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Modern Tools for Sustainable Development of Territories. Special Topic: Project Management in the Regions of Russia

INTEGRATED SAFETY AND HEALTH ISSUES IN THE NUCLEAR INDUSTRY

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Abstract

For a modern society a significant social and economic problem is the complete or partial loss of capacity for work by people working in industries with harmful conditions and / or living in technologically unfavorable territories. The problems of the study of the cause-effect relationships of disability, the prevention of disability, the rehabilitation of people of working age are complex and cannot be resolved within the framework of only health system, they require coordinated efforts of government agencies (including regional ones), industrial enterprises management, as well as organizations representing interests of people working and living in adverse conditions. It is shown how relevant in the technogenic environment is the topic of rehabilitation of persons with disabilities or those who are limited fit to work in high-tech industries, as the loss of health by such workers forces them to switch to other less harmful work, which is associated with significant economic and social problems. The article discusses a number of statistical data on the causes of disability and partial loss of capacity for work by persons of high-tech enterprises using the example of nuclear energy, and establishes the presence of positive dynamics of reducing risks that are directly related to professional activities. This article is devoted to the analysis of the current situation and the search for models that can improve the sphere of technosphere safety while improving the existing health care system, reduce social risks while developing high technologies that ensure a stable level of energy production.

Keywords: Labor longevity, socio-economic factors, technosphere safety.

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1. Introduction

In modern humans the absence of evolutionarily developed mechanisms for protecting an organism from the effects of harmful factors of anthropogenic and environmental genesis, and psycho-emotional overloads leads to the emergence of new diseases – "diseases of civilization", deterioration in public health, and disability. Disability of the population is closely related to economic development both at the regional level and at the state level, since a reduction in the labor potential of the population employed in the high-tech industry leads to a rise in the cost of each additional case of disability in the form of underproduction of the gross domestic product (Natsun & Shabunova, 2018). Representation of disability as an information indicator of public health, to a certain extent, reflects professional employment, access to medical services in accordance with socio-economic differences (income level, stratification). When considering a complex of phenomena associated with a complete or partial loss of working capacity and acting both on society and on an individual, it is necessary to clearly distinguish between some concepts. In particular, it is medical rehabilitation (restoration) of health and habilitation (formation of new professional skills) in persons previously recognized as fully or temporarily incapable of work and, for objective reasons, unable to return to their previous socio-economic positions.

The habitation and rehabilitation of persons who, in the course of their labor activity, encounter harmful and dangerous production factors, is a significant social problem. This issue has long outgrown the boundaries of rehabilitative medicine, occupational health, or compliance with safety rules in a particular industry. The rapid development of modern technogenic civilization and high technology has led to the involvement in the modern production of an increasing number of people with a high educational level and qualification in relation to the total number of employees. In addition, over the past half century, humanization of the production sector has become increasingly important throughout the world, expressed in toughening the rules and regulations that ensure control over harmful working conditions and protect the health of workers. (Unfortunately, this process is mainly characteristic of industrialized countries, while in Third World countries progress in this area is much less noticeable.)

The topic of this article is the analysis of data on various parameters (medical, economic, social, technical and technological) that affect the health status of people employed in high-tech industries. The main material of the study is medical information about people working in the field of nuclear energy or living in territories adjacent to enterprises and first recognized as disabled.

2. Problem Statement

The hypothesis of this study is the assumption of a multifunctional relationship between individual parameters that affect the health status of people associated with harmful production factors. Moreover, it is argued that the necessary measures of preserving the health of citizens declared by the state are implemented on the basis of two approaches independent from each other: departmental and regional. These approaches apply to different groups of the population and not only do not coincide with each other, but for a number of socio-economic reasons they cannot coincide. This point of view allows a different approach to the process of social modelling, the ultimate goal of which is to find the most rational ways for the optimal distribution of resources allocated to measures for the habilitation and rehabilitation of people, who have lost fully or partially working capacity when working in harmful conditions, or residents of territories that have undergone negative exposure to technogenic environment.

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The solution of these issues is important and necessary in view of the fact that for the modern industrialized information society, such problems constitute a significant part of the more general problems of technosphere security. In turn, such questions cannot be answered without building adequate development models that really assess the possibility of using certain resources. Without efforts in this direction, it is impossible to solve health issues related to the impact of harmful production factors and the problems of technosphere safety in general. This, ultimately, is about the stable development and sustainability of society, which, on the one hand, cannot exist without the energy-intensive industries that nuclear power provides, and, on the other hand, wants to protect itself from the dangers associated with the effects of harmful industries, including those related to nuclear energy itself.

As a first approximation, the socio-economic model may have a linear form of three "blocks" connected by direct and feedback links: "State - Agency - Disabled". On this "line" in each block there are two independent parameters that reflect the position of abilitants and rehabilitants. With a more detailed study of the model, another intermediate block "Regions" arises between the "State" and "Disabled", which is independent and forms its own "line" with the extreme blocks. To take into account all the interconnections and interactions between the blocks, a more detailed study is required, which is beyond the scope of this article.

3. Research Questions

Conducting a retrospective analysis of the results of surveys of citizens aged 18 years and older in a cohort of employees of nuclear industry enterprises with especially dangerous working conditions, subordinate to the Federal Biomedical Agency (FMBA) of Russia, and the population of certain closed administrative-territorial formations (ZATO) for the period 2016-2018.

Comparison of the share of occupational diseases associated with the effects of production factors with all other diseases, including those caused by technogenic environmental effects.

Assessment of prospects for an increase in the proportion of abilitants in the general number of people who have worked in hazardous industries or who have contacted them in their places of residence.

4. Purpose of the Study

The purpose of the study is to identify approaches at various levels (state, industrial regional, personal) to building of a model that allows describing the complex interaction of socio-economic factors on the process of resolving issues to improve the situation of people exposed to harmful production factors.

5. Research Methods

The scientific and practical research was interdisciplinary in nature and, in addition to the general scientific methodology, it used the fundamentals of epidemiology and statistical analysis, including methods for analyzing the dynamics of social phenomena. Literature reflecting the legislation and the foundations of employment policy, vocational rehabilitation strategies and corporate practices in support of the full and equal inclusion of people with disabilities in society was reviewed. A continuous statistical study was carried out on the basis of an analysis of the report of the Main Bureau of the medical and

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social expertise of the Federal Medical and Biological Agency (MSE FMBA) of Russia for the period 2016-2018, including statistical data on the nuclear industry of the Russian Federation. The sample size was 26,210 acts of medical and social expertise of citizens 18 years of age and older, first recognized as disabled (VPI) and related to a cohort of employees of the state corporation Rosatom, and the adult population living in technogenically unfavorable territories.

For statistical data processing, a computer program MicrosoftOfficeExcel 2010 was used. During statistical processing of the research results, the arithmetic mean values (M) and standard errors were determined, taking into account the deviation of the sample values from the arithmetic mean values (±m). Normality of distribution was checked using the Kolmogorov – Smirnov test. Upon the condition of the correspondence of the normality distribution, the reliability of the obtained differences of the compared values was evaluated using Student's t-test. The results show the odds ratio (OSh) and 95% confidence interval (DI). Data were considered statistically significant at $p \leq 0.05$.

6. Findings

The share of people who were first recognized as disabled in 2016 amounted to 83.87% of the number of people who were first examined, in 2017 - 85.68% and in 2018 - 85.044%, respectively (without significant statistical differences). It is important to note that the number of people of working age with signs of disabilities undergoing medical and social expertise (MSE) in order to determine the needs for measures of social protection, rehabilitation and habilitation for the three analyzed years (2016-2018) also does not have statistically significant fluctuations (Figure 01). The level of primary disability due to occupational diseases did not change significantly for three years (Figure 02).

One citizen (pensioner) in 2016 was recognized as a disabled person due to radiation accidents and disasters, which amounted to 0.012% of all newly recognized invalids (VPI) in 2016, and one citizen of working age in 2018 (0.013%) of all VPI in 2017 (Figure 02). Thus, the causal relationship of disability with work to eliminate the consequences of radiation accidents and disasters is identified in a small percentage of cases.

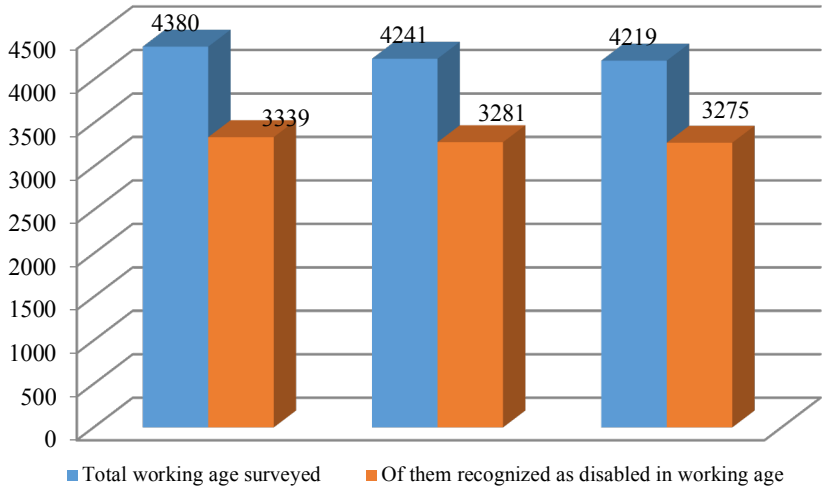

Figure 01. Distribution of the number of disabled people of working age in the cohort of the first examined people of working age (person)

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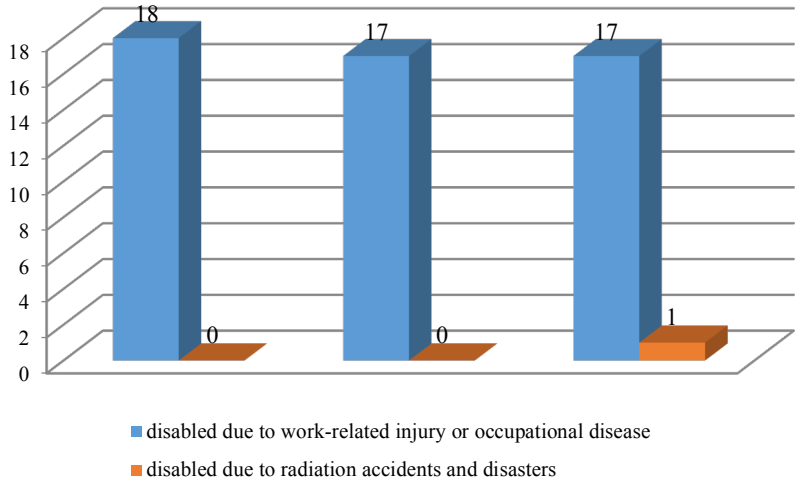

Figure 02. Distribution of the number of disabled people of working age due to work-related injury / occupational disease and radiation accidents / disasters in the cohort of the first-time examined people of working age (person)

We studied the structure of diseases that served as the main cause of the primary disability of the employable adult population of this cohort for 2016-2018. The following nosologies were found to occupy the first 5 ranking places: malignant neoplasms (1st place), circulatory system diseases (2nd place), musculoskeletal system diseases (3rd place), nervous system diseases (4th place), diseases of the digestive system and diseases of the endocrine system (5th place). The increase in the share of first recognized persons with disabilities (VPI) due to a malignant disease among employees of the nuclear industry, and the population living in technogenically unfavorable territories amounted to 2.7% in 2018, which is 2.07% higher than in 2017. This indicator reflects the trend in the incidence of malignant neoplasms in the country as a whole. For example, in 2018 in the Russian Federation, the growth of this indicator compared to 2017 amounted to 1.2%, which is 1.2% higher than in 2017 and 23.1% higher than in 2008 (Kaprin, Starinskii, & Petrova, 2019). It is noteworthy that over the course of a three-year period, against the background of an increase in the number of patients with oncopathology, there is a clear tendency toward a decrease in the proportion of first recognized persons with disabilities (VPI) due to circulatory system diseases. This is probably due to the medical examination of the population, the competent organization and an increase in the amount of high-tech assistance, the possibility of its implementation in leading research centers of the Russian Federation. From which it follows that the national project “Health”, launched in 2006, is the beginning of a qualitatively new stage in the development of Russian healthcare.

What is the potential of modern medical technologies in measures for vocational rehabilitation and retraining of working-age citizens with limited working abilities? As we noted earlier, over time, the number of people who have been able to achieve production adaptation and fully restore their social and labor status, is growing (Tverdynin, Tikhonova, Grishakina, Ruff, & Dengin, 2019). It is known that long-term disability negatively affects the level of participation of the population in the work process, since motivation to work is reduced by subsidies from the state, such as a pension, disability allowance under the social insurance program. Research shows that the education, age, and severity of a disease that

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causes disability are predictors of recovery and a desire to return to work (Langhammer, Sunnerhagen, Sällström, Becker, & Stanghelle, 2018).

Rehabilitation plays a key role in promoting the recovery of a disabled person and reducing health care costs, for example, by changing conditions in everyday life and in the workplace, gaining independence by means of transportation, etc. (European Physical and Rehabilitation Medicine Bodies Alliance, 2018). For example, for training novice wheelchair users, it is possible to use semantic technologies that support an innovative learning process based on virtual reality scenarios (Arlati, Spoladore, Mottura, Zangiacomi, Ferrigno, Sacchetti, & Sacco, 2018). The implementation of disability prevention policies in the workplace depends on the contextual impact of socio-political conditions and relationships at the governmental and public levels. Concerned parties implementing this strategy should be directly involved in production as partners (Ståhl, Costa-Black, & Loisel, 2018). A review of the literature suggests that the provisions and guidelines regarding persons with disabilities are often ambiguous, resulting in poor protection of them. Thanks to advanced technologies and changing demographics, in order to manage the labor resources of people with limited working ability, it is possible to use more flexible working conditions for both the employee and the employer, namely: (a) temporary and conditional employment; (b) part-time; (c) virtual work / telework; and (d) single workers (Ekberg, Pransky, Besen, Fassier, Feuerstein, Munir, & Blanck, 2016). One of the main reasons for social exclusion and restrictions on various types of activities for people with disabilities is the low availability of transport services (Wasfi, Steinmetz-Wood, & Levinson, 2017). The data show that the involvement of socially excluded people, including people with disabilities, is effective through the mediation of social integration services and the wider inclusion of digital technologies for an effective management resource (French & Richardson, 2017). The abilities of individuals who are not directly used in production at the moment, but can be activated in the future, are considered in the framework of the concept of human potential (Doktorovich, 2010).

Thus, it can be stated that the problems of habilitation and rehabilitation of citizens exposed to ionizing radiation are not only socially significant, but also allow a fresh assessment of the economic opportunities in the field of nuclear energy and technosphere safety in general. The proper use of resources, including human capital, can reduce biomedical risks and solve many social problems, significantly improving people's lives.

7. Conclusion

The approach to the problem of public health, as the main task of the organization of health and social security, should not focus on persons with disabilities. Address distribution, and, in some cases, the redistribution of forces and means between rehabilitation, habilitation and prevention are necessary.

In the conditions of modern Russia, the role of National projects of regional and departmental programs has become obvious, providing improved protection of citizens from harmful production factors, and, in a broader sense, the country's technosphere security.

The main efforts to prevent occupational diseases associated with technogenic impacts on people in their work and residence areas should be aimed at solving problems in the field of oncological diseases.

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References

Arlati, S., Spoladore, D., Mottura, S., Zangiacomi, A., Ferrigno, G., Sacchetti, R., & Sacco, M. (2018). Analysis for the design of a novel integrated framework for the return to work of wheelchair users. *Work, 61*(4), 603-625.

Doktorovich, A. B. (2010). Reproduction of social and human potentials. *Labor and social relations, 1,* 11-18. [in Russ.].

Ekberg, K., Pransky, G. S., Besen, E., Fassier, J. B., Feuerstein, M., Munir, F., & Blanck, P. (2016). New Business Structures Creating Organizational Opportunities and Challenges for Work Disability Prevention, *J Occup Rehabil, 26*(4), 480-489.

French, T., & Richardson, J. (2017). A Community-Level Perspective on Digitally and Socially Including Disabled People. *Stud. Health Technol. Inform, 242*, 859-863.

Langhammer, B., Sunnerhagen, K. S., Sällström, S., Becker, F., & Stanghelle, J. K. (2018). Return to work after specialized rehabilitation-An explorative longitudinal study in a cohort of severely disabled persons with stroke in seven countries. *Brain & Behavior, 8*(8), e01055. https://doi.org/10.1002/brb3.1055

Natsun, L. N., & Shabunova, A. A. (2018). On the issue of the economic price of disability. *Economic and social changes: facts, trends, forecast, 11*(2), 160-174. [in Russ.].

Kaprin, A. D., Starinskii, V. V. & Petrova, G. V. (2019). Sostoyanie onkologicheskoi pomoschi naseleniyu Rossii v 2018 godu, M, MNIOI im. P.A.Gertsena filial FGBU NMIC Radiologia Minzdrava Rossii. [in Russ.].

European Physical and Rehabilitation Medicine Bodies Alliance. (2018) White Book on Physical and Rehabilitation Medicine in Europe. Chapter 2. Why rehabilitation is needed by individual and society. *Eur. J. Phys. Rehabil. Med, 54*(2), 166-176.

Ståhl, C., Costa-Black, K., & Loisel, P. (2018) Applying theories to better understand socio-political challenges in implementing evidence-based work disability prevention strategies. *Disabil Rehabil, 40*(8), 952-959.

Tverdynin, N. M., Tikhonova, O. A., Grishakina, N. I., Ruff, A. S., & Dengin, V. V. (2019). Improving Rehabilitation Efficiency for Citizens with Limited Work Capacity: Socio-Economic Aspects. *European Proceedings of Social& Behavioural Sciences, 59*, 753-758.

Wasfi, R., Steinmetz-Wood, M., & Levinson, D. (2017). Measuring the transportation needs of people with developmental disabilities: A means to social inclusion. *Disabil Health J., 10*(2), 356-360.