Use of Genetic Technologies in Formation of Specialized Professional Selection Programs in the Health Care System as a Factor in Ensuring the Sustainable Development of Society and Regions in the Context of the COVID19 Pandemic

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Abstract: The article indicates that the most important factor in ensuring sustainable socio-economic development of society as a whole and of each individual region is the state of labor resources, and in this regard, the question is raised of the need to apply anti-pandemic approaches at different levels of organization of the life of modern society and, above all, in the healthcare sector. It is concluded that the epidemic of the new coronavirus infection is an unprecedented challenge to the national health systems, checking the degree of their preparedness and the speed of response to the current emergency. The importance of taking proactive complex measures to create more favorable conditions for performance of professional duties by health care professionals in the case of a large-scale spread of dangerous infections is emphasized. In this regard, it is recognized that it is necessary to revise various aspects of occupational safety and health, to strengthen measures to prevent violations of their somatic and mental health, and to form a system of special legislation that defines working conditions and guarantees the rights of health care professionals in the case of a pandemic. To solve the problem of optimizing the work and rest of health care professionals in a pandemic, preventing burnout syndrome, it is offered to use, among other things, genetic technologies. It is proved that the proper performance of professional duties in the context of a pandemic of new infectious diseases is determined not only by the necessary competencies formed during the period of training and the work itself, but also, to a large extent, by human genetic data. The necessity of development and legal consolidation of modern standards of professional selection and appropriate rotation of health care professionals on the basis of genetic information about the characteristics of the immune status, the stability of circadian biological rhythms, resistance to stress factors, and etc. is justified. The importance of scientific discussion of the establishment of basic genetic markers, on the basis of which professional selection and personnel management programs in the health care system shall be implemented in a pandemic, is emphasized. The key directions of the formation and implementation of these programs for the professional selection and management of medical personnel using genetic technologies are determined.

1 INTRODUCTION

An outbreak of a new coronavirus infection SARS-CoV2, first registered in December 2019 in Wuhan, China, quickly spread throughout the world in a short period of time and led to the development of the COVID19 pandemic (Lu, Zhao, Li, Niu, Yang, Wu, 2020), (Carvalho, Krammer, Iwasaki, 2021). Until now, a large-scale circulation of various variants of SARS-CoV2 continues (Richardson, Hirsch, Narisimhan, Crawford, McGinn, Davidson, 2020), (Planas, Veyer, Baidaliuk, Baidaliuk, Staropoli, Guivel-Benhassine, Rajah, 2021), which provides chronic stress to the national health systems, social

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sphere and economies of almost all countries. As of August 26, 2021, 213,967,020 cases of COVID19 were confirmed and 4,464,245 deaths were registered.

The complex course and multi-organ nature of COVID19, the lack of effective treatments for this disease so far, the ability of a new virus to undergo mutational changes, an increasing rate of spread and an increase in the damaging activity of new SARS-CoV2 variants and, as a result, a violation of the socio-economic infrastructure that developed during the pre-pandemic period most countries – all these circumstances actualize the search for effective ways and mechanisms to counter a pandemic of a new infectious disease. Wherein, the need to apply anti-pandemic approaches at different levels of organization of the life of modern society is clearly traced. Undoubtedly, these approaches shall, among other things, be based on modern scientific achievements and include artificial intelligence systems for collecting, analyzing and storing a large array of various data, genetic technologies, innovative communication programs under conditions of social distancing, the latest means of predicting the course of a pandemic, and etc. No less important is an active discussion of the problem of applicability of innovative technologies from the standpoint of modern law and bioethics.

The most important factor in ensuring sustainable socio-economic development of society as a whole and of each individual region is the state of labor resources. In this regard, attention shall be paid to optimizing the functioning of those services whose work is aimed at preserving human life and health. These include, first of all, the health care system, the importance of which during a pandemic can hardly be overestimated. In the light of the foregoing, the issues of conducting the correct personnel policy in this area come to the fore, within formation of which it is necessary to consider that the proper performance of the professional duties by health care professionals is determined not only by the necessary competencies, but also, to a large extent, by the genetic data of a person.

The foregoing confirms the relevance of the problem of forming specialized programs for recruiting workers in the field of medicine in emergency epidemiological conditions using genetic technologies. Wherein, development of such programs shall be based on the results of interdisciplinary scientific research that can assess various aspects of the COVID19 pandemic (from biomedical to bioethical and legal ones) and indicate integrated approaches to successfully address personnel policy issues in the healthcare system in emergency conditions of society.

2 STUDY METHODS

The purpose of this cross-scientific study is to establish the possibility and necessity of using genetic technologies in preparation of specialized professional selection programs in the healthcare sector in the context of the COVID-19 pandemic. In support of the conclusions made in the paper, data on the prevalence of COVID-19 from official sources, as well as the data given in the doctrine, obtained as a result of experimental observations, generalization of clinical material, analysis of relevant genetic information, and etc., were used.

When considering the importance of considering the genetic data that determine some psychotypical characteristics of a person, restructuring the activity of physiological systems, as well as the problem of influence of night work on the cognitive functions of health care professionals, a complex of physiological research methods was used: registration of the electrical activity of the heart and individual indicators of the cardiac cycle (Cardiocode analyzer), daily monitoring of blood circulation parameters (Kardiotechnika-04-8M analyzer). Male students (n = 42) at the age of 20-28 years of medical university took part in the study on a voluntary basis in compliance with the bioethics norms. Among them were students combining educational activities with work as nursing staff (n = 8).

In addition, a systematic analysis of the latter was carried out in order to substantiate the offer for improving the Russian legislation defining working conditions and guaranteeing the rights of health care professionals in a pandemic.

The doctrinal basis for writing this paper was the works of scientists conducting studies in the field of assessing the medical and biological aspects of the new coronavirus, the physiology of adaptation processes, circadian biorhythmology, and law.

In the course of the study, both general scientific and specific scientific methods of cognition were used: dialectical, systemic, intersectoral, and natural science ones.

3 STUDY RESULTS

An analysis of the results of the latest studies (Pouwels, K.B., House, T., Pritchard, E., Robotham,

J.V., Birrell, P.J., Gelman, A. et al., 2021), (Nafilyan, V., Pawelek, P., Ayoubkhani, D., Rhodes, S., Pembrey, L., Matz, M. et al., 2021) shows a positive relationship between the incidence of diseases and deaths from a new coronavirus infection with certain professions. So, doctors of intensive care units and nurses caring for patients with COVID19, workers of nursing homes are among the main risk group for this disease (Burdorf, L., Porru, F., Rugulies, R., 2020), (Chadeau-Hyam, M., Bodinier, B., Elliott, J., Whitaker, M.D., Tzoulaki, I., Vermeulen, R. et al., 2020; Sim, M.R., 2020), (Mutambudzi, M., Niedzwiedz, C., Macdonald, E.B., Leyland, A., Mair, F,. Anderson, J. et al., 2021).

In the context of the fight against the COVID-19 pandemic, healthcare workers are exposed to various kinds of risks and traumatic situations, which include the following: SARS-CoV2 infection while providing medical care to patients; physical overwork and emotional exhaustion; irregular working hours; discrimination in society and family, and etc.

The Interim Recommendations of the International Labor Organization (ILO) and the World Health Organization (WHO) "COVID-19: Occupational Health and Safety of Health Workers", released on February 2, 2021, provide an update on health and safety measures for health workers and activities of the occupational health services within the new coronavirus pandemic.

In addition to reviewing various aspects of occupational safety and health in the case of a large-scale spread of dangerous infections, it is necessary to strengthen measures to prevent violations of the somatic and mental health of health workers. This shall consider the current classification of risk levels. Otherwise, insufficient and untimely measures in the field of arranging the work of health care professionals can lead to an unpredictable increase in morbidity, a decrease in labor productivity and the quality of care in pandemic conditions. This, in turn, can lead not only to a collapse in the health care system, but to a dangerous overstrain of the socio-economic sphere of society.

An important aspect of the problem under consideration is provision of an individual approach to prevent overwork and disruption of professional adaptation of health care professionals in the context of a pandemic. Such a personalized approach can be associated with use of modern technologies for the analysis of genetic information revealing the adaptive potential of a person.

Considering the high degree of tension in the mechanisms of regulation of the activity of the cardiovascular system in emergency situations, it is relevant to consider the genetic markers of the risk of diseases of the heart and blood vessels. Wherein, it is advisable to correlate these risks with the behavioral characteristics of a person. According to the concept of behavioral types, the prevalence of coronary heart disease, atherosclerosis, myocardial infarction, arterial hypertension,-cerebrovascular disorders are higher in representatives with type A behavior (Denollet, J., De Potter, B., 1992), (Kucherenko, K.N., Belyakov, V.I., 2018). Health care workers with type A behavior can be a potential risk group for occurrence of functional and organic disorders of the cardiovascular system, as well as professional maladjustment due to a high predisposition to emotional burnout.

The above-mentioned features of representatives with type A behavior are in good agreement with the results obtained in the framework of this study. Analysis of the dynamics of the parameters of the activity of the cardiovascular system during the day revealed higher average daily values of systolic and diastolic blood pressure, pulse rate, and presence of a greater number of acrophases for these indicators in type A representatives. Calculation of the Kerdo vegetative index in this group of subjects revealed the dominance of sympatho-adrenal mechanisms of blood circulation regulation. Under the conditions of motor functional tests, subjects with type A showed hypertensive and dystonic types of reactions.

There is data (Melentyev, I.A., Vershinin, A.A.. Kolesnikova, E.A., Melentyev, N.A. Malygina, I.V. Kostomarova, V.P. Zaitse, A.S., 2006) about a greater distribution of the DD genotype for the ACE (Angiotensin Converting Enzyme) gene among individuals with characteristic type A behavior. Meanwhile, this genotype is associated with a relatively high predisposition to myocardial infarction and other diseases of the cardiovascular system. Considering the peculiarities of the genotype (namely, the ACE gene) in the programs for the selection of medical personnel for work in emergency conditions will make it possible to prevent diseases of the cardiovascular system and recommend, first of all, persons who are not prone to type A behavior to perform work with high and extremely high risk.

Based on the analysis of genetic information, it is also possible to determine the individual-typological characteristics of a person, for example, those associated with the regulation of circadian biological rhythms and resistance to occupational desynchronosis. The need and timeliness of a comprehensive accounting of such data is determined by intense hours-long work shifts, work on a shift schedule, unplanned attendance due to the illness of

colleagues in the context of a pandemic of infectious diseases.

In the experimental part of this study, we analyzed the effect of night shift work on attention function and parameters of electrical activity of the cerebral cortex in junior medical personnel. It was found that a 12-hour working day and absence of night sleep negatively affect the function of attention (there is a decrease in its stability and concentration). A key feature of the pattern of electrical activity of the brain in medical students working at night was a significant change in the frequency component of the delta rhythm for various functional tests. Further studies are necessary to indicate specific violations of the functioning of individual neurotransmitter systems, the physiological activity of various areas of the cerebral cortex. In this case, it is necessary to consider the genetically specified features of the course of circadian biorhythms. We believe that the peculiarities of a person's chronotype can also be reflected in specialized genetic passports.

Experimental observations and extensive clinical material indicate that a violation of the flow of circadian biological rhythms poses a certain threat to the immune system and cellular defense mechanisms. As new data (Zheng, L., Wang, X., Zhou , C., Liu, Q., Li , S., Sun, Q. et al., 2020) on the prevalence of COVID-19 show, there is a significant number of cases (including deaths) among doctors and auxiliary medical personnel. The results of the studies (Zhanq, R., Wang, X., Ni, L., Di, X., Ma, B., Niu, S. et al., 2020) indicate a direct connection between the severity of COVID-19 and the deficiency and dysregulation of immunity.

With the integrated use of modern programs for professional selection and management of the rotation of medical personnel, genetic markers of the immune status shall also be analyzed. Variations of several of these genes are currently being discussed (Debnath, M., Banerjee, M., Berk, M., 2020). The paper (Anastassopoulou, C., Gkizarioti, Z., Patrinos, G.P., Tsakris, A., 2020) provides generalized information on presence of a relationship between certain alleles of genes with the susceptibility and severity of COVID-19. As a result of polygenomic studies (Pathak, G.A., Singh, K., Miller-Fleming, T.W., Wendt, F.R., Ehsan, N., Hou, K. et al., 2021), data were obtained on the relationship of 27 genes involved in the regulation of inflammation and hemocoagulation with the risk of hospitalization when infected with SARS-CoV2. Genomic regions associated with key mechanisms of antiviral immunity and the activity of proinflammatory cytokines in COVID-19 have been identified (Pairo-Castineira, E., Clohisey, S., Klaric, L., Klaric, L., Bretherick, A.D., Rawlik, K., Pasko, D. et al.,2021; Radzikowska, U., Ding, M., Tan, G., Zhakparov, D., Peng, Y., Wawrzyniak, P. et al., 2020).

As such, genetic analysis based on variations in specific genes can provide reliable information about the risk, severity and outcome of new multiple organ disease, COVID-19.

4 DISCUSSION OF RESULTS

The epidemic of the new coronavirus infection presents an unprecedented challenge to national health systems with test of their preparedness and how quickly they can respond to this emergency. The references (SHarapova, A.I., Antonova, N.L., 2020) correctly emphasize that since the modernization of the healthcare sector is one of the main tasks of any state, in the field of medicine, the solution of personnel management issues and the rational use of human potential are of paramount importance.

A comprehensive consideration of the problem of staffing the medical sector in the context of the large-scale and rapid spread of dangerous infectious diseases such as the COVID-19 pandemic indicates the need to use innovative approaches, namely, based on taking into account human genetics. This will allow for more efficient selection and optimal rotation of health care professionals in a pandemic. Namely, with an established individual low level of immunological protection, a tendency to develop dysregulation in the immune system, as well as a low speed of making effective decisions in stressful situations with a large number of infected people, it is possible to recommend performing professional duties not related to contacts with patients and visitors to medical institutions (work in the field of telemedicine, remote interviewing of patients, and etc.). For a more thorough professional selection, we consider it expedient to widely introduce the so-called specialized genetic passports, the development of which requires use of DNA technologies (Ruzanova, V.D., Belyakov, V.I., 2020; Ruzanova, V.D., Inyushkin, A.A., Kryukova, E.S., Povarov, I.S., Belyakov, V.I., 2020).

WHO and ILO provide clear guidelines for management of health care workers in emergencies. Namely, it is indicated that five eight-hour or four ten-hour shifts per week are relatively well tolerated. Longer shifts are a risk of overwork. In the evening and at night, short shifts are more physiological. When drawing up a work schedule, it is preferable to alternate individual shifts in a forward direction (first

morning shift, then day shift, then evening one). When choosing a professional workload, one shall take into account its complexity and duration. So, twelve-hour shifts are more optimal for performing "light" work (for example, for working with documents). On the contrary, heavy workloads shall be carried out in shorter work shifts.

Particular attention shall be paid to consideration of issues related to provision of rest, physical and emotional recovery of health care professionals. It is recommended that certain rules be established regarding the length of the work period and the time of rest and recovery.

As you know, Russian labor legislation classifies health care professionals as special subjects of labor law, establishing reduced working hours (no more than 39 hours per week) and additional paid vacations (Article 350 of the Labor Code of the Russian Federation). We shall note that the regulatory provisions in this area apply both to all health care professionals and to their individual categories, depending on the type of work performed and services provided, as well as a number of other factors (Manasyan, R.V., Sapozhnikova, N.I., 2021). Due to the spread of COVID-19 in Russia, a whole package of regulatory legal acts of various levels and clarifications from authorized bodies aimed at protecting and stimulating the work of health workers was adopted urgently. So, for health care professionals a shortened 36-hour working week and special social payments with use of increasing coefficients have been established, additional insurance guarantees have been introduced in the form of a one-time insurance payment, cases of infection of health care professionals with coronavirus infection are classified as occupational diseases. However, today this is clearly not enough, since formation of an integral system of special legislation is required that determines the working conditions and guarantees the rights of health care professionals during a pandemic on the basis of a differentiated approach to determining their legal status, depending on the function performed and other criteria.

Based on the analysis of various sources of information and our own experimental data, it can be concluded that the proper fulfillment of professional duties by health care professionals in the context of the COVID-19 pandemic (possibly future new infectious diseases) is determined not only by the necessary competencies formed during the training and the work itself, but also to a significant extent, by the genetic data of a person. This actualizes the need for development and appropriate legal consolidation of modern standards of professional selection and the necessary rotation of health care professionals based on genetic information about the characteristics of the immune status, the stability of circadian biological rhythms, resistance to stress factors, and etc. In this regard, we consider it timely for a more active discussion among a wide range of specialists to determine the basic genetic markers, on the basis of which professional selection and personnel management programs in the health care system shall be implemented in a pandemic.

5 CONCLUSIONS

In order to achieve a "workable" state of labor resources in a pandemic as the most important factor in ensuring sustainable socio-economic development of society as a whole and each individual region, we offer to highlight three key areas for formation and implementation of programs for professional selection and management of medical personnel using genetic technologies:

1. Creation of the genetic base of "professional markers", revealing, namely, the peculiarities of the functioning of the mechanisms of innate and adaptive immunity. This will make it possible to more reliably determine the susceptibility, severity of the course and possible outcomes of infectious diseases. It is relevant to use such a genetic base when scheduling the work of doctors and auxiliary medical personnel, which is determined by the special importance of circadian biological rhythms for the adaptive capabilities of a person, his/her effective and safe labor activity.

2. Development of an individual program of preventive examinations based on genetic data, analysis of the risk of health disorders and occurrence of occupational desynchronosis in a pandemic of infectious diseases.

3. Improvement and effective application of legal support mechanisms, legal registration of such programs, as well as discussion of the bioethical side of the problem of genetisation of the personal and professional sphere of a person.

We also consider it necessary to form an integral system of special legislation that defines working conditions and guarantees the rights of health care professionals during a pandemic on the basis of a differentiated approach to determining their legal status, depending on the function performed and other criteria.

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