state of a person, reflecting his health and functional capabilities in the dynamics of life and work.

2) Health is a reflection of the integrity of the organism and its components, which characterize the capabilities and abilities of an individual to satisfy his biological, spiritual and social needs with perfect adaptation to external environmental and social conditions.

3) The level of health can be assessed quantitatively, if we take as a basis the amount of reserve capacities of the organism, ensuring the preservation of homeostasis of its internal environment while adapting to constantly changing conditions of the external world (or loads).

4) The organism and its habitat are a single whole, which determines mutual influences on each other. Therefore, when identifying health risk factors, it is important to assess the sanitary and hygienic conditions of life and work.

5) When assessing the influence of various risk factors, a dynamic approach should be used, which makes it possible to consider in the process of life and work the degree of changes in the morphofunctional and psychological characteristics of a person and to identify positive or negative tendencies.

6) For a quantitative assessment of the impact of risk factors on health, an integrative approach is important, taking into account the indicators of physical development, functional, psycho-emotional state of the body in specific conditions of the environment and activity.

The developed computer programs make it possible to quickly, efficiently and economically assess the impact of risk factors on health in the dynamics of the short and long term.

THE RESULTS OF ESTIMATION OF FOOD ORGANIZATION IN THE EDUCATIONAL ORGANIZATIONS OF THE CHELYABINSK REGION

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Rational nutrition of students ensures normal growth and development of the body, helps prevent the development of alimentary-dependent diseases, and reduce the risk of developing cardiovascular diseases.

The purpose of the study is to study the availability and quality of hot meals for students in schools in the Chelyabinsk region and develop regional preventive measures.

The object of the research was the study of the nutrition of 389,573 students in 691 schools in the region. Evaluated non-compliance of the actual menu with food rations, compliance with the completeness of the diet, the mass of portions, the technology of cooking, compliance with the regime issues of the work of food units, the principles of healthy eating, laboratory studies of food raw materials and ready-made meals were also carried out, the temperature of hot dishes was measured at distribution, parental opinion was assessed on the quality of food in schools. When distributing educational institutions by potential risk of harm to health, it was found that in the 1st quarter of 2021, the share of objects belonging to the group of medium and moderate risk decreased over the dynamics of 3 years by 3.74 % and 5.86 %, respectively (amounted to 62.32 % and 7.41 %), with an increase in the share of objects attributed to the group of significant risk by 9.6 % (amounted to 29.43 %).

On the basis of the results obtained, it was revealed that the total nutritional coverage of students was 88.4 %, and the primary level was 100 %. In 5.9 % of schools, there is a discrepancy in the energy value of dishes, including an imbalance in the diet, insufficient portions in 29 cases (4.2 %), a violation of the temperature of ready meals – in 3.7 %, a violation of the technology for preparing ready meals, which resulted in 1.9 % microbial contamination of prepared food. The proportion of samples of ready-made meals that do not meet sanitary and epidemiological requirements in 2019–2021 in terms of microbiological indicators, it is at the same level, which indicates the need to develop a regional program to improve the quality of nutrition of schoolchildren, conduct continuous monitoring with an assessment of risk factors and tighten control and supervisory measures.

Key words: schoolchildren, meals, hot meal coverage, risks.

ORGANIZATION OF EDUCATION IN A DIGITAL EDUCATIONAL ENVIRONMENT: HEALTH RISKS OF SCHOOLCHILDREN

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The digital educational environment, along with a positive impact on the cognitive activity of students, is characterized by a whole range of factors that have a potentially negative effect on the development and health of children.

The indicators related to the organization of the educational process make the greatest contribution to the variability of the health indicators of schoolchildren and are the most manageable; in addition, their optimization does not require special material costs.

To predict the prevalence of pronounced fatigue among schoolchildren in the dynamics of learning using electronic means, using the method of multiple regression analysis, we built and analyzed a mathematical model of the relationship between the frequency of occurrence of cases of a significant drop in the productivity of mental performance of students, characterizing the tiring effect of the educational process on the functional state of the body, with the indicators of organization lesson (duration of use of electronic teaching aids, lesson density) and training schedule.

It was found that the following factors of the organization of the educational process (according to the degree of influence) make a significant contribution to the development of pronounced fatigue of students in the learning process in a digital environment: the hygienic rationality of the school timetable, the duration of the use of electronic teaching aids in the classroom, the density of the lesson. These indicators can serve as indicators of the risk of overwork in schoolchildren in the hygienic assessment of the organization of the educational process at school.

Key words: prevention of severe fatigue, electronic means, lesson, schedule.

REGIONAL NUTRITIONAL CHARACTERISTICS OF SCHOOLCHILDREN OF THE SVERDLOVSK REGION (RESULTS OF MONITORING CARRIED OUT WITHIN THE FRAMEWORK OF THE FEDERAL PROJECT "STRENGTHENING PUBLIC HEALTH")

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Providing an integrated approach to the formation of children's adherence to healthy nutrition is based on monitoring multifaceted factors that affect the receipt of a complete or inade-

quate diet. The monitoring of the nutrition of school-age children organized by Rospotrebnadzor in 2019 within the framework of the Federal Project "Strengthening Public Health" is undoubtedly a unique initiative.

Purpose. To assess the features of the organization of nutrition, eating behavior of school-age children living in various territorial conditions of the Sverdlovsk region.

Results. The organization of children's nutrition in educational institutions is satisfactory, the nutritional value of the rations corresponds to the physiological needs of the body of schoolchildren for basic nutrients, energy and the distribution of calories over the main meals. There are differences in the organization of meals in terms of the cost of food, the range of products and dishes used, nutritional value, depending on the residence of children in urban or rural areas where children live. School-age children are dominated by one or two meals a day in educational institutions, children in home meals prefer fast food, confectionery, sweet carbonated water from 7 to 8 times a week, while their consumption of dairy products and fruits is limited.

Conclusions. The data obtained on monitoring the nutrition of schoolchildren make it possible to use them for the development of municipal programs, including changes in the amount of sugar and salt introduced in the manufacture of public catering products, the cost of dishes high in sugar, saturated fat, salt, as well as subsidies for healthy food products.

Key words: regional nutritional characteristics, schoolchildren, health, nutrition, children.

STUDY OF THE INFLUENCE OF THE DIET PATTERN OF DAY AND SHIFT WORKERS ON THE DEVELOPMENT OF OBESITY

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The principles of dietetics are based on the concept of calorie restriction and a balanced diet of micro- and macronutrients depending on the level of energy consumption of an individual and his / her gender and age physiological needs. However, the daily regime of food intake and abstinence from it should be paid no less, and possibly more attention, than counting calories. The study of eating patterns is particularly relevant among shift workers, who should stay awake at night. It leads to a shift and expansion of the "food window" (the time of day during which food consumption is appropriate).

The study involved 264 shift (CM) and "day" (DM, 1 shift) male employees of the metallurgical plant aged 22–64 years having work experience of 1–42 years. CM includes 204 people (average age was 38.17 ± 0.59, average work experience amounted to13.35 ± 0.53 years), DM-60 consists of people (42.62 ± 2.12 and 23.59 ± 2.14 years). The examined persons was subject to questionnaire and anthropometry: measurement of waist circumference, height and weight with the

calculation of body mass index. Statistical processing of the results was carried out using MS Excel and Medstatistic.ru.

During the study, it was found out that the food pattern of shift workers is characterized by an irrational regime with "food windows" of more than 15 hours and their shift towards a late dinner. Additional risk factors for obesity in CM: increased sugar and water intake, low physical activity, and alcohol abuse. There is a tendency to increase the prevalence of obesity among CM. It might be considered as occupational disease. It is proved by the value of the relative occupational risk of obesity between the experience groups of 20 and more years and less than 20 years of experience (*RR* = 1.79; 95 % *CI*: 1.11–2.89).

To prevent obesity in shift workers, it is of importance to develop health-improving measures including the promotion of a healthy lifestyle with an emphasis on rational nutrition.

Key words: shift work, "food window", nutrition pattern, obesity.

Section V

Health risk analysis in epidemic research

RATIONALE OF REFERENCE PATHOGENS FOR QUANTITATIVE ASSESSMENT OF HEALTH RISKS ASSOCIATED WITH WATER

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Research object: representative microorganisms for COMR.

Purpose of the study: substantiation of the list of reference pathogenic microorganisms for a quantitative assessment of microbiological health risks associated with water.

Methods and approaches used: expert-analytical, laboratory research, hygienic assessment.

Main results. Within the framework of the COMR, the probability of human infection is studied on the basis of data on potential exposure (the number of pathogenic microorganisms entering the human body, calculated based on the level of their presence in water and the volume of water consumed) and the use of known dose-dependent models of the body's response to various routes of entry of pathogens. The CDM uses country-specific data on the severity of the disease, its duration, and the incidence of asymptomatic infections.

The quantitative assessment of COMR is carried out on representative (reference, index) pathogenic microorganisms (hereinafter – PM) for bacteria, viruses and protozoa (at least 1 representative). At the same time, such pathogens are justified taking into account the specifics of the country, taking into account their differences, including the sensitivity for different water treatment processes, the availability and reliability of methods for determination in water. Selection criteria: waterborne transmission, the presence of a dose-dependent reaction model, data on the prevalence of the disease, presence in the source, survival in the external environment, high resistance to water treatment, infectivity, the frequency of infections and the severity of their course, the presence of a detection method. The optimal choice of the reference pathogen should provide the worst-case scenario COMR.

The expediency of using adenoviruses as a reference virus is shown, which is due to their high occurrence in the aquatic environment, the lack of seasonality in the distribution among the population, as well as resistance to external influences, especially to UV disinfection, which is widespread at underground water intakes, which are the main source of drinking water supply in Republic of Belarus. To substantiate the reference pathogenic bacteria, it is advisable to continue studies to study the potential of enteropathogenic *E. coli* and campylobacter, protozoa – cryptosporidium and lamblia.

Key words: drinking water, quantitative assessment of microbiological risks, reference pathogens, safety.

METROLOGICAL EVALUATION OF THE RESULTS OF SIMULATION OF MICROBIC AIR CONTAMINATION IN EXPOSURE CHAMBERS

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Object of the research: microbiota of model air samples. Ensuring and hygienic control of the safety of the microbial status of the air environment of healthcare institutions is an independent medical and biological problem and requires the development and assessment of metrological parameters of quantitative methods for determining the concentrations of microorganisms in accordance with the requirements of the International Organization for Standardization ISO. Based on the results of experimental modeling of aerosols of microorganisms-contaminants of the genus Staphylococcus in the air as a health risk factor, the metrological parameters of methods for controlling microorganisms were calculated. Metrological parameters of the methods (standard deviation of repeatability, standard deviation of intermediate precision, expanded uncertainty) correspond to the requirements for methods with an accepted confidence level $p = 95$ %.

Key words: microorganisms, air samples, healthcare institutions, purity classes, priming chamber, contamination, quantitative determination.

EXPERIMENTAL SIMULATION OF MICROBIAL CONTAMINATION IN FOOD PRODUCTION FACILITIES

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Object of research: microbiota of washings of environmental objects of technological equipment of food production. International recommendations in the field of hygiene of food production require manufacturers of products to conduct dynamic monitoring, assessment of changes in microbiological indicators in the production of food products (assessment of microbiological trends). Therefore, for a relevant quantitative assessment of the microbial status, it is necessary to develop a metrologically certified method for performing measurements. Based on the results of experimental modeling of microbial contamination on the surfaces of objects of the technological environment of food production as a risk factor for impact on health, the metrological parameters of the method for controlling microorganisms were calculated. Metrological parameters of the method (standard deviation of repeatability, standard deviation of intermediate precision, expanded

uncertainty) correspond to the requirements for the methods with the accepted confidence level $p = 95$ %.

Key words: microorganisms, air samples, healthcare institutions, purity classes, priming chamber, contamination, quantitative determination.

ISOLATION AND CHARACTERISATION OF STAPHYLOCOCCUS AUREUS FROM TWO LARGE-SCALE FOOD POISONING OUTBREAKS IN VIETNAM

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In Vietnam and around the world, *Staphylococcus aureus* remains a major hazard of food safety and food poisoning. *S. aureus* is present in many places and easily contaminates food production during processing chains.

In this study, we successfully isolated *S. aureus* strains from suspected samples of two food borne poisoning outbreaks in Ha Giang and Vinh Phuc in 2017 and 2018, respectively. The collected samples were examined for presence of staphylococcal enterotoxins (SEs) by using 3MTM TECRATM Staph Enterotoxin kit, from there all the samples were positive with SEs. Different strains of S. aureus were isolated and then confirmed by MALDI-TOF technique. Those strains then were stored in Brain heart solution with 15 % glycerol until further analysis.

Our results identified three STs, ST96, ST88 (spa type t7558), and ST72 (spa type t3092), were responsible for two outbreaks. Two virulence genes detected from the above strains were sea and sec. Furthermore, these strains are test for antibiotic resistance susceptibility with commonly antibiotics. Penicillin are found to be resisted by all three STs, in particularly, ST96 and ST88 are both resistant to erythromycin while ST72 is resistant to gentamicin.

Taken together, our study highlights the usefulness of molecular characterization to study and monitor bacterial pathogens associated with food poisoning outbreaks in Vietnam.

Key words: antibiotic-resistant, food poisoning, β-lactamase, ESBL, ampC β-lactamases, *Staphylococcus aureus*, MLST, spa genes, staphylococcal toxins.

LONG–TERM DYNAMICS OF THE NUMBER OF SUFFICIED FROM IXODIC MITCHES IN THE TERRITORY OF SVERDLOVSK REGION: ANALYSIS AND FORECAST

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The incidence of tick-borne viral encephalitis and other tick-borne infections is directly related to the number of victims of tick bites. This indicator can be characterized by long-term dynamics and cyclicality, depending on both natural and social factors.

The purpose of this work is to synthesize and analyze a formal statistical model both for describing the long-term dynamics of the registered number of cases and the risks of the population being exposed to tick attacks on the territory of the Sverdlovsk region, and for forecasting.

To describe the dynamics and forecast the number of victims of tick bites in the Sverdlovsk region, harmonic regression was used and prognostic estimates were calculated. With the help of multi-model inference, as an optimal combination of predictions of multicomponent fluctuations, it was possible to obtain a model that adequately describes long-term dynamics with satisfactory predictive ability. The dynamics of the number of victims of tick bites in the Sverdlovsk region is characterized by the presence of long-term (long-wave) and short 2–3-year cycles, which may be due to biological, climatic and social factors. The dynamics and forecast of the chances of the region's population to suffer from tick bites are fully comparable with the dynamics of the number of victims: the probability of suffering from tick bites, according to the forecast, will increase and in 2021 it will amount to 1.09 % of the region's population may be attacked by ixodid ticks with a predicted interval of 0, 84–1.43 %.

Key words: tick-borne viral encephalitis, ixodid ticks, harmonic oscillations, odds ratio, multi-model inference, prediction.

ASSESSMENT OF THE VACCINATION STATUS AND THE STATE OF COLLECTIVE IMMUNITY TO THE PERFECTIVE AGENT IN PUPILS IN THE AGE ASPECT

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The study of the vaccination history and the state of collective immunity against whooping cough in students of different age groups of secondary educational institutions of a

large industrial center (observation group) and a small city of cultural and recreational type (comparison group).

A comparative analysis of the data of medical records on the timeliness and completeness of the implementation of preventive vaccinations against whooping cough in 321 students aged 7–17 years was carried out. It was found that only 57–67 % of children in the studied groups begin primary immunization against whooping cough at the age of 3 months, only 18–31 % complete it, and the first revaccination was carried out on time in 10–18 % of students. Full coverage of primary pertussis immunization in the surveyed schools has been achieved by 3 years of age. In the observation group, 1.2–1.8 times more often revealed non-compliance with the state-regulated terms of immunization against whooping cough, 1.7–4.1 times more gross deviations (more than 6 months) and incomplete revaccination by the time of examination. At the same time, violations of the terms of vaccination and revaccination among students increase with age, however, deviations from the schedules among students 7–11 years old are 1.2–2.2 times greater relative to children aged 13–17 years.

To study the state of collective immunity against whooping cough, 179 students were selected, who received a full and timely vaccination and revaccination with the DPT vaccine. A study of the level and intensity of pertussis immunity showed that 45–90 % of students in the studied groups have high titers of specific antibodies against whooping cough. At the same time, in the observation group, the average group titer of antibodies was 1.7 times lower than in the comparison group, and the number of children with no protective level of antibodies was 2.5 times higher, reaching 31–35 % among students in grades 4 and 9–11 grades.

Key words: vaccination history, whooping cough, herd immunity, students, timeliness, cities and towns.

LABORATORY DIAGNOSTICS OF ENVIRONMENTAL OBJECTS TO DETECT THE PATHOGEN SARS-COV-2. RESEARCH RESULTS

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The article presents information on the structure of the performed studies on the detection of the pathogen SARS-CoV-2.

Key words: environmental objects, flushes, SARS-CoV-2 pathogen, laboratory diagnostics.

DEVELOPMENT OF METHODOLOGICAL APPROACHES TO ASSESS THE RISK OF CORONAVIRUS INFECTION AMONG DENTAL SPECIALISTS BASED ON SANITARY AND HYGIENIC CRITERIA

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The breakout of a new coronavirus infection (COVID-19) in December 2019 in the People's Republic of China has become a world health issue. Medical workers are at increased risk, because they work with patient every day, the dental service in particular. The main location of the virus in the human body is the oropharynx and nasopharynx. As a role, the transmission route should be considered airborne. During the work, the dentist has direct contact with saliva, blood, uses devices with rotating elements. It increases the formation risk of drops and aerosol and the occurrence of coronavirus infection. In order to improve public health and ensure the safety of medical personnel, a method to assess the risk of infection on a three-dimensional scale was applied and sanitary and hygienic criteria were developed. To reduce the risk of a new coronavirus infection, it is suggested using hygienic and sanitary principles.

Key words: risk assessment, sanitary and hygienic criteria, dentistry, prevention, COVID-19.

MONITORING THE LEVEL OF AWARENESS OF YOUNG PEOPLE ABOUT HIV INFECTION TO DETERMINE THE SOCIAL RISK OF INFECTION AND SEARCH FOR PRIORITY AREAS OF PREVENTION

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The object of the research is the youth of the Khabarovsk Territory at the age of 14–25 years.

The goal is to identify the dynamics of the level of awareness and risks affecting the spread of HIV infection among young people in order to determine priorities and strategies for prevention work.

Methods used: equipment of research data for 2012–2014, published in scientific articles, own behavioral studies in 2016–2020, carried out by the method of continuous random sampling

using two types of structured questionnaires and through express surveys, comparison of the obtained (analysis) data.

To reduce the risk of the spread of HIV infection among young people, along with the medical aspects of epidemiology, diagnosis and treatment, the issue of introducing effective prevention programs remains topical. Using monitoring of the level of awareness of young people about transmission routes, the risk of their own infection, as well as sources of knowledge on the problem of HIV / AIDS, it is possible to plan priority areas of health education and prevention methods.

According to the research, a positive result can be considered a 1.5-fold decrease in the share of so-called “street universities” as a source of knowledge and an increase in the authority of medical and educational workers among young people on HIV prevention. However, in recent years, there has been a tendency towards a decrease in the level of awareness of the problem; among the youth there are myths and phobias regarding the risk of infection, which requires active information and educational work.

Key words: youth, HIV infection, awareness, risk of infection, prevention.

Section VI

Risk analysis in labor hygiene

DYNAMICS OF CHANGES IN INDICATORS OF WORKING CONDITIONS WITH AN ASSESSMENT OF THEIR INFLUENCE ON THE LIFE EXPECTANCY OF THE POPULATION OF THE RUSSIAN FEDERATION

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The health status of the working-age population is of importance for the developing economy of the Russian Federation. It is confirmed by the adopted target indicators of national projects in the field of human capital conservation. It is stated that the number of work places not meeting the sanitary standards has decreased in the Russian Federation for the period 2010–2019. At that, microclimate (by 57.5 %), vibration (by 46.5 %), noise (by 37.5 %), etc. were chosen as production factors. At the same time, it was noted that the number of employees working under harmful and (or) dangerous industrial conditions has increased during this period of time: in general, by 32.1 %, for certain factors, such as the severity of the labor process – by 87.0 %, noise – by 23.4 %, chemical factor – by 17.9 %. The forecast calculation of the public life expectancy growth potential showed that the cumulative effect of indicators characterizing working conditions on the life expectancy of the population of the Russian Federation amounts to 0.2 years (75.4 days).

Key words: workers, working conditions, life expectancy, neural networks.

ANALYSIS OF RISK FACTORS FOR HEALTH DISORDERS BASED ON SUBJECTIVE ASSESSMENTS OF EMPLOYEES WORKING BY ELECTRIC MACHINE–BUILDING ENTERPRISE

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The national goals and strategic objectives of the development of the Russian Federation stipulated by the Decree of the President of the Russian Federation and earlier by

the [1]Decree[2], the implementation of national projects to ensure its implementation determine the priorities of health care in achieving key socially significant results by 2030. It is about increasing life expectancy, reducing morbidity and mortality rates of the working-age population, preserving and strengthening the health of workers. To assess the factors affecting the employees health, a study was carried out based on a system-forming electric machine-building enterprise located in the Pskov region and specialized in the production of electrical equipment for the needs of the transport, energy and mining industries ($n = 49$ people). It was found out that employees are overweight and have an increased cardio-vascular risk (46.9 %), as well as first-grade obesity and a high risk of cardiovascular diseases (14.3 %). The workers never measured blood sugar (38.8 %) and blood pressure (20.4 %). The calculation of smoking rate using the pack-years index showed that 22.4 % of employees are "real smokers" and have a risk of developing chronic obstructive pulmonary disease. The results of HAM test show favorable indicators of employees: activity index – 4.8 ± 0.87 points, well-being – 5.0 ± 0.99 points and mood – 5.3 ± 1.02 points. The highest level of professional stress among employees (4.1 % of respondents) is estimated from 30 to 34 points (with a maximum value of 75 points according to the Weissman method).

Key words: Health of employees, health risk, occupational stress, occupational health, working capacity.

NEUROGENIC MECHANISMS OF DEVELOPMENT OF CARDIOVASCULAR PATHOLOGY IN WORKERS OF UNDERGROUND MINING CHROME ORE

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The aim is to study the characteristics of heart rate variability among workers in underground mining of chrome ore. The observation team consisted of 98 workers of underground chrome ore mining. The average age in the observation group was $39.2.8 \pm 9.0$ years, the average length of service was 9.7 ± 8.4 years. The comparison group (working in conditions outside the influence of the investigated production factors) consisted of 75 employees – managers and specialists of the administrative and managerial personnel of the enterprise. To study the influence of working conditions on the health of workers, workplaces with a characteristic set of harmful production factors and the same work regimes were selected.

[1]Decree of the President of the Russian Federation dated July 21, 2020 No. 474 "On the national development goals of the Russian Federation for the period up to 2030", https://rg.ru/2020/07/22/ukaz-dok.html.

[2]Decree of the President of the Russian Federation No. 204 dated 07/05/2018 "On National Goals and Strategic Objectives of the development of the Russian Federation for the period up to 2024", http://publication.pravo.gov.ru/Document/View/0001201805070038.

The results of cardiointervalography showed the predominance of the initial sympathicotonia in the workers of the observation group, which was determined reliably 2.1 times more often than in the comparison group. The decrease in parasympathetic influences on the heart rate is evidenced by a significantly lower 1.2 times value of the parameter of the parasympathetic link of autonomic regulation (Dx) relative to the comparison group ($p = 0.04$). The mean values of the stress index (SI), which characterizes the state of the central circuit of regulation and is sensitive to increased tone of the sympathetic nervous system, in both groups corresponded to sympathicotonia. In the observation group workers with work experience of up to 10 years, the eitonic type of the initial autonomic tone was recorded reliably 2 times less often than in the comparison group, with a significant 2.9-fold increase in the proportion of persons with initial sympathicotonia and 2.2-fold hypersympathicotonia. Analysis of the mean group values of cardiointervalography indices confirmed an increase in sympathetic influences on heart rate in workers in the observation group, in whom the level of AMo, IN1 was significantly higher than in the comparison group, and Dx, reflecting parasympathetic influences, was 1.4 times lower. The revealed changes observed in the heart rate variability in workers of underground chromium ore mining under the influence of a complex of harmful factors of production, indicating the activation of the sympathetic link of the autonomic nervous system, which contributes to an increase in the risk of the formation of production-induced AH

Key words: underground mining of chrome ore, heart rate variability, vegetative nervous system.

MARKER INDICATORS OF METABOLIC DISORDERS IN MINE EMPLOYEES EXTRACTING CHROMIUM ORES

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The aim of the work is to study the features of the formation of metabolic disorders in workers of a chrome ore mine using modern marker indicators.

Materials and methods. The working conditions, clinical and laboratory status of 236 employees of the chromium mine were studied.

Research result. It was found out that cardiovascular and endocrine pathology develop 2.8–3.3 times more often under the combined impact of production factors of underground chrome ore mining (dust, noise, vibration, tension and severity of work, cooling microclimate) when compared to acceptable working conditions. As for feature of metabolic disorders, we observed an unfavorable abdominal form of obesity (1.4 times frequently), as well as an increase in "metabolic

indices" by 1.2–1.4 times relative to the comparison group ($p = 0.001–0.048$) (lipid accumulation coefficient, LAP and visceral obesity index, VAI).

Conclusion. Thus, the medical examination programs should calculate the early markers of metabolic disorders (VAI and LAP indices) to prevent cardiovascular diseases, in employees extracting chromium ores in particular.

Key words: miners; chromium mining; metabolic disorders; obesity; marker indicators, lipid accumulation coefficient; visceral obesity index; periodic medical examinations.

RISK FACTORS FOR DEVELOPMENT OF PRODUCTIVELY CONDITIONED PATHOLOGY OF RESPIRATORY AND CIRCULATORY ORGANS IN METALLURGICAL WORKERS

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The relevance of the study of cardiovascular disease (CD), as a production-conditioned pathology in working in industrial enterprises, is due to the presence in the technological process production factors (noise, general vibration, microclimate, heaviness of work, chemical factors), potentially capable of provoking the development of CD. We examined 139 patients working in environments exposed to dust, chlorine, and hydrogen chloride. Among those examined there were 74 women and 65 men. The comparison group (45 people) consisted of 20 women and 25 men who were not exposed to harmful factors of production in the course of labor activity. The workers group who were exposed to occupational exposure to dust, chlorine and hydrochloride gas revealed a decrease in velocity parameters of external respiratory function, development of proatherogenic metabolic disorders, and an increase in laboratory inflammatory indices. These changes can lead to early manifestation of cardiovascular and respiratory pathology in this category of workers.

Key words: metallurgical production, productively conditioned pathology, dust, chlorine, hydrochloride.

HEATING MICROCLIMATE AS A RISK FACTOR FOR THE DEVELOPMENT OF DISEASES OF THE CIRCULATORY SYSTEM IN WOMEN WORKING AS PROTECTED GROUND VEGETABLE GROWERS

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In our study we focused on working conditions, the functional state in the dynamics of the working shift and the health status of protected ground vegetable growers.

Our research aims atassessing the influence of the heating microclimate on the morbidity of the circulatory system in women employed as protected ground vegetable growers based on the complex physiological and hygienic studies and the results of regular medical examination.

Materials and methods. Comprehensive physiological and hygienic studies were carried out under production conditions and general morbidity according to the data of regular medical examination of women employed as protected ground vegetable growers when performing main work. At that, we used accepted methods of occupational medicine and current sanitary and epidemiological requirements.

Results. It was found out that vegetable growers are exposed to the heating microclimate during 63–69.6 % of the annual production cycle. It leads to the accumulation of heat in the body from 2.69 to 4.56 kJ/kg (classes 3.1–3.4). The work of vegetable growers causes the changes in the functional state of the body. It leads to disease of blood and respiration systems, gas exchange disorders and the development of fatigue in during the working shift. When self-evaluating working conditions, vegetable growers pointed out elevated temperature (67.7 %) and humidity (56.6 %) among the harmful production factors in the most cases. A positive statistically significant correlation was found between subjective manifestations of fatigue during the work shift and unwellness at the end of it and the assessment of the microclimate by vegetable growers as the cause of their occurrence ($r = 0.71$ and $r = 0.58$, respectively).

Diseases of the circulatory system occupied the first rank among the newly identified and took the third place among the chronic general diseases of women working as vegetable growers. Significant correlations of average strength between the frequency of newly detected diseases of the circulatory system and work experience ($r = 0.56$) were found. A high degree of association of arterial hypertension with work was established ($RR = 2.805$; $EF = 64.35$ %; $CI = 1.498–5.253$). Thus we might draw an conclusion about the occupational diseases.

Key words: protected ground vegetable growers, heating microclimate, circulatory system.

OCCUPATIONAL DISEASES OF WORKERS IN BASIC AGRICULTURAL INDUSTRIES RISK ASSOCIATED WITH THE SEVERITY OF THE LABOR PROCESS

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The work highlights the results of many years of sanitary, hygienic and ergonomic studies of the occupational conditions in the main branches of agricultural production (crop, livestock, poultry), as well as updated data on the level of occupational morbidity (OM) of agricultural workers in the Russian Federation.

The purpose of this study was to identify modern trends in the formation of occupational pathology under the influence of the severity of the labor process, as well as to analyze the influence of this factor on the nosology of occupational diseases in workers in the basic sectors of agriculture.

Main results. It has been established that working conditions in the agricultural sector of the Russian Federation continue to be harmful in terms of the severity of the labor process (classes 3.2–3.3) and represent an occupational risk of categories from medium to high for the development of diseases of the musculoskeletal system and connective tissue. In percentage terms, the largest number of occupational diseases (37.2 %) in the industry developed under the influence of physical overload caused by the severity of work. In total, for the period from 2011 to 2017, 1063 diseases associated with the severity of the labor process were detected in agricultural workers of the Russian Federation (radiculopathy of the cervical and lumbosacral levels, mono- and polyneuropathy of the upper extremities, shoulder lesions, as well as osteoarthritis of other localization), from which the share of workers occupied in crop production accounted for 46.5 %, animal-breeding – 53.5 %. The increase in the frequency of diagnostics of diseases of the musculoskeletal system and connective tissue was, primarily associated with a statistically significant increase in the incidence of occupational radiculopathies, mainly of the lumbosacral level. A high etiopathogenetic relationship was established between the nosological form of the disease and working conditions in the profession, which must be taken into account when developing risk-oriented complex medical and hygienic measures for the prevention of occupational pathology for agricultural workers.

Key words: agricultural workers; the severity of the labor process; occupational diseases; prevention.

FEATURES OF VEGETATIVE REGULATION IN WORKERS OF HAZARDOUS PRODUCTIONS

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The autonomic nervous system, specifically the interaction of the sympathetic and parasympathetic departments has a leading role in the formation of stress manifestations. Industrial factors can cause damage to the diencephalic brain structures, limbic system, medulla oblongata, with subsequent disturbance of neuroendocrine regulation and disruption of physiological functions of the body.

The purpose of this work is to analyze vegetative regulation in workers in hazardous industries.

Materials and methodologies. Observation group – 100 workers engaged in hazardous work. The average length of service is 18.2 ± 5.4 years, the average age is 42.6 ± 7.3 years. The comparison group consisted of 100 workers of industrial enterprises of the Perm Territory, whose working conditions corresponded to class 2 "permissible". The average experience was 19.8 ± 6.3 years ($p > 0.05$), the average age was 45.4 ± 8.4 years ($p > 0.05$). The assessment of working conditions, anamnestic, sociological, clinical, functional diagnostics, statistical processing of materials was carried out.

Results. The analysis of working conditions based on the results of the SAWS showed that among the employees of the observation group, the final class of working conditions in 96 % corresponded to class 3 "harmful" with a degree of 3.2–3.3, in 4 % of cases – to class 4. The analysis of the functional state according to the test results showed the presence of signs of fatigue among the employees of the observation group: a decrease in the indicators of well-being and activity against the background of an increase in mood. The main clinical manifestations of autonomic disorders were lability of heart rate and blood pressure, tension headache, sleep disturbance. The analysis of cardiointervalography data showed profound violations of compensatory mechanisms in the workers of the observation group, the overstrain of the parasympathetic division of the autonomic nervous system increased with increasing length of service.

Conclusions. Working in hazardous industries contributes to the formation of chronic stress, accompanied by the depletion of adaptive energy; manifested by a decrease in the regulatory capabilities of the autonomic nervous system, the depletion of the parasympathetic department is more pronounced.

Key words: autonomic nervous system, autonomic regulation, hazardous industries.

CURRENT PROBLEMS OF HEALTH OF THE WORKING POPULATION UNDER EXPOSURE OF INDUSTRIAL ALLERGENS

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According to the World Health Organization, by 2050, allergic diseases will be detected in the majority of the world's population.

The aim of the work is to evaluate the health of workers in conditions of exposure to chemicals, including industrial allergens.

To analyze the health indicators of workers, observation and comparison groups were formed. Monitoring group: working in conditions of exposure to chemicals – 196 people. Comparison group: workers without exposure to chemicals – 64 people. The research program included: analysis of medical records for the period 2015–2019, the results of a special assessment of working conditions (SAWC) and production control results, a comprehensive examination of workers, a static-mathematical processing of the results.

The analysis of the results of the SAWC showed that at all workplaces of the workers of the observation group the class of working conditions by the chemical factor is "permissible" (class 2). Of the chemicals used in the technological process, industrial allergens and irritants are present in the air of the working area. In a clinical study, it was found that respiratory diseases are the priority. In the observation group of workers, already with an experience of up to 5 years, pronounced difficulty in nasal breathing prevailed, which was recorded 1.6 times more often than in the comparison group. According to spirography data, with an increase in experience, the number of employees with impaired ERF (external respiratory function) increases.

The mucous membrane of the upper respiratory tract is more sensitive to the effects of chemicals. The key enzyme-specific antibodies that determine sensitization to detergent enzymes are antibodies to BLAP and Amylase ST. Prevention and early detection of workers with sensitization before clinical manifestations is a priority in the development of medical and preventive technologies. The effectiveness of the prevention of allergic diseases.

Key words: prevention; chemical production; allergic diseases; allergy diagnostics.

SANITARY–EPIDEMIOLOGICAL MODELING OF THE FORMATION OF PROFESSIONAL INCIDENCE IN THE REGION

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Hygienic assessment of social and hygienic monitoring data using autocorrelation, correlation-regression, cluster analysis allows you to get a broader understanding of the formation of occupational morbidity in the region, highlight the most relevant areas for conducting state sanitary and epidemiological surveillance of working conditions and develop preventive measures to reduce occupational health. morbidity.

The purpose of the study is to scientifically substantiate the optimization of sanitary and epidemiological supervision over working conditions that form high professional risks for workers in a region with a developed coal industry.

The work used data from over 9 thousand cards for recording occupational diseases in the Kemerovo region, hygienic assessment of working conditions of enterprises for the main types of economic activity. A model for analyzing the conditions affecting the formation of occupational morbidity in the region has been developed and tested.

The data obtained indicate that more than 75 % of the victims are employed at enterprises for the extraction of fuel and energy minerals in workplaces with hazard classes 3.2 and 3.3. It was found that with an increase of 1 degree in harmful working conditions of the main and concomitant factors, the length of service in which an occupational disease develops decreases by 4–6 years, depending on the nosological form. According to a set of indicators contributing to the development of occupational morbidity, clusters of similarity of the sanitary and epidemiological situation at enterprises by type of economic activity, mining towns and in the context of mass professions were obtained, which made it possible to give reasoned conclusions when preparing the sanitary and hygienic characteristics of working conditions with suspicion of occupational diseases. as well as rationally plan control and supervisory activities, focus attention on the most problematic areas.

Key words: working conditions, occupational morbidity, cluster analysis, the semblance of a sanitary and epidemiological situation, prevention.

ASSESSMENT OF THE RISK OF DISEASES RESULTING FROM EXPOSURE TO NOISE EXCEEDING THE MAXIMUM PERMISSIBLE LEVELS

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In accordance with the requirements of paragraph 3.2.6 of the SanPiN "Sanitary and epidemiological requirements for physical factors in the workplaces", if the noise level in the workplace exceeds 80 dBA, the employer is obliged to conduct an assessment of the risk to the health of employees and confirm the acceptable risk to the health of employees. An assessment was made of the relationship between the incidence of occupational and occupational diseases with exposure to noise exceeding the maximum permissible levels (80 dBA) at the food industry enterprise of the Perm Region. Assessment of the association of morbidity with noise exposure is the first step in assessing the occupational health risk of workers working in conditions of noise exceeding the RTM. When establishing a reliable association of morbidity with noise exposure, an occupational risk assessment is carried out.

According to the results of the epidemiological analysis of the health status of workers in conditions of exposure to noise above the RTM, there is a link between noise exposure and the development of bilateral mixed conductive and sensorineural hearing loss (code H90.6-according to ICD-10). The relative risk index (RR) was – 4.39, with the etiological proportion (*EF*) – 77.19 (confidence interval *CI* = 1.06–18.14). The risk level calculated on the basis of the value of the additional probability of the disease was $5.7 \cdot 10^{-2}$, this value exceeds the acceptable level ($1 \cdot 10^{-3}$).

Key words: maximum permissible noise levels, occupational risk, occupational diseases.

POSSIBILITIES OF PRESERVING THE HEALTH OF WORKERS IN CONDITIONS OF COMBINED EXPOSURE TO VIBRATION AND PHYSICAL OVERLOAD

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Diseases of the musculoskeletal system (MSS) occupy a significant place in the structure of occupational diseases. These diseases are characterized by persistence and long periods of exacerbation, in addition, they reduce the working capacity of workers. Currently, the number of young workers suffering from chronic diseases of the CMS is increasing.

The purpose of the work is to develop treatment and rehabilitation programs for industrial workers in conditions of combined exposure to vibration and physical overload.

A purposeful comprehensive examination of workers at industrial enterprises of the Perm Territory, exposed to the combined effects of physical overload and vibration, was carried out.

Key words: diseases of the musculoskeletal system, combined effects, physical overload, vibration.

JUSTIFICATION OF CRITERIA FOR PREDICTORS OF WORK-RELATED ARTERIAL HYPERTENSION STATES BASED ON THE ESTABLISHMENT OF A CAUSAL RELATIONSHIP OF HEALTH IMPAIRMENT WITH WORK

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As reported by the World Health Organization, there has been a steady increase in mortality from cardiovascular disease in all countries. Currently, diseases of the circulatory system are the leading cause of death and disability in the world. The most common cardiovascular diseases are coronary heart disease and arterial hypertension, which are developing in young men in modern society. A significant number of cases of morbidity and mortality from cardiovascular disease are strongly influenced by lifestyle and a person's attitude toward their health. However, the increase in the retirement age requires consideration of this problem in the aspect of the formation of occupational and industrial risk.

Justification of criteria for predictors of work-related arterial hypertension states based on the establishment of a causal relationship of health impairment with work.

Materials and methods. Observation group – 62 workers exposed to a complex of harmful production factors, their average age – 39.4 ± 6.3 years, the average length of work experience – 15.3 ± 5.7 years. Comparison group – 58 employees whose working conditions were without exposure to harmful production factors, the average age – 41.6 ± 6.9 years, the average length of work experience – 16.7 ± 6.1 years.

A research program was developed and implemented, including an analysis of working conditions. Medical records, clinical examination, risk assessment, and statistical data processing.

Results. Analysis of the state of health of workers in harmful working conditions revealed that under the influence of harmful industrial and social factors pathological reactions are formed in the form of violations of autonomic and vascular regulation, endothelial dysfunction, reduction of antioxidant protection, and activation of atherogenesis, as well as the development of inflammatory reactions. The main links in the pathogenesis of work-related arterial hyperten-

sion under conditions of exposure to harmful factors of production are oxidative stress and activation of atherogenesis.

Conclusions. The assessment of the degree of the causal relationship between health disorders and work allowed us to establish predictors of work-related arterial hypertension: dyslipidemia, reduction of antioxidant protection.

Key words: causal relationship, predictors, oxidative stress, atherogenesis, arterial hypertension.

ANALYSIS OF OCCUPATIONAL MORBIDITY IN RELATION TO PRODUCTION-RELATED FACTORS

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The research was conducted according to state official statistics based on federal statistical observation forms No. 18 "Information on the Sanitary State of the Subject of the Russian Federation" and No. 24 "Information on the Number of Persons with Newly Diagnosed Occupational Diseases (Poisonings)" for the Republic of Buryatia over the period 2016–2020.

The aim of the study was to analyze occupational morbidity in the Republic of Buryatia in relation to production-related factors for the 5-year period.

Materials and methods. Comparative method of studying the data obtained from the state forms of statistical observation for the period 2016–2020.

Results. Unsatisfactory working conditions and long-term exposure to harmful factors in the workplace were the main reasons for the formation of occupational pathologies among workers. Over the 2016–2020 period, 331 cases of occupational diseases were registered in the Republic of Buryatia; the occupational morbidity rate per 10,000 workers averaged 3.03. In the structure of occupational pathology, depending on the harmful industrial factor, occupational pathology due to excessive exposure of workers to physical factors of production processes took the leading position. In terms of economic activity, workers in the mining industry were the most significant contributors to occupational disease rates. The nosological forms of occupational diseases are as follows: vibration disease, sensorineural hearing loss, and respiratory diseases. The proportion of chronic occupational diseases diagnosed for the first time in workers during their periodic medical examinations, unfortunately, tended to decrease over the period analyzed, due to the low detection rate of occupational pathologies under the current system of medical examinations for compulsory workers.

Key words: occupational diseases, industrial enterprises.

PLACE OF PERIODIC HEALTHCARE IN THE SYSTEM FOR ASSESSING THE RISKS OF HARMFUL EFFECTS OF CHEMICAL FACTORS ON THE HEALTH OF WORKERS

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Mandatory medical examinations (preliminary and periodic) form the basis of medical prevention of the individuals occupied in contact with chemical compounds. The purpose of the work is to assess the impact of regulatory orders on mandatory medical examinations on the quality of medical equipment in terms of identifying health risks for workers. 349 archived outpatient records of employees of one of the chemical plants in Dzerzhinsk, who underwent in-depth periodic medical examinations (PME) at the center of occupational pathology, have been analyzed in a random order. The workers were divided into two groups. 136 people (group 1) passed the PME according to the regulations of the order of the Ministry of Health and Social Development dated 19.08.2004, No. 83. 213 people (group 2) passed the PME on the basis of the order of the Ministry of Health and Social Development dated 04/12/2011. No. 302n. According to the nature of harmful occupational risk factors, three subgroups were identified. The first one – working outside the influence of chemical risk factors (75 people), the second – working with chemicals, mainly irritating (113 people), the third – working with chemicals of general toxic action (161 people). The most frequently detected pathological conditions in workers of a chemical enterprise were: refractive errors, arterial hypertension and cerebrovascular disorders, vertebrogenic diseases, and middle ear pathology. The diseases were detected in the PME group by order No. 83 and among those working in direct contact with chemical compounds.

It was revealed that the expansion of the list of the studies regulated by orders during the PME did not lead to a corresponding improvement in diagnostic work. At the same time, the absence of a significant difference in the incidence of diseases (lesions) of the main target organs could indicate that the examination algorithms regulated by the PME orders are not sufficiently sensitive to detect early signs of damage to target organs specific for a particular chemical risk factor.

Key words: compulsory medical examinations, health status, chemical production.

PREVALENCE OF TRADITIONAL RISK FACTORS FOR CARDIOVASCULAR DISEASES IN EMPLOYEES WORKING IN A LARGE METALLURGICAL ENTERPRISE

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To date, cardiovascular pathology is the most common global disease. Prevention of cardiovascular diseases including those based on the identification of risk factors for their development is one of the priority areas in medicine.

The study aims at assessing the prevalence of traditional risk factors for cardiovascular pathology in men working in a large metallurgical enterprise.

Material and methods. The study included 200 men working in VMZ JSC aged from 24 to 65 years and having work experience from 4 to 40 years. All the examined patients were subject to an in-depth regular medical examination as per the order of the Ministry of Health and Social Development dated 12/04/2011 No. 302n.

Results. Among the examined men, 59 % suffered from excessive weight and obesity, 50.5 % had hypercholesterolemia, 44.5 % were smokers, 34 % had arterial hypertension, and 5 % had carbohydrate metabolism disorders. A third of the examined workers who have normal total cholesterol levels suffered from lipid metabolism disorders. At least one risk factor for cardiovascular disease is present in 96 % of the men examined, and 36.5 % of employees have a combination of three or more risk factors.

Conclusions. The analysis of the obtained data revealed a high prevalence of traditional risk factors for cardiovascular diseases among men of working age. It is of importance to study the expanded lipid profile during regular medical examinations.

Key words: risk factors, cardiovascular diseases.

RISKS TO THE HEALTH OF MINERS WHEN EXPOSED TO WELDING AEROSOLS AND COOLING MICROCLIMATE

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Despite extreme climatic conditions and weak infrastructure development, a powerful industry was created and continues to develop in the Russian North. In its structure, the leading place

is occupied by the extraction and processing of natural resources, that is, sectors of the economy with harmful and dangerous working conditions.

The aim of the study was to compare the health status of miners exposed to welding aerosols and low air temperatures of underground working areas mine in the Arctic.

Materials and methodologies. A comparative analysis of the results of periodic medical examinations of two groups of workers of underground mines of the Far North was carried out. The main group consisted of 310 electric and gas welders and electric fitters who performed welding by manual arc welding method. 276 machinists of an underground narrow gauge electric locomotive were included in the control group.

Results. According to the periodic medical examination, 499 diseases of eleven classes according to MKB 10 were found in employees of the main group, and 536 diseases of twelve classes were found control. In both groups, the three most common classes of diseases were the pathology of the musculoskeletal system, the eye and its appendage apparatus, the circulatory system. At the same time in the main group there was an increased risk of respiratory diseases ($OR = 1.91$; DI 1.22–3.01; $\chi^2 = 8.30$; $p = 0.004$) due to frequent detection of curvature of the nasal septum with impaired function breaths. In the control group workers, the risk of endocrine system diseases increased ($OR = 2.26$; CI 1.47–3,46; $\chi^2 = 15.1$; $p = 0.0001$) and skin ($OR = 2,29$; CI 1.50–3.51; $\chi^2 = 15.7$; $p<0.001$). The overall risk of developing all forms of chronic pathology in both groups was not significantly different.

Key words: working conditions; welding aerosols; cooling microclimate; employees of enterprises; state of health.

RISK ASSESSMENT TO WORKERS UNDER EXPOSURE OF HERBICIDE, TRICETONE DERIVATIVE

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Every year the range of plant protection products is expanding, the range of crops treated with pesticides is increasing. The deliberate introduction of pesticides into the environment, high biological activity and the ability to migrate in natural objects pose a certain threat to human health. The risk assessment for workers in real conditions using a herbicide based on tricetones has been carried out. The time period for the safe exit of people to the treated areas for carrying out mechanized work has been substantiated. The conditions for using the studied drug do not pose a danger to humans and meet hygienic requirements.

Key words: risk assessment, agriculture, pesticides, tricetone derivative.

HEALTH RISK ANALYSIS OF CEMENT PRODUCTION WORKERS

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Assessment of the state of the upper respiratory tract and biochemical parameters in workers under the influence of unfavorable factors of cement production.

Materials and methods. 255 workers of the main professions of cement production and 45 people of the control group were examined. The morphological structure of the mucous membrane and the transport function of the upper respiratory tract were studied. Laboratory indicators of homeostasis were assessed using standard methods.

Results. Pathological changes in the upper respiratory tract were detected in 35–61 % of workers in the main professions. According to the data of the rhinocytological study, an experience-dependent increase in the process of desquamation of cells of the prismatic epithelium, the number of their degeneratively altered forms and metaplasia in the stratified squamous epithelium was noted. A slowdown in the transport function of ciliated epithelium cells was found in 50.0–73.2 % of the examined. With an increase in work experience, a weakening of the regulatory influence of the hormonal system was observed: a decrease in the concentration of ACTH, cortisol, triiodothyronine, thyroxine, TSH. The development of classic oxidative stress (an increase in the content of malondialdehyde, a decrease in superoxide dismutase, catalase, and myeloperoxidase) was noted in trained workers. The study of the cytokine profile revealed a decrease in immunological reactivity in the form of an increase in the production of IL-1β, IL-4, IL-8 and TNF-α, a decrease in the production of IL-2 and interferon-γ.

Conclusion. Early nonspecific pathological changes in various organs and systems of the human body were revealed, which requires the development of preventive measures aimed at preserving the health of cement workers.

Key words: cement production, production factors, health risk, upper respiratory tract, biochemical parameters, immunological parameters

RISK FACTORS ANALYSIS AND PREVENTION OF HEART RHYTHM DISORDERS IN RAILWAY TRANSPORT LOCOMOTIVE ENGINEERS

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Risk factors for cardiovascular diseases in railway workers include generally accepted (age, smoking, obesity, hypercholesterolemia, arterial hypertension, hypodynamia), as well as factors

related to work (stress, high work intensity, shift work, unfavorable microclimate of the working environment, particularly noise, dust, vibration). Heart rhythm disturbances in locomotive drivers can lead to life-threatening conditions and potentiate the creation of an emergency situation in railway transport.

The study and prevention of risk factors for the development of cardiac arrhythmias is of great importance. The presented work analyzes the prevalence of psychoemotional stress, sleep apnea, and vitamin D deficiency among locomotive drivers. Locomotive drivers have high levels of stress and anxiety. Reactive anxiety according to the Spielberger-Khanin scale is most common among locomotive drivers with cardiac arrhythmias, prognostically unfavorable in terms of the risk of sudden cardiac death and thromboembolic complications. Obstructive sleep apnea syndrome, assessed by the sleep apnea / hypopnea index, was found in 60 % of drivers. A decrease in the level of vitamin D was found in 100 % of the surveyed drivers: 50 % – vitamin D deficiency, 50 % – vitamin D deficiency. The researchers revealed the relationship of the studied factors with the development of cardiac arrhythmias, prognostically unfavorable in terms of the risk of sudden cardiac death and thromboembolic complications. The obtained results of the study made it possible to formulate recommendations for the prevention of risk factors for the development of cardiac arrhythmias in locomotive drivers in order to reduce the likelihood of developing accidents on the railway. Recommendations are given for the inclusion of the following measures in the periodic examinations of locomotive drivers: determination of the level of vitamin D, polysomnographic examination, assessment of the level of anxiety according to the Spielberger-Khanin scale.

Key words: Locomotive drivers, heart rhythm disturbances, psycho-emotional stress, sleep apnea, vitamin D.

COMPLEX ASSESSMENT OF THE RISKS OF PROFESSIONAL BURNOUT FOR TEACHERS IN GENERAL EDUCATION SCHOOLS

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The paper presents the results of the complex assessment of professional burnout risk factors for the teachers of secondary schools including hygienic assessment of working conditions for teachers and social teachers, the study of psychological features of the educational process, socio-demographic status, actual nutrition of the contingent under study. Based on the carried out researches the program for prevention of professional burnout syndrome among the teachers was developed.

Key words: risk factors, hygienic assessment of working conditions, professional burnout syndrome, teachers of general secondary schools, prevention program.

RISK ASSESSMENT FOR OPERATORS IN THE APPLICATION OF PREPARATIONS BASED ON GLYPHOSATE IN AGRICULTURAL CONDITIONS

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The results of hygienic risk assessment of the use of pesticides based on glyphosate in agricultural production are presented. The permissible risk of exposure to pesticides on workers has been established, subject to technological regulations and safety requirements.

Subject of research. Agricultural operators in contact with glyphosate-based pesticides.

Objective. To conduct hygienic studies to determine the exposure levels of glyphosate in the air of the working area and on the skin of operators and to assess the risk of glyphosate exposure to the health of workers when using herbicides based on it in agricultural conditions.

Methods. Chemical and analytical studies to measure the concentrations of glyphosate in the air were carried out using MU 4379-87 "Guidelines for measuring the concentrations of glyphosate, glyphosine and glycine in the air of the working area." The control of the content of the active substance on the skin was carried out under the conditions of analysis of the air of the working area, which is recommended in the methodological guidelines "Assessment of the risk of exposure to pesticides on workers" (MU 1.2.3017-12), in accordance with which the degree of risk of exposure to pesticides on workers in real conditions of agricultural production.

Key words: pesticides, glyphosate, risk assessment, operators.

SUBJECTIVE ASSESSMENT OF THE STATE OF THE ORGANISM AS AN ELEMENT OF PREVENTION OF PROFESSIONAL HEALTH DISORDERS OF MEDICAL WORKERS

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The article presents the results of a survey of 270 medical workers of outpatient and inpatient healthcare organizations, conducted with the aim of subjectively assessing the impact of medical devices for respiratory protection on their functional state during operation in a favorable and unfavorable epidemic environment. It was found that the time of operation of medical devices for respiratory protection by medical workers when working in an unfavorable epidemic situation exceeds that when working in a favorable epidemic situation both in outpatient health care organizations and in inpatient health care organizations, which leads to an increase in the number of and

the severity of symptoms that characterize the process of fatigue, while the nature of the symptoms is different for medical workers of different health organizations. The information obtained as a result of the questionnaire will allow a differentiated approach to the development of measures aimed at preventing health disorders of medical workers in the process of professional activity.

Key words: medical workers, personal protective equipment, questionnaires.

HEALTH RISK ASSESSMENT AND MORBIDITY OF DUST ETIOLOGY IN THE RUSSIAN FEDERATION AND ABROAD

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The morbidity of dust etiology remains one of the key factors in the structure of general occupational morbidity. Despite improvements in working conditions and the introduction of preventive measures, current health risk assessment criteria for dust-related professions do not always reliably reflect the level of risk in particular enterprises, and respiratory diseases are still common among workers in various types of industry.

The work analysed Russian and international publications and studies related to diseases caused by dust exposure, as well as workers' health assessments and criteria for the validity of the obtained data.

The final results highlight the inadequate protection of workers' health, the poor quality of the preventive measures introduced in industrial production, and the inaccurate assessment of workers' occupational risk, whether in the Russian Federation or in other countries. New methodologies need to be introduced to objectively assess the level of risk, and preventive measures need to be refined and monitored in enterprises to reduce occupational health risks to workers. The strict observance and implementation of preventive measures, as well as the use of additional criteria and studies in assessing the level of occupational health risk in dust-related professions, can significantly reduce the number of diseases directly related to the dust factor.

Key words: risk assessment, dust, occupational risk, morbidity of dust etiology, dust professions.

FEATURES OF IMMUNOLOGICAL INDICATORS IN WORKERS IN THE PETROCHEMICAL INDUSTRY WITH CARDIOVASCULAR PATHOLOGY

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The paper presents features of immune regulation and specific hypersensitivity indicators in workers with cardiovascular pathology under conditions of exposure to chemical risk factors at

petrochemical production. The results of immunological research revealed a deficit of CD25+, CD95+ lymphocytes expression, hyperproduction of Annexin V-FITC+7ADD-negative cells, TNFR, p53, bcl-2, bax, vascular endothelial growth factor VEGF, excessive specific sensitization of the organism to benzene, which characterizes the features of indicators of immune homeostasis, associated with the formation of disorders of CVD in workers in the conditions of petrochemical production. Translated with www.DeepL.com/Translator (free version)

Key words: cell regulation, sensitisation, petrochemical production, cardiovascular system, workers, benzene.

REPRODUCTIVE HEALTH OF MALE WORKERS IN THE STEEL INDUSTRY

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In recent years, there has been a significant decline in the fertility of the population, especially male reproductive performance. The total number of men with infertility in Russia during 2000–2018 increased 2 times. To solve demographic problems, the national project "Demography" was adopted, the main goal of which is to achieve natural population growth. In recent years, attention has increased to the problem of the impact of harmful production factors on reproductive health. Harmful factors of metallurgical production (heating microclimate, chemical factor, vibration) are a risk factor for violations of the reproductive function of workers. The reason for such pathological changes is the complex effect of the thermal microclimate in almost all major professions, vibration and manganese compounds, which are classified as dangerous to human reproductive health. This study aims to assess the relationship of occupational hazards from metallurgical production to reproductive hormones and sperm quality. The study of reproductive function in 100 workers of reproductive age included analysis of spermograms according to the WHO method, determination of blood hormones: testosterone (TSTO), follicle-stimulating hormone (FSH), luteinizing hormone (LH). Increased viscosity of spermatozoa was significantly more common in the main group, somewhat more often – agglutination of spermatozoa, violation of the qualitative and quantitative parameters of ejaculate, pathospermia. Determination of the level of sex hormones in workers of childbearing age showed a decrease in testosterone levels of less than 12.1 nmol / l in 6, 7 % of metallurgists with work experience> 5 years.

Key words: occupational exposure, reproductive hormones, semen quality, metallurgical industry.

Section VII

Medical and biological aspects of the impact of risk factors on human

THE EFFECT OF BIOLOGICALLY SIGNIFICANT SUBSTANCES ENTERING THE BODY FROM FOOD ON THE CONTENT OF HEAVY METALS IN THE BLOOD

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The population living in some territories of the Russian Federation is under the influence of an unfavorable environmental situation. This leads to an increase in disorders of various organs and body systems in the population. Adjusting the diet might reduce the concentration of heavy metals in the blood, both by reducing absorption and stimulating the activity of the excretory system. The article evaluates the ability of the daily diet to influence the concentration of heavy metals in the blood. To determine the structure of consumption of food components, a survey of 1,609 people was carried out. Based on the obtained data on the diet and the concentration of heavy metals in the blood, paired mathematical models of the relationship of the selected indicators are constructed. According to the data obtained, an increase in the diet of proteins, vegetable fats, ascorbic acid and dietary fiber leads to a decrease in the concentration of certain heavy metals in the blood. Reducing carbohydrates and total fat in the diet can reduce the concentration of copper and manganese by up to 8 %. When adjusting the diet, the concentration of heavy metals might be reduced up to 29 %.

Key words: questionnaires, modeling, nutrition, heavy metals, alimentary adaptation

COMPARATIVE ANALYSIS OF THE CONTENT OF MICROELEMENTS IN WOMEN WITH BREAST DISEASES UNDER MULTI–ENVIRONMENTAL EXPOSURE BY METAL–DISRUPTORS

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Research in recent years has shown that many metals in the environment, entering the body can manifest themselves as endocrine disruptors, impairing the activity of the endocrine, reproductive and other systems of the body. At the same time, hormonal disorders provoke a number of comorbid pathologies due to a common pathogenetic mechanism, which can lead to hormonal imbalance of the hypothalamic-pituitary-adrenocortical system and, consequently, to the occurrence of breast diseases in women of fertile age. In recent years, a number of studies have focused on the

formation of a metabolic syndrome associated with exposure to chemical xenobiotics at low subthreshold doses.

The purpose of the study. To carry out a comparative analysis of the trace element composition of hair in women with breast diseases associated with multi-media exposure to metals-disruptors.

It was found that the total pollution factor of atmospheric air is 1.13 contributions of metals – disruptors – 29 %; drinking water 0.67, the contribution of metals - disruptors in the total burden – 51 %. The highest total coefficient of metal pollution is set for the soil (1.72) with a proportion of the contribution of disruptors – 27 %.

All examined women had reduced levels of essential microelements (chromium, selenium, zinc) relative to the reference values. At the same time, women with breast disease had significantly higher manganese levels and lower iodine levels both relative to reference levels and relative to healthy controls.

Key words: disruptors, endocrine system, trace elements, breast diseases, metals-disruptors.

COMPARATIVE ASSESSMENT OF TOXICITY AND DANGER OF REPELLENT DRUGS FOR YOUNG CHILDREN

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Repellent agents, in the form of a spray milk, based on IR3535 and DEET.

Objective of the study. Comparative assessment of the toxicity and danger of repellent agents based on different active ingredients (IR3535 and DEET) for young children.

Research methods. Guideline 4.2.3676-20 "Methods of laboratory research and testing of disinfectants to assess their effectiveness and safety", Directive 2010/63 / EU of the European Parliament and of the Council of September 22, 2010 on the protection of animals used for scientific purposes.

Results. In the course of a comparative analysis of the toxicity and danger of two repellent agents with different active ingredients, it can be concluded that the IR3535-based agent has a less pronounced toxic effect than the DEET agent. To protect against blood-sucking flying insects among children under one year old, it is recommended to use funds based on IR3535; for children over one year old, it is allowed to use funds for DEET, but with a specification of the concentration of the active substance.

Key words: toxicity and danger, repellents, children.

FEATURES OF THE IMPACT OF COMPONENTS OF MODERN SYNTHETIC DETERGENTS ON THE HUMAN BODY

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Synthetic detergents (SD) are widely used in human households. Their production can be seen as an artificial mini ecosystem. In its interactions with the environment, the human body exhibits certain reactions, i.e. a predictable change in the health status. The technological process for the production of SD consists in mixing the raw components at a certain temperature, followed by drying the composition and introducing non-thermostable additives. To ensure environmental safety, technological lines at all stages of SD production are equipped with dust and gas cleaning systems. However, it is impossible to completely exclude the influence of SD components on the human body.

The aim of the work is to study the effect of enzymes of detergents on the employee's body.

A total of 275 workers were surveyed who were exposed to enzymes of detergents, a detergent and home care product (SD) company. The study included: analysis of sanitary and hygienic working conditions, questionnaires, clinical and functional examination according to standard methods in compliance with ethical standards, medical monitoring using radioallergosorbent testing (RAST), health risk assessment, statistical analysis of the results obtained.

In the air of the working area (AWA), chemical substances used in the technological process are present in the form of industrial allergens (formaldehyde, SD, enzymes, enzyme-containing aerosol; animal and vegetable dust), irritating substances ("aggressive" substances (acids and alkalis), strong-smelling substances (fragrances). Chemical substances are mixtures, the components of which, when combined, can change their biological activity. Enzyme-specific antibodies were detected in 27 workers. Of these, 17 had specific antibody levels in excess of the Rast-Class 2 range. According to the number of antibodies detected, only 10 workers should be classified as enzyme-sensitized according to the Rast-Class.

The production of SD using enzymes poses a risk to the health of the worker: 27 workers have enzyme-specific antibodies.

Key words: synthetic detergents, enzymes, health risk.

FEATURES OF BIOACCUMULATION AND TOXIC EFFECTS OF COPPER (II) OXIDE NANOPARTICLES DURING A SINGLE INHALATION EXPOSURE IN RATS

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Due to the wide range of applications of copper (II) oxide nanoparticles (CuO nanoparticles), there is an increased risk of environmental contamination and, as a consequence, the likelihood of public exposure to this nanomaterial.

The aim of the study is to study the features of bioaccumulation and toxic effects of CuO nanoparticles during a single inhalation exposure.

The particle size was determined by scanning electron microscopy and dynamic laser light scattering. The specific surface area is determined using the Brunauer, Emmit, Teller method. The total pore volume is determined by the Barrett, Joyner, Halenda method. After 14 days of exposure, the rats had internal organ samples taken to determine their weight, copper concentration, and histological analysis.

The study was performed in comparison with microparticles of copper (II) oxide (microparticles of CuO). The studied CuO sample is a nanomaterial in terms of size, surface area and pore volume. The bioaccumulation of CuO nanoparticles is more expressed relative to its micro-dispersed counterpart and occurs in the lung, liver, stomach, kidney, and brain. The pathomorphological changes are equally pronounced when exposed to CuO nanoparticles and CuO microparticles and appear in lung tissues as hyperplasia of lymphoid tissue, pneumonia, bronchitis, vasculitis, accumulations of brown pigment; liver – hepatitis and venous haemorrhage; kidney – mesangial cell proliferation and brown pigment accumulation; stomach – acute gastritis; small intestine – hyperplasia of lymphoid tissue and Paneth cells, enteritis; large intestine – eosinophilic colitis. The pathomorphological changes in the lungs, liver and kidneys of exposed rats are accompanied by a decrease in the weight of these organs. The obtained results should be taken into account when developing preventive measures for workers and consumers who are in contact with products containing CuO nanoparticles.

Key words: copper (II) oxide, nanoparticles, microparticles, inhalation, toxicity.

POLYMORPHISM OF THE *CYP1A1* CYTOCHROM P450 GENE (RS1048963) IN CHILDREN IN THE SIBERIAN REGION OF RUSSIA, UNDER CONDITIONS OF EXCESSIVE BIOCHEMICAL CONTAMINATION WITH HEAVY METALS

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On the territory of the Siberian region, there are a number of large industrial enterprises in Russia with excessive atmospheric air pollution, including heavy metals. It is known that the main way of metabolism of heavy metals and organic compounds with carcinogenic properties is the metabolic processes involving cytochrome P450 enzyme, whose polymorphic gene variants are assimilated to onco-proliferation development.

The aim of the study was to examine the polymorphism of the *CYP1A1* (rs1048963) gene in children in the Siberian region of Russia living in an area with excessive exposure to heavy metals. Two groups of children living in the Siberian region were examined. The observation group was 100 children aged 4–9 years (52 boys, 48 girls) living in an industrial centre. The comparison group consisted of 52 children aged 5–12 years (25 boys, 27 girls) living in a conditionally clean area and not exposed to heavy metals. Typing of the polymorphic locus Ile462Val of the *CYP1A1* gene (rs1048963) was determined by Real-Time PCR. The results of the chemical and analytical study revealed that children in the observation group had excessive levels of heavy metals in their blood relative to the state of the biological media of the children from the comparison group. When genotyping, we found that the occurrence of the minor G allele of the *CYP1A1* gene (rs1048963) was 10 times higher in children exposed to heavy metals than in the comparison group ($p<0.05$). The study of the level of expression of cancer markers CA-19-9, CEA, and NSE allowed us to establish its excess of fetoproteins CA-19-9 by 2.19 times; CEA by 1.96 times; NSE by 3.03 times in the observation group relative to the comparison group ($p<0.05$). Therefore, a superabundance of variant allele G of cytochrome P450 gene *CYP1A1* (rs1048963) associated with hyperexpression of fetal proteins has been established in the children of the ecologically unfortunate region of Siberia exposed to heavy metals. All these results allow us to classify the G allele of the *CYP1A1* gene (rs1048963) as a candidate genetic marker for the risk of developing onco-proliferative conditions in conditions of excessive contamination of biological media with heavy metals.

Key words: technogenic province, heavy metals, cytochrome P450, cancer markers.

ASSESSMENT OF THE PROTEOMIC IMMUNE PROFILE OF EMPLOYEES OF THE OIL PRODUCTION ENTERPRISE USING THE METHOD OF FLOW CYTOMETRY

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An assessment of the proteomic immune profile of oil production enterprise workers, the formation of which is determined by the conditions of exposure to harmful factors of production on their health, was carried out. The study involved 60 men working at an oil production plant in the Perm Territory. The observation group ($n = 35$) included the surveyed male workers – oil production operators, the comparison group – the surveyed male workers – representatives of the administrative apparatus. The state of the proteomic profile was assessed by indicators of cell regulation (apoptosis). The expression level of proteins Bcl-2, Bax, p53, TNFR receptor was determined by flow cytometry. Comparative analysis with physiological norm indicators revealed significant overproduction of membrane and intracellular factors of cellular immunity in oil production operators. Overexpression of the proteins Bax, Bcl-2 and p53, the TNFR receptor responsible for natural cell death ($p < 0.05$), was established. A number of indicators of the observation group significantly differed from those of the comparison group: the level of anti-apoptotic protein Bcl-2 was significantly increased more than on 10 %; increased content of TNFR, Bax and p53 proteins by 30 %, 10 % and 20 %, respectively; the content of specific IgG to benzene was 1.4 times higher. The results of the study made it possible to establish an increase in the expression of protein controllers of cell death as a result of excessive activation of cell membrane reception, which consistently forms the phenomenon of cellular immunodeficiency. The high sensitivity of the membrane and cytoplasmic components of the proteomic immune profile allows them to be used as indicators of the health status of oil production operators, to timely identify the development of a regulatory imbalance of the immune system as early violations of cell-associated pathological processes (cellular immunodeficiency, autoimmune and proliferative processes), as well as timely and effectively implement measures to prevent the development of industrial-related diseases in workers at oil production plants.

Key words: operators of oil production, cell regulation, expression of immune profile proteins.

PECULIARITIES OF MEN'S SPERMOGRAM INDICATORS WITH VARYING DEGREES OF REPRODUCTIVE HISTORY BURDEN, THOSE WHO LIVE IN THE TERRITORY OF A LARGE INDUSTRIAL CITY

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The deterioration of the environment as a result of the high frequency of anthropogenic and technogenic processes has a negative impact on the reproductive health of men. The aim of the study was to assess the incidence of impaired sperm quality in men with a burdened history of living in a large industrial city. The study includes laboratory data from 75 men living in a large industrial city under the age of 45. Observation group No. 1 – 30 people with an established diagnosis of chronic prostatitis in remission, observation group No. 2 – 45 people with an established diagnosis of chronic prostatitis in an exacerbation stage. Fresh sperm samples were assessed for quality according to WHO guidelines 2010 g. It was found that in men with a burdened reproductive history living in a large industrial city, the number of immotile and non-progressively motile spermatozoa does not meet the parameters of normal sperm. It was found that in persons with chronic prostatitis during the period of exacerbation there is a statistically significant ($p = 0.015$) 30 % increase in the number of immotile spermatozoons relative to the results identified in men with chronic prostatitis during the period of remission. Obviously, in living conditions in a large industrial center, peculiarities of deviations in spermatogenesis indices are formed depending on the degree of exacerbation of the clinical reproductive process, which requires further research on the study of spermatogenic function, timely detection of deviations in reproductive health is necessary for the tasks of maintaining the generative function of men in conditions of large industrial city.

Key words: reproductive history, industrial city, spermogram.

PATHOGENETIC PATTERNS OF THE FORMATION OF POLYVALENT HYPOVITAMINOSIS ASSOCIATED WITH THE INFLUENCE OF ALIMENTARY AND CHEMICAL TECHNOGENIC FACTORS

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Unsatisfactory vitamin supply of preschool children in the Russian Federation reaches 90 %. Exposure to chemicals of technogenic origin has a direct catalytic effect on vitamins and affects the level of vitamin availability.

To study the features of vitamin availability of preschool children attending pre-school educational institutions on the territory of a large industrial center and to carry out a comparative analysis of the content of chemicals of technogenic origin of organic nature in the blood of children, a survey was conducted of 254 pupils of two standard pre-school institutions located in different administrative-territorial districts of Perm that differ in the sanitary and hygienic characteristics of the quality of environmental objects. The observation group (pre-school educational institution observation) consisted of 120 children, and the comparison group (pre-school educational institution comparison) included 134 children.

The assessment of the children's diet, sampling and assessment of the atmospheric air quality, indoor air and drinking water of the preschool institutions were carried out. The association of a decrease in the level of children's vitamin supply with an increased content of organic compounds in the blood of the examined children was revealed. Long-term exposure to chemicals of technogenic origin with air and water leads to a violation of the antioxidant system of the body. It is confirmed by a decrease in the enzyme level of the antioxidant profile and the level of total antioxidant activity of the blood serum in the examined children. Under conditions of chronic exposure to chemicals of technogenic origin and a decrease in the functional activity of the enzyme link of the redox-antioxidant system, the role of non-enzymatic reactions of antioxidant protection carried out by vitamins increases. It leads to their increased consumption. Vitamin deficiency is caused by the mechanism of their increased consumption under chronic toxicant load. It requires a new approach when developing the comprehensive measures aimed at preventing hypovitaminosis in children living under sanitary and hygienic problems caused by the content of chemicals of technogenic origin in environmental objects.

Key words: children; hypovitaminosis, chemicals of technogenic origin; vitamins.

PHAGOCYTIC ACTIVITY OF PHENOLIC COMPOUNDS OF PLANT ORIGIN (ON THE EXAMPLE OF POLYSTROBIL)

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Exposure to chemical factors of various origins change the adaptive capabilities of the immune system, including nonspecific defense factors. To study the effect of phenolic compounds of plant origin (for example, polystrobil) on the absorption activity of phagocytes, an *in vitro* system was used (14 samples of venous blood were analyzed). Control samples - samples without the addition of polystrobil ($n = 14$), experimental samples - samples with the addition of polystrobil at a concentration of 1.84 mg / ml ($n = 14$). The drug was prepared in accordance with the requirements of the State Pharmacopoeia of the 14th edition. A statistically significant ($p = 0.002$) decrease of up to 80 % of the initial level of phagocytic activity of peripheral phagocytes was found during exposure to polystrobil. The presented experimental results obtained in the *in vitro* system suggest a change in the oxygen-dependent mechanisms of phagocytosis under conditions of exposure to phenolic compounds of natural origin.

Key words: phenol compounds, phagocytosis, polystrobil.

MARKERS OF EXPOSURE OF METALS-DISRUPTORS AND METALS-CARCINOGENS IN THE BIOLOGICAL ENVIRONMENT OF THE POPULATION LIVING IN THE TERRITORY WITH A HIGH INCIDENCE OF THYROID CANCER

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Numerous studies have confirmed that impaired iodine metabolism in the body leads to the formation of endemic goitre (diffuse enlarged thyroid), which is a predisposing factor for the development of many thyroid diseases, including malignant neoplasms. It is convincingly proved that today the forming of iodine deficiency diseases is connected with the influence of "nonspecific goitrogens" coming from environmental objects: chemical compounds, heavy metals, industrial waste, pesticides, as well as disorders of exchange of essential and toxic microelements, caused by bioexposure of environmental

objects to metals. The relationship between deficiency or excess of microelements with disruptor properties and the biosynthesis of thyroid hormones has been reliably established.

The purpose of the study is to conduct a comparative analysis of the microelement composition of biological environments in populations living in areas with a high morbidity rate of thyroid cancer and to determine the relationship with exposure to metals-disruptors and metals-carcinogens.

An analysis of the content of the metals-disruptors and metals-carcinogens in the environmental objects in the areas of observation and comparison with the determination of the total exposure dose was carried out. The study areas were established on the basis of a retrospective epidemiological analysis of morbidity and mortality from malignant neoplasms. The microelement composition of the biological environment was carried out by atomic absorption chromatography. The present study found that complex multi-mediated exposure to xenobiotics in areas with a high level of cancer incidence leads to the formation of a microelement imbalance in the biological environment of the population, which is manifested by an increased content of trace elements with disruptive properties – lead, cadmium and nickel, as well as a reduced content of essential trace elements – zinc and manganese. Statistically significant causal relationships were established between the exposure of disruptor metals in biological environments and environmental objects with identified marker indicators of exposure in the population living in the territory with a high incidence of thyroid cancer: lead, cadmium, nickel.

Key words: bioexposure, heavy metals, endocrine disruptors, thyroid cancer.

THE USE OF MULTIMARKER TESTING IN THE EARLY DIAGNOSIS OF CARDIOVASCULAR DISEASE IN WORKERS EXPOSED TO HAZARDOUS WORKPLACE FACTORS

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A total of 310 workers from a metallurgical plant in the Nizhny Novgorod region, men aged 25–51 (39.34 ± 9.84 years), were examined.

The aim of the study is to estimate the information content of immunological and biochemical indices as an indicator of early cardiovascular pathology development in workers exposed to industrial noise and industrial aerosols of predominantly fibrogenic action and to reveal some pathogenetic mechanisms of cardiovascular disease risk formation in this category of workers.

The study used functional, biochemical, immunological, and mathematical-statistical methods of investigation. Significant correlations between cytokines (TNFα, IL-10), C-reactive protein, oxidized low-density lipoproteins, and body mass index, blood pressure were revealed in the group of workers exposed to industrial aerosols, lipidogram, glucose, which allowed us to conclude about the pathogenetic role of cytokines, acute phase proteins and oxidized low-density lipoproteins in the development of inflammatory and atherosclerotic processes in this category of workers.

These indicators (interleukins and oxidized low-density lipoproteins) can be used to identify cardiovascular risk groups among workers in hazardous working environments.

Key words: workers, industrial aerosols, occupational noise, multimarker testing, interleukins, oxidized low-density lipoproteins.

THE ACTIVITY OF ANTIOXIDANT HUMAN BLOOD ENZYMS DURING GEOMAGNETIC CHANGES

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The most common approach to studying the mechanisms of the influence of the Earth's magnetic field on biosystems involves the search for correlations between geomagnetic indices and various parameters of the functioning of living organisms. The article evaluates the relationship between the enzymatic activity of the antioxidant defense system using the example of superoxide dismutase (SOD) and catalase with a planetary Kp-index. The correlation relationship between the activity of SOD and the index of the disturbance of the geomagnetic field is shown.

Key words: geomagnetic activity, Kp-index, superoxide dismutase, catalase, human body.

COMPARATIVE ANALYSIS OF INDICATOR INDICES OF THE IMMUNE SYSTEM AMONG CHILDREN WITH DIFFERENT LEVELS OF STRONTIUM CONTAMINATION IN BIOLOGICAL MEDIA

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The use of drinking water with a high content of chemical impurities contributes to their accumulation in the biological media of the body, thereby creating the prerequisites for the formation of dysfunction of the immune system. In this study a comparative characterization of the level of expression of biomarkers characterizing apoptosis, the dynamics of which are associated

with the level of blood contamination with stable strontium, was carried out. In total, including the comparison group, 125 children aged 4 to 7 years old, living in various sanitary and hygienic conditions, were examined. The work used chemical-analytical and immunological research methods. Observation group No. 1 – 24 children consuming drinking water containing Sr^{2+} at levels corresponding to the maximum permissible concentration (1.0 MPC), with a level of blood contamination with strontium corresponding to the upper limit of the reference values of its content in the blood; observation group No. 2 – 76 children consuming drinking water with a high strontium content (1.35 MPC), with the level of blood contamination with strontium 1.6 times higher than the upper limit of the reference level and 2.2 times the values obtained in the subjects of the comparison group ($p < 0.05$). Comparison group – 25 children consuming drinking water with permissible strontium content (0.11 MPC), with a level of blood contamination with strontium, corresponding to the range of reference values of its content in the blood. It was found that when strontium was identified in the blood at the level of the upper limit of the reference interval in the examined children (observation group No. 1), hyperexpression of the early activation marker was noted (by the criteria of CD25+; $p < 0.05$). In children, in whose blood the average group strontium content is 1.6 times higher than the reference values (observation group No. 2), inhibition of receptor-mediated and p53-controlled apoptosis is noted (according to the criterion of CD95 +, TNFRI, p53; $p < 0.05$). Thus, a comparative analysis of the indicators of the immune status of the examined children showed that a decrease in the activation markers of membrane cell regulation and the level of apoptosis biomarkers is associated with an increase in strontium concentration in biological media. The study of the expression level of apoptosis biomarkers, as well as the factors affecting their expression, reveals the features of the immune regulation mechanism and makes it possible to develop new approaches and a set of indicators for early diagnosis of prenosological conditions in individuals living under conditions of excessive strontium contamination of biological media.

Key words: strontium, drinking water, indicator parameters, apoptosis.

THE IMMUNE STATUS OF PRESCHOOL CHILDREN UNDER CONDITIONS OF EXCESSIVE CONTAMINATION OF BIOLOGICAL MEDIA WITH CYCLIC HYDROCARBONS AND HEAVY METALS

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Excessive combined exposure to heavy metals (mercury, arsenic) and cyclic hydrocarbons (phenol, benzo (a) pyrene) in the preschool child population of an industrially developed region causes changes in the composition of biological media, namely, an increase in the level of blood contamination with benzo (a) pyrene and phenol, and also the excess content of mercury and arsenic in urine relative to the comparison group ($p < 0.05$). The immunological status of the surveyed contingent is characterized by a deficit in the absolute and relative content of T helpers $CD3^+$ $CD4^+$- and T-cytotoxic $CD3^+$ $CD8^+$ lymphocytes, a decrease in the immunoregulatory $CD4^+$ / $CD8^+$ index and

phagocytic activity of leukocytes (percentage of phagocytosis, phagocytic index, phagocytic and absolute phagocytosis) ($p < 0.05$), which indicates inhibition of the cellular link of both innate and acquired immune responses. At the same time, the humoral immunological status of the child population of an industrially developed region is characterized by an excessive content of serum IgA and IgG antibodies and signs of hypersensitization to technogenic haptens according to the criterion of specific IgG to phenol, IgG to benzo(a)pyrene and IgG to mercury relative to the comparison group ($p < 0.05$). Established signs of suppression of the cellular (decrease in $CD3^+$ $CD4^+$- and $CD3^+$ $CD8^+$-, percentage of phagocytosis, phagocytic number, phagocytic index, absolute phagocytosis) link of the immune response against the background of hyperactivation of humoral immunity (increased IgA and IgG), including the development of a sign of hypersensitivity to technogenic haptens (IgG to phenol, IgG to benzo(a)pyrene, IgG to mercury) with increased contamination of biological media with benzo(a)pyrene, phenol, mercury and arsenic are characterized by the peculiarities of the immune status of preschool children under conditions of excessive combined exposure to heavy metals (mercury, arsenic) and cyclic hydrocarbons (phenol, benzo(a) pyrene) and are recommended as marker indicators for early diagnosis of health disorders associated with the immune system.

Key words: immunological status, heavy metals, cyclic hydrocarbons, preschool children.

ASSESSMENT OF THE STATE OF THE IMMUNE SYSTEM OF THE ADULT POPULATION UNDER THE INFLUENCE OF TECHNOGENIC CHEMICAL RISK FACTORS

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The study of the characteristics of immunological parameters in the adult population under the influence of exogenous chemical factors has been carried out. According to the results of the carried out immunological studies, the presence of changes in the parameters of the immune system was revealed, which are manifested in a decrease in phagocytic activity, hyperproduction of specific IgG to benzo (a) pyrene, mercury, epichlorohydrin, phenol, reliable in relation to the norm and the comparison group (excess in 1.3–3.2 times). The hyperproduction of the relative content of T-lymphocytes (CD3+) in relation to the comparison group was established, as well as the deficit of indicators of the absolute and relative content of B-lymphocytes (CD3-CD19+) by almost 2 times, which indicates the suppression of the B-cell link of immunity. The revealed changes characterize not only an imbalance in the state of cellular immunity, but also the development of processes of increased sensitivity of specific humoral immunity to phenol and benz(a) pyrene, which indicates the formation of negative effects associated with exogenous haptenic load.

Key words: chemical risk factors, specific sensitization, cell markers, apoptosis, adult population.

IDENTIFICATION OF OMIC–MARKERS FOR PREDICTION OF THE RISK OF DEVELOPMENT OF NEGATIVE EFFECTS IN CHILDREN WITH INCREASED CONTENT OF COPPER AND NICKEL IN BLOOD

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The technology of proteomic profiling is a promising direction for studying and substantiating the molecular mechanisms of the emergence and development of body responses to negative influences at the earliest stages of their formation, before the onset of symptoms of cellular and organ damage. Of particular relevance is research aimed at increasing the efficiency of predicting the development of negative effects for the tasks of early detection and prevention of consequences associated with the impact of chemical factors of the environment, primarily, with atmospheric air.

The aim of the study is to identify omic markers for predicting the risk of developing negative effects in children with increased levels of copper and nickel in the blood. A proteomic study of blood plasma in children, modeling of cause-and-effect relationships was carried out. In children with an increased content of copper and nickel in the blood up to 3.5 times, about twenty protein spots were revealed, significantly differing in children of the control group. Dependences of an increase in the relative volume of three protein spots, including apolipoprotein AI, anchor protein A-kinase 9, vitronectin, and a decrease in the relative volume of one protein spot, including transthyretin, on the increased content of copper and nickel in the blood (R^2 = 0.30–0,44; p = 0.0001–0.008). The listed proteins are prognostically significant for the development of negative effects associated with impaired neuroregulation and endothelial dysfunction. The realization of the risk of developing predicted negative effects in the form of an increased incidence of diseases of the nervous and cardiovascular systems with an increased concentration of copper and nickel in the blood (R^2 = 0.35–0.96; p = 0.0001–0.013) has been proved. The established list of potential target molecules (apolipoprotein AI, vitronectin, anchor protein A-kinase 9, transthyretin) and genes encoding their expression (APOA1, VTN, AKAP9, TTR) is substantiated as omic markers of the development of negative cardiovascular effects. vascular and nervous systems.

Key words: copper and nickel in blood, health risk, proteomic profile of blood plasma, nervous system, cardiovascular system.

METABOLISM OF PHENOL AND ITS CONTENT IN HUMAN BIOLOGICAL MEDIA

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Phenol is a high-priority, highly toxic pollutant of the environment. The formation of phenol is a result of both natural processes associated with the biochemical transformation of organic substances and man-made origin. Determination of phenol in human biological media in carrying out sanitary and hygienic studies is an urgent task, which is caused by the widespread distribution of the toxicant in the habitat.

The paper describes the ways of phenol transformation at intake into the human body, provides scientific literature data on the content of free and bound phenol in biological media (blood, urine). It has been noted that the measured phenol concentrations in biosubstances differ when using different analytical procedures, therefore, it is advisable to present the results of measuring free or total phenol in blood and other biological media by indicating the method of determination and method of sample preparation.

Key words: free phenol, metabolism, blood, urine.

MORPHO–FUNCTIONAL FEATURES OF THE THYROID GLAND IN PRIMARY AND SECONDARY SCHOOLS

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The relevance of the work is due to the stable growth of thyroid pathology among the child population.

In order to study the prevalence of morphological and functional changes in the thyroid gland (TG) in primary and secondary school students, 50 schoolchildren of each level of education were examined.

In the course of the work, an analysis of thyroid pathology was carried out according to the data provided by the Perm Regional Medical Information and Analytical Center (2010–2019). The results of laboratory analysis (total and free thyroxine, autoantibodies to thyroid tissues) and ultrasound scanning (volume and structure of the thyroid gland) were evaluated.

For the period 2010–2019 In the Perm Territory, the incidence of thyroid diseases among children increased by 1.5 times, reaching 6.9 ‰, in the structure of which thyroid hyperplasia and subclinical hypothyroidism prevailed. According to the data of ultrasound examination, structural disorders were detected in 76–92 %, and in volume – in 56–73 % of schoolchildren. The frequency

of detection of functional disorders reached 24 % in primary school students, with a significant decrease in the level of free thyroxine relative to primary school.

Primary childhood morbidity with thyroid pathology is characterized by continuous growth. Morphological and functional changes in the thyroid gland in children are detected already at the level of primary school education and have an increasing tendency in the future.

Key words: thyroid disease, schoolchildren, prevention.

CHARACTERISTICS OF THE BILIAR DYSFUNCTION DEVELOPMENT IN PRIMARY SCHOOLCHILDREN IN GYMNASIUM

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The schooling period contributes to the deterioration of children's health. According to the data of preventive examinations among school pathology in children, diseases of the digestive system occupy the 3rd-4th place in the structure of morbidity.

The aim of the study is to investigate the characteristics of the biliar dysfunction development in primary schoolchildren. A comprehensive clinical and laboratory examination of 61 junior schoolchildren of the gymnasium was carried out. The comparison group included 54 children of 7–10 years old from a secondary general education school.

According to the results of the hygienic assessment of educational activity, it was found that primary school gymnasium children have a higher intensity of the educational process associated with an increase in the duration of the academic hour and the distribution of the classroom weekly load. In addition, in the gymnasium, an interactive whiteboard is used for lessons longer than the allowed time. It was revealed that almost all gymnasium schoolchildren attend institutions of additional education; therewith every fourth child is trained at several sections and study groups. It was noted that in 40.9 % of cases, when visiting additional institutions, gymnasium schoolchildren receive homework there. Among the unfavorable factors that affect the primary schoolchildren in gymnasium is an imbalanced diet, which is characterized by a low consumption of meat and dairy products with an excess of confectionery. It was revealed that every second primary schoolchild of the gymnasium has a functional pathology of the gallbladder associated with the intensity of the educational process and nutritional characteristics, and what is manifested in every third schoolchild by an increase in the volume of the bladder and signs of dyscholia against the background of a fixed inflection in 42.6 % of cases. Motor-tonic dysfunction of the gallbladder is accompanied by hepatocellular disorders (increased total cholesterol, total bilirubin, alanine aminotransferase (ALT)), oxidative stress (increased levels of malondialdehyde (MDA)) and depletion of antioxidant defense resources (decreased antioxidant activity (AOA)).

Key words: primary classes, gymnasium, educational process, nutrition, biliary dysfunction.

ESTIMATION OF THE BALANCE OF NEUROMEDIATORS AND THE ACTIVITY OF OXIDATION PROCESSES IN CHILDREN LIVING IN THE HARD NORTH REGION

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The article discusses neurotransmitters and biochemical indicators of oxidation processes, reflecting individual pathogenetic links of negative effects that characterize the development of functional disorders in the central nervous system in children living in the Far North. The aim of the study is to assess the balance of neurotransmitters and the activity of oxidation processes in children living in the Far North. According to the results of the study, an increase in the activity of indicators of oxidation processes and a decrease in indicators of antioxidant protection, an increase in the levels of neurotransmitters synthesized in the adrenal medulla, an imbalance in the level of concentration of markers of nerve tissue damage in children of the observation group relative to similar indicators in the comparison group and the physiological norm. The results obtained can be used to develop measures for the prevention of diseases of the central nervous system in children living in the Far North.

Key words: Far North, climatic factors, child population, neurotransmitters, oxidative processes, negative effects.

PECULIARITIES OF OXIDATIVE STRESS IN CHILDREN WITH RESPIRATORY DISEASES UNDER DIFFERENT CONDITIONS OF COMPLEX AEROGENIC EXPOSURE OF THE CHEMICAL SUBSTANCES

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It is now known that the pathogenesis of many diseases, including respiratory diseases, are the processes of free radical oxidation.

The aim of the study is to reveal the features of oxidative stress in children with respiratory diseases under various conditions of complex aerogenic exposure to chemicals. A comprehensive clinical examination of 730 children aged 5–14 years with chronic respiratory diseases, living in the territory with aerogenic pollution mainly by organic aromatic compounds and suspended substances (group A), in an industrial center with a large plant for the processing of ferrovanadium alloys (group B) and in conditions of sanitary and hygienic well-being (group B).

It was found that the exposed children showed increased blood levels of benzene, toluene, phenol, formaldehyde, vanadium and manganese up to 6.8 times higher than the level of the compari-

son groups. It was found that 53.0–74.1 % of children with respiratory diseases develop oxidative stress caused by increased blood levels of toluene, phenol, manganese and the level of the average daily content of suspended particles in the air. The likelihood of an increase in lipid hydroperoxides in children under conditions of aerogenic pollution mainly with metals is up to 17.1 times higher. In 81.1–88.9 % of exposed children with respiratory diseases, there was a decrease in antioxidant protection associated with an increase in the level of benzene, phenol, formaldehyde in the blood and the level of the average daily content of suspended particles in the air. It was found that under conditions of aerogenic multicomponent action of predominantly metals in children, the probability of a decrease in the total antioxidant capacity of blood serum is up to 18.5 times higher. The decrease in superoxide dismutase activity is up to 11.8 times higher in children living under conditions of aerogenic combined exposure to aromatic compounds and suspended solids. In areas with aerogenic exposure to technogenic chemicals, reduced glutathione-S-transferase levels were recorded in every third child with respiratory pathology, glutathione peroxidase – in 16.3–19.8 % of the examined children.

Key words: children, respiratory diseases, oxidative stress, metals, aromatic hydrocarbons, suspended matter.

BIOCHEMICAL STATUS OF MALE WHITE RATS AFTER REPEATED ADMINISTRATION OF DIISODEDECYLPHTHALATE

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The object of research was a plasticizer high molecular weight ester of phthalic acid - diisodecyl phthalate (DIDP), CAS No. 26761-40-0. The aim of this work is to study the biochemical status of male albino rats after repeated intragastric administration of DIDP in a subchronic experiment. Phthalate was injected into the stomach of experimental animals using a probe needle as a solvent, and vegetable oil was used for the control group of rats. Experimentally established data indicate that when DIDP was administered in the dose range from 8.0 to 800.0 mg / kg to male white rats for 60 days, no fatal effects were established, however, changes in a number of clinical and biochemical parameters indicate the development of chronic polytropic poisoning. having a dose dependence. On the part of mineral metabolism and nitrogen-containing products of protein metabolism, with the introduction of DIDP at doses of 80.0 and 800.0 mg / kg in the blood serum, a statistically significant decrease in the level of iron by 1.5 and 2.3 times, calcium by 1.4 and 1,5 times, as well as an increase in the concentration of phosphorus by 18.5 and 25.2 %, uric acid by 1.3 and 1.4 times, respectively. With the introduction of these doses, a violation of the functional state of the kidneys was evidenced by an increase in daily urine output by 1.9–2.2 times, an increase in calcium content by 1.8–2.3 times, a decrease in phosphorus by 1.3–1.5 times and uric acid. by 29.4–36.5 % in urine. With the introduction of a dose of 800.0 mg / kg, a statistically significant increase in the relative coefficients of the mass of the liver, kidneys and spleen, an increase in the level of urea by 32.8 %, gamma-glutamyl transpeptidase by 20.0 %, a decrease in aspartic aminotransferase and alanine aminotransferase by 22.0 and 13.3 %, respectively, in blood serum, as well as a decrease in the content of total protein and urea, an increase in the clearance of urea in the urine. The 8.0 mg / kg dose may be taken as inactive.

Key words: diisodecyl phthalate, DIDP, cumulation, subchronic toxicity, blood, hormones.

Section VIII

Chemical–analytical and information–software support for health risk assessment

IMPROVEMENT OF METHODOLOGICAL ASPECTS OF DETERMINATION OF LOW CONCENTRATIONS OF HEAVY METALS IN THE ATMOSPHERIC AIR TO INCREASE THE RELIABILITY OF ASSESSMENT OF RISK–GENERAL FACTORS OF THE EXTERNAL ENVIRONMENT

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Investigations of the factors that make the main contribution to the measurement error of trace amounts of heavy metals in the atmospheric air have been carried out; it is shown that the most significant factor is unregulated contamination of the sampling material. As part of the search for an alternative filter material, the background content of elements in aerosol filters of the AFA-KhA-20 type and Merck Millipore-MF filters was studied by inductively coupled plasma mass spectrometry. An assessment was made of the possibility of a reliable determination of a number of priority pollutants in the ambient air when sampling for Merck filters.

Methodological approaches to measuring low concentrations of heavy metals in atmospheric air by inductively coupled plasma mass spectrometry are proposed.

Key words: analytical aerosol filters, risk assessment; atmospheric air; heavy metals; inductively coupled plasma mass spectrometry.

RELEVANCE OF THE SUSPENDED SOLIDS DEFINITION IN THE ATMOSPHERIC AIR

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Suspended solids and dust are classified by the World Health Organization as priority substances in terms of their impact on public health. In this article we show the relevance of the total concentration monitoring of suspended solids and the need to develop modern methods for determining the normalized dust based on high-precision quantitative methods to found the contribution of each type of dust in the total dust content of atmospheric air.

Key words: suspended solids, general dust, wood dust, abrasive dust, coal dust, metal dust, chemical composition, gravimetric method.

REQUIREMENTS FOR SAMPLE PREPARATION TO ANALYZE FOOD PRODUCTS USING INDUCTIVELY COUPLED PLASMA–MASS SPECTROMETRY METHOD

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Food safety is the main function of public health, which makes the issue of developing methods for determining toxic elements in various types of food products relevant. The sample preparation is an important stage of the analysis. To achieve the highest recovery rate and loss free conditions, it is of importance to work out the requirements for each of the food groups that differ from each other in matrices. The article presents the results of testing the sample preparation conditions to measure the mass concentrations of arsenic, cadmium, lead and mercury in milk and dairy products; meat, meat products, poultry meat and poultry meat products; fruit and vegetable products using inductively coupled plasma-mass spectrometry method.

Key words: inductively coupled plasma-mass spectrometry, food, milk, meat products, fruit and vegetable products, toxic elements, sample preparation.

PRACTICAL APPLICATION OF THE MODERN SOLID–PHASE EXTRACTION METHOD FOR DETERMINING N–NITROSOAMINES IN DRINKING WATER

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A method of sample preparation for chromatography-mass-spectrometric analysis of N-nitrosoamines (N-nitrosodimethylamine, N-nitrosodiethylamine, N-nitrosodipropylamine, N-nitrosopiperidinamine) in water using an automatic solid-phase extraction (SPE) system at the stage of sample preparation is proposed. In the course of the study, four schemes of elution for sample preparation were worked out. It was found that the highest degree of extraction of N-nitrosoamines from water samples is achieved using the optimal elution scheme 4. At the same time, the completeness of extraction for N-nitrosodipropylamine was 100.0 %, for N-nitrosopiperidinamine – 95.3 %, for N-nitrosodimethylamine – 73.8 %, nitrosodiethylamine-90.7 %.

Key words: gas chromatography, gas chromatography-mass spectrometry, drinking water, N-nitrosoamines, solid-phase extraction.

DEVELOPMENT OF OPTIMAL IDENTIFICATION CONDITIONS AND CHROMATOGRAPHIC SEPARATION OF AZITHROMYCIN BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

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The results are presented on the development of optimal conditions for identification and chromatographic separation of azithromycin by reversed-phase high-performance liquid chromatography with diode-matrix (HPLC-DAD) and mass spectrometry (HPLC-MS) detectors.

A mixture of methanol and 0.02 M phosphate buffer solution (pH 8) in a volume ratio of 90:10 was used as a mobile phase for the separation of azithromycin by HPLC-UV. The identification of azithromycin was carried out in the ultraviolet region of the spectrum at a wavelength of 205 nm. A mixture of methanol and a 0.02 M solution of ammonium acetate acidified to pH 5.5 with acetic acid in a volume ratio of 75:25 was selected as the mobile phase for elution of azithromycin by HPLC-MS. Optimization of the operating conditions of the mass spectrometric detector was carried out, the mass spectra of the parent ion and 4 confirming daughter ions were obtained.

In the process of calibrating the mass spectrometry detector, a calibration coefficient was established for the quantitative determination of azithromycin in methanol. Calculated the lower limit of quantitative (LOQ) determination on a liquid chromatograph with a mass spectrometry detector with a triple quadrupole LC / MS 6460, equal to 0.001 μg/dm^3, and with a diode array detector at a level of 0.014 mg/dm^3. The obtained data showed a higher efficiency of using a mass spectrometry detector compared to a diode-matrix detector. Spent azithromycin analysis conditions HPLC-MS will be used in further research on the development of methods of quantitative determination of the residual content of azithromycin in food products of animal origin.

Key words: antibiotics, azithromycin, chromatographic separation, high-performance liquid chromatography, mass spectrometry.

METHOD FOR MEASURING MASS CONCENTRATIONS OF METHYL ACRYLATE, METHYL METHACRYLATE AND VINYL ACETATE IN AQUEOUS EXTRACTS BASED ON VAPOR PHASE GAS CHROMATOGRAPHIC ANALYSIS TO ASSESS THE HYGIENIC SAFETY OF CONSUMER GOODS

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The object of research is model samples simulating water extracts from consumer goods (samples of distilled water containing a mixture of methyl acrylate (MA), methyl methacrylate

(MMA) and vinyl acetate (VA) in mass concentrations at three levels characterizing the lower limit, middle and upper limit of the measurement range for each substance: 1) level No. 1 – a mixture of MA at a concentration of 0.01 mg/dm^3 with MMA and VA at concentrations of 0.1 mg / dm3; 2) level No. 2 – a mixture of MA at a concentration of 0.03 mg/dm^3 with MMA and BA at concentrations of 0.3 mg/dm^3; 3) level No. 3 – a mixture of MA at a concentration of 0.05 mg/dm^3 with MMA and VA at concentrations of 0.5 mg/dm^3.

The purpose of the study is to develop a methodology for the simultaneous measurement (MVI) of the concentrations of MA, MMA, VA in water extracts from consumer goods. Developed MVI MN 6152-2019 “Mass concentrations of MA, MMA and VA in water extracts. Methods for making measurements by gas chromatography ". The MVI is based on a method based on the extraction of substances from an aqueous extract by gas extraction while heating a sample in a closed volume, analysis of the equilibrium vapor phase by gas chromatography on two parallel quartz capillary columns, identification of substances on two channels of a flame ionization detector by retention time and their quantitative determination by the method of absolute calibration. For the developed MVI, the values of the measurement accuracy and relative expanded uncertainty were established: the repeatability and intermediate precision for MA were 28 %, the repeatability and intermediate precision for MMA were 36 %, the repeatability and intermediate precision for VA were 34 %, and the relative expanded uncertainty for MA – 21 %, for MMA – 23 %, for VA – 22 %, the correctness indices differ insignificantly from one.

Key words: methyl acrylate, methyl methacrylate, vinyl acetate, water extract, vapor phase gas chromatographic analysis, measurement technique.

IMPROVEMENT OF METHODOLOGICAL SUPPORT TO REDUCE THE DETECTION LIMITS OF AROMATIC HYDROCARBON CONCENTRATIONS IN THE BLOOD BASED ON THE USE OF MODERN ANALYTICAL EQUIPMENT

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To effectively control the content of toxicants in biosurfaces and assess the contribution of anthropogenic pollution sources, analytical techniques that would combine high sensitivity and selectivity with the ability to determine a wide range of contaminants with low detection limits are needed.

The article presents the results of experimental studies on the validation of the method for reducing the detection limits of aromatic hydrocarbons in blood. In the process of research, the following indicators of the quality of the analysis results were experimentally established: accuracy, correctness, repeatability, intra-laboratory precision of the analysis results.

Reducing the detection limits of aromatic hydrocarbons in blood (benzene from 0.005 to 0.0012 μg/cm^3, toluene from 0.01 to 0.0012 μg/cm^3, ethylbenzene from 0.007 to 0.0026 μg/cm^3, p, -m-xylene with 0.014 to 0.0026 μg/cm^3 and o-xylene from 0.03 to 0.0026 μg/cm^3) was achieved

due to the use in research: a modern instrumental method of analysis of high-performance capillary gas chromatography (gas chromatograph "Kristall-5000") and a highly sensitive ionization detector.

The use of a 50 m long, 0.32 mm x 0.50 μm HP-FFAP capillary column (Agilent J&W Ultra) with low surface activity and low flaking and carryover provided a lower detection limit for aromatic hydrocarbons in blood.

The performed control of the acceptability of the results of measurements of the lower range of concentrations of aromatic hydrocarbons in the blood with a given accuracy according to the current analysis technique in order to identify and exclude random errors from the measurement results and prevent the issuance of unreliable results of quantitative chemical analysis can be considered satisfactory.

Key words: aromatic hydrocarbons (benzene, toluene, ethylbenzene, o, -m, -p-xylene), quality indicators of the analysis results: accuracy, correctness, repeatability, in-laboratory precision.

SIMULTANEOUS DETERMINATION OF FOOD ADDITIVES: NATAMYCIN, SORBIC ACID, BENZOIC ACID IN CHEESE USING HIGH–PERFORMANCE LIQUID CHROMATOGRAPHY

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The object of the study. Standard solutions of sorbic acid, benzoic acid and natamycin, as well as samples of cheese with these food additives.

The study aims atdeveloping a method for simultaneous determination of the following food additives: sorbic acid, benzoic acid and natamycin in cheese using high-performance liquid chromatography. The method is based on the extraction of additives, purification of extracts and quantitative determination of analytes using high-performance liquid chromatography with diode-matrix detection. For the additives extraction, a mixture of acetate buffer solution (pH 4.7): methanol (1:1 vol. %) was used. Chromatographic separation was performed on a reverse-phase column C18 (Eclipse Plus C18, 250 x 4.6 mm, 5.0 microns). A mixture of acetate buffer solution: methanol: acetonitrile (2:1:1 vol. %) was used as the mobile phase. The degree of analyte extraction as a analysis result by the developed method amounts to 97.0–99.0 %. The rate of repeatability varies from 1.3–3.9 %. The limit of quantitative determination of sorbic and benzoic acid was 1 mg/kg, natamycin – 0.5 mg/kg.

Key words: benzoic acid, sorbic acid, natamycin, HPLC, food products.

APPLICATION OF GEOINFORMATION TECHNOLOGIES IN THE PRACTICE OF SOCIAL AND HYGIENIC MONITORING

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Data from social and hygienic monitoring of the state of drinking water, toxicological monitoring, results of risk assessment and data on the incidence of new coronavirus infection.

Purpose. Practical application of geographic information systems in the activities of the Federal State-Funded Healthcare Institution "Center for Hygiene and Epidemiology in the Ryazan Region" in the implementation of social and hygienic monitoring. Informing the population about the results obtained during the monitoring.

Methods and approaches used. As a cartographic basis, we used OpenStreetMap data for the Ryazan region. To prepare the maps, the geoinformation capabilities of the automated information system "Social and Hygienic Monitoring" (AIS "SGM") and the desktop geoinformation system NextGIS QGIS were used.

Main results. Cartographic ranking of the territory and analysis of social and hygienic monitoring data were carried out. A series of geoinformation cartographic materials has been created to draw public attention to the problems of sanitary and epidemiological well-being of the population of the Ryazan region.

Key words: geographic information systems, data mapping in social and hygienic monitoring.

SENSITIVITY ASSESSMENT OF THE MATHEMATICAL MODEL RELATED TO PLANNING OF CONTROL AND SUPERVISORY ACTIVITIES OF ROSPOTEBNADZOR TO CHANGES IN PARAMETERS

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The article is devoted to the relevant aspects related to the improvement of the risk-based model of control and supervisory activities in the field of ensuring sanitary and epidemiological well-being. The paper aims at studying the simultaneous equations proposed in the framework of

the mathematical scenario to study the sensitivity to changes in parameters. During identifying the ranges of parameter variation and studying the sensitivity of model solutions to changes in parameters, the most significant of them are found: the coefficient for the frequency of checks in the absence of violations, the weight coefficients of the labor cost function set by the method of expert assessments. Special attention should be paid to the identified parameters when planning control and supervisory activities. The developed approaches complete the risk-based model of control and supervisory activities in the field of ensuring sanitary and epidemiological well-being and are of importance when preparing the annual plans for scheduled checks of economic entities at the regional level.

Key words: risk-based model, control and supervisory activities, planning, economic entities, production facilities, risk category, sensitivity to changes in parameters.

APPROACHES TO MATHEMATICAL MODELING OF THE HUMAN RESPIRATORY SYSTEM FOR TASKS FOR ASSESSING HEALTH RISKS DURING INHALATION EXPOSURE OF CHEMICALS

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Within the framework of a multilevel model of the accumulation of functional disorders in the human body under the influence of environmental factors, a submodel of the "meso-level" of the respiratory system is being developed. The mathematical model includes three related submodels that describe the breathing process as a set of synchronized processes of gas dynamics, deformation of a porous medium, and diffusion. The conceptual formulation of the problem, a block diagram with the connection of submodels of the respiratory system are presented. The algorithm for solving the problem involves the use of a step-by-step procedure in the form of a set of time steps. The approaches considered can be applied to solve problems of assessing the health risk of the population during inhalation exposure to chemicals.

Key words: mathematical modeling, human respiratory system, environmental factors, evolution of functional disorders.

EXPERIENCE IN DEVELOPING A SOFTWARE TOOL FOR DECISION SUPPORT IN EPIDEMIOLOGY IN THE R LANGUAGE WITH THE IMPLEMENTATION OF A GRAPHICAL INTERFACE

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In the context of the rapid development of the epidemic, even a short-term forecast gives stakeholders sufficient time to make the necessary decisions and adjust the measures taken. However, the existing analytical algorithms are technically complex, which requires the development of a simple and affordable means of their automating.

The aim of the study is to implement an approach to the development of a software tool for statistical analysis and decision support in epidemiology by the example of creating a tool for calculating the reproduction rate and short-term forecasting of infectious morbidity.

Materials and methods. To calculate the reproduction coefficient Rt, the method previously described by Cori and co-authors was used, based on modeling the number of cases of the disease taking into account the values of the serial interval. The prediction was carried out using the method of constructing scenarios for the spread of the disease (projections), based on the daily dynamics of the number of cases and the Rt value obtained in the described method.

Results and discussion. The prediction of the number of COVID-19 cases in the Sverdlovsk region was carried out using this method, and the results of the prediction were compared with those actually observed. For the period 21.12.2020–14.02.2021, the actual number of cases in any of the days of observation did not exceed 95 % of the prognostic values, in 25 % of cases, the actual number of cases fell within the interquartile range of prognostic values. A software tool has been developed – a graphical add-in for executing scripts in the R language with an intuitive interface for calculating the reproduction index and predicting the number of COVID-19 cases.

Conclusions. The developed software tool allows you to effectively solve the problems of calculating the reproduction coefficient and predicting the incidence of COVID-19. The proposed approach to creating programs makes it possible to quickly implement advanced analytical algorithms in the practice of epidemiologists with maximum user friendliness. The implemented mathematical apparatus is potentially applicable for the analysis of a wide range of infectious diseases and has the potential for optimization.

Key words: reproduction rate, disease prediction, COVID-19, R language, software tool.

Section IX

Prevention of risk-associated health disorders

PREVENTIVE MEASURES TO REDUCE HARMFUL EFFECTS OF ELECTROMAGNETIC RADIATION ON HEALTH

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While organizations such as ICNIRP (International Commission on Non-Ionizing Radiation Protection) claim that electromagnetic fields (EMF) cause "only thermal effects", upholding obsolete thermal safety standards, extensive scientific evidence has demonstrated non-thermal health effects of electromagnetic radiation important to health. This review aims to identify preventive measures to reduce such effects.

Methods and approaches used. Exposure to electromagnetic radiation has been associated with non-thermal biological effects, including damage to cells and DNA. Reviewed effects were demonstrated in: the hematologic system, the nervous system, the immune system, the reproductive system, the skin, the cardiovascular system, carcinogenic effects, glucose metabolism, and Electrohypersensitivity ("Microwave sickness"). Protective measures are suggested.

Main results. Reduction of exposure from cellphone towers/ antennas and wireless utility meters is extremely important – especially maintaining distance from kindergartens, schools and bedrooms, but the most extensive exposure comes from use of personal devices. ***Distance*** and ***use reduction*** are the most important factors that each person can apply to reduce health risks.

Recommendations.

Don't do. Avoid carrying cellphone on your body * When talking or texting, position cell phone as far from your body as possible * Maintain distance from cordless home phone which emits EMF 24/7 * Don't place laptop/tablet on lap * Don't charge cellphone near bed when sleeping * Children should use cellphone only in emergency * Avoid use of Wi Fi in school * Avoid wireless utility meters

Do. Prefer wired home phone * Minimize time of phone use, prefer text to long conversations * Do not stream content – download and access on "airplane mode" * Turn off Wi Fi /Bluetooth / location modes whenever not in use * Avoid cellphone use in metallic or moving spaces (elevator, car) * Turn off Wi Fi function of printers.

Key words: electromagnetic radiation, EMF, safety standards, thermal effects, biological effects, electrohypersensitivity, EHS, Microwave Sickness.

PRACTICES OF THE HEALTH OF PRIMARY SCHOOL CHILDREN IN THE FAMILY

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The article is devoted to the analysis of the practices of maintaining the health of primary school children in the family. The object of the study, conducted in February 2021 in the Perm Territory, is the parents of children studying in the elementary grades of the school. The purpose of this work is to identify the features of the practice of preserving the health of children in families with different types of health-preserving behavior of parents. The data was collected using a formalized survey using Google Forms, a sample of 500 parents. The data was analyzed statistically using IBM SPSS Statistics software. To determine the types of health-preserving behavior of parents, an integral indicator of parents' leading a healthy lifestyle was created, which includes 3 types of behavior: type 1 – "Follow the principles of healthy lifestyle", type 2 – "Partially follow the principles of healthy lifestyle", type 3 – "Do not follow the principles HLS ". Further, the relationship of this indicator with individual practices of preserving the health of children was analyzed. The results of the study showed that a healthy lifestyle is not widespread among parents, while most of them strive for a healthy lifestyle, i.e. implements only some healthy lifestyle practices. Also, a relationship was revealed between the lifestyle of parents and the lifestyle of children, namely with such practices as regular preventive medical examinations (correlation coefficient = 0.136), nutritional control (correlation coefficient = 0.251) and hardening (correlation coefficient = 0.141). As a result, it was concluded that it is important to work with the lifestyle of parents to improve the health of children and reduce their health risks.

Key words: health, family, health preservation practices, healthy lifestyle, children, parents.

THE SYSTEM FOR THE FORMATION OF A HEALTHY LIFESTYLE IN THE CONDITIONS OF THE EDUCATIONAL PROCESS IN GENERAL EDUCATIONAL ORGANIZATIONS AND THE HEALTH OF MINORS

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The objects of the study were the system of formation of healthy lifestyle skills in the educational process, as well as the morbidity of minors in the region for the period from 2008 to 2019.

The aim of the study is to study the influence of the systemic formation of a healthy lifestyle in students in the educational process on the health status of minors.

Objects of observation were the systems for the formation of a healthy lifestyle in educational organizations, the unit of observation was schoolchildren. The work uses traditional statistical, socio-hygienic and epidemiological methods of studying health.

Results. The model of a continuous system for the formation of a healthy lifestyle included hygienic education of pedagogical staff, parents, the formation of students' healthy lifestyle skills with the involvement of not only stakeholders in the system, but also representatives of the public, the media, and the volunteer corps. The introduction in the 2008–2009 academic year into the educational process of students of individual schools of a continuous system for the formation of a healthy lifestyle, its successful maintenance in the future in most schools in the region, made it possible to increase the proportion of children and adolescents with healthy behavior skills, which contributed to a decrease in the incidence of children and adolescents in subsequent years.

Key words: the system of continuous education for the formation of a healthy lifestyle, students, morbidity.

FEATURES OF LIFE TRAINING MEDICAL PREVERSARY

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The development of society and the reform of education creates a need for an ever-increasing amount of information that a person needs for successful activity, moreover, this information permeates not only educational, but also extracurricular activities of a student. Society's requirements for specialists with the implementation of demanded professional competencies is constantly growing, which dictates the need for a high level of assimilation of information through an emotional-value attitude to activities; to form the ability to learn through the exchange of experience, activation of thinking, personal growth, to be able to work in a team, to be able to pose new problems. In 2019, on the basis of the Resource Center "Medical Sechenovsky Preuniversity", a study of the time budget was carried out using an individual survey using a specially developed questionnaire (chronocard), for the analysis, the average daily time budget of schoolchildren (in hours and minutes) was calculated. A number of behavioral risk factors were identified: the average duration of night sleep was 6.52 ± 1.2 hours; the time spent on all meals per day is 59.09 ± 29.06 minutes, which is evidence of a fairly fast food intake process; only 39.2 % of schoolchildren are engaged in physical culture and recreation activities (on average, 70.29 ± 41.23 minutes a day). Preparing homework and time for schoolwork, including additional tasks, takes a significant amount of time for 74 % of schoolchildren in medical classes. The road to the place of study takes on average 1.82 ± 0.8 hours a day, every 5th student spends more than 2.5 hours on the road every day. Students use more than one type of electronic means at the same time and for a significant amount of time. Thus, the average time of using a cell phone per day is almost 3 times higher than the time spent on educational activities. In addition, students spend 2.4 to 5.9 hours a day working with a tablet and a computer.

Key words: hygiene, high school students, pre-professional medical training, time budget, health risk factors.

PECULIARITIES OF THE STUDY OF THE EFFICIENCY OF THE USE OF INDUSTRIAL EXOSKELETONS DESIGNED TO SUPPORT THE UPPER LIMBS

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Despite the development of production automation, there are still professions and labor operations that require the use of human physical strength, which determines the high level of occupational pathology associated with physical overload and overstrain of individual body systems. One of the leading forms of musculoskeletal disorders are diseases and injuries of the shoulder girdle. At the same time, their connection with working with hands at a level above the head is a proven fact. A modern solution to this problem is the introduction of industrial exoskeletons designed to assist in performing such production operations. These technologies are actively developing all over the world, but their implementation in production is difficult due to insufficient study of issues related to their effect on the human body, which is due to the lack of standard methods for testing these systems. The object of the study was an industrial exoskeleton "X-Rise" manufactured by "Exraise" LLC, designed to support the upper limbs of manual workers. The aim of the study was to assess the impact of its application on the functional state of a person in the course of modeling the labor activity of potential consumers. Biomedical tests were carried out, including ergospirometric testing, biomechanical motion capture, electromyography, myotonometry, and methods of subjective assessment. As a result of the study, it was found that the use of the industrial exoskeleton "X-Rise" is safe and can help reduce the load on the cardio-respiratory system and the musculoskeletal system, reduce the level of fatigue and increase performance. The data obtained, together with the experience of foreign authors, can serve as a basis for the development and implementation of standards for assessing the use of industrial exoskeletons, intended, in particular, to reduce the load on the upper limbs of manual workers.

Key words: occupational pathology, industrial exoskeleton, biomechanical capture of movements, myotonometry, electromyography, ergospirometry.

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