Literature review

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Medical and social aspects of the occupational health of workers with post-COVID syndrome (thematic review)

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On the basis of a thematic review of studies by foreign and domestic authors, scientists have conducted the analysis of multimorbid manifestations of post-COVID syndrome in workers. We have considered the risk factors of occupational health disorders of workers in the post-COVID period, the problems of returning to work of patients who have undergone COVID-19.

Specialists have presented modern approaches to the examination of the professional suitability of employees, the examination of the connection of COVID-19 with the profession and comprehensive medical rehabilitation in the post-COVID period.

Keywords: *professional health; employees; ability to work; post-COVID syndrome; medical examinations*

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Introduction. In the context of the spread of a new coronavirus infection, occupational medicine faces the need to both preserve and strengthen the professional health of the working population and the working capacity of people who have undergone COVID-19.

Various countries actively study the consequences of infection in the form of post-COVID syndrome[1] (the persistence of signs and symptoms for more than 12 weeks after COVID-19). Experts create registers with accumulated clinical cases for the subsequent development of standards of medical care, solve issues of improving the quality of life and returning patients to work and habitual life [1–3].

To date, the issues of preserving the professional health and well-being of employees are relevant. According to the joint Committee of the ILO and WHO (1950)[2], occupational health and well-being (Occupational health and safety, ONS) are related to the safety, health and well-being of workers. Researchers consider the goals of occupational health and well-being as the promotion and maintenance of the highest degree of physical, mental and social well-being of workers of all professions; prevention of health deterioration among workers caused by working conditions; protection of employees from risks caused by adverse health factors; placement and maintenance of employees in a professional environment appropriate to their physical and psychological needs[3]. The main indicator of occupational health is working capacity [4, 5].

The pandemic has created a number of problems for the working population: financial difficulties, remote work and social isolation, increased burden on persons of socially significant professions, shortage of personnel or job cuts, the stressful situation associated with the pandemic, difficulties in assessing the professional suitability of workers after a coronavirus infection [6].

We have paid much attention to the issues of establishing a causal relationship between COVID-19 and the profession, primarily in workers at high risk of infection in the workplace [7].

There are judgments about the impact of the new coronavirus infection on the biological age and premature vascular aging of patients who have undergone COVID-19, due to the development of diseases peculiar to old age[4] in the post-COVID period in previously healthy people. In this regard, the issues of accelerated aging of workers with post-COVID symptoms deserve special attention of occupational health specialists.

Risks of development and general clinical characteristics of post-COVID syndrome. Currently, scientists can identify post-COVID syndrome not only as a consequence of a severe form of the disease (in patients with hospitalization and intensive care), but also in patients who have suffered a mild form of SARS-CoV-2 infection [8, 9].

We have established a number of risk factors for the development of post-COVID syndrome: old age, the presence of comorbid diseases (diabetes, hypertension, obesity, cardiovascular diseases), changes in laboratory parameters (lymphopenia, thrombocytopenia, elevated levels of D-dimer, troponin, ferritin), prolonged stay in the ICU, chronic alcoholism, smoking [10–13].

[1] COVID-19 rapid guideline: managing the long-term effects of COVID-19 NICE guideline Published: 18 December 2020 www.nice.org.uk/guidance/ng188

[2] Occupational health and safety, OHS, 1950

[3] Occupational safety and health in public health emergencies: A manual for protecting health workers and responders. International Labour Office, Geneva, 2018 ISBN: 978-92-2-030794-6 (print) ISBN 978-92-2-030795-3 (web pdf)

[4] VI International Online Conference "COVID-19. Russian and international experience" 03.15.2021 Tkacheva O.N. Chief freelance Geriatrician of the Ministry of Health of Russia.

At the same time, the vaccination reduces the risk of developing post-COVID syndrome. The resolution of the International Council of Experts of the Eurasian Association of Therapists and the Russian Society of Cardiology states that six months after the COVID-19 vaccination is recommended for all patients [2].

In patients vaccinated before the disease and within twelve weeks after COVID-19, the risk of post-COVID syndrome decreased [14]. However, in cases of breakthrough infection (development of COVID-19 after vaccination), there was only a slight decrease in the risk of a long-term post-ovoid symptom complex or no effect on the risks in the post-COVID period [15].

The long-term consequences of COVID-19 include multiple organ pathological manifestations (respiratory, neuropsychiatric, cardiovascular, hematological, gastrointestinal, renal, endocrine, cutaneous, neuromuscular) of largely unknown pathogenesis [16].

The consequences of COVID-19 are a serious threat not only to physical and mental health, but also to the well-being of society as a whole[5].

The researchers have established long-term mental health and psychological disorders of patients who have undergone COVID-19 [17, 18].

One of the most frequently reported manifestations of the post-ovoid condition is fatigue syndrome, described during previous outbreaks of coronavirus. Thus, during the SARS epidemic in Toronto in 2003, 10% of survivors after three years had symptoms such as weakness, myalgia or headache, which reduced the ability to perform previous work [19].

Experts often diagnose in the post-COVID period asthenic syndrome, including the presence of severe fatigue that does not go away after a long rest, headaches, increased drowsiness, decreased productivity, ability to concentrate, muscle weakness [20], intolerance to even small physical and mental loads [21]. The severity of asthenic manifestations usually does not correlate with the severity of COVID-19 [22].

According to Evans R A et al. (2021), in patients in the long-term post-COVID period (up to a year or more), due to physical and/or mental health disorders, vital activity decreases, in particular the ability to self-serve (29%), the ability to perform habitual activities (73%) [23].

An online survey of about four thousand patients with a suspected and confirmed diagnosis of COVID-19 revealed that more than 85% of them noted cognitive problems and memory impairment, which had a significant impact on performance [6].

In a study of the quality of life of 178 patients (from 16 Italian intensive care units) a year after COVID-19, experts observed persistent mental disorders in 38.2% of cases against the background of partial recovery[6].

In the conditions of the COVID-19 pandemic, there is not only fear and a real possibility of contracting a new coronavirus infection[7], but also a stressful situation dangerous for mental health with insufficiently studied long-term consequences [24].

According to WHO, during the COVID-19 pandemic, mental health care is necessary both at work and in society[8]. Scientists often identify a depression, anxiety and post-traumatic stress disorder (PTSD) in the post-COVID period in patients who have undergone a new coronavirus infection [2] regardless of the severity of the infection [23, 25, 26].

These violations may be caused by job loss, fear of returning to work, financial problems, death of a family member or colleague, fear of transmission of the virus to loved ones, the need for quarantine and isolation, the presence of a high perceived threat to life, social stigmatization [27–29]. All this leads to an increase in the number of absenteeism and layoffs and a decrease in labor productivity [30–32].

The lack of timely psychiatric and psychological help[9] plays an important role.

According to the Eurasian ACTIVE Registry, three and six months after the COVID-19, specialists have registered in 5.9% of patients cardiovascular diseases (coronary artery disease, hypertension, acute cerebrovascular accident, atrial fibrillation), as well as diabetes mellitus.

Moreover, the level of "new" morbidity in post-COVID patients of 49–50 years significantly exceeded that in the general population of the Russian Federation [3].

We have noted the frequent repeated treatment of this contingent for medical care, including repeated hospitalizations, worsening of the course of existing diseases, and high mortality. In combination with previously detected diseases in the post-COVID period, patients have a multimorbid state [2, 3].

Changes in the organization of work and quality of life in patients who have undergone COVID-19. In the context of a pandemic, issues of both restoring the professional health of workers who have undergone COVID-19 and restoring their working capacity are extremely important, which is especially important for people employed in harmful (dangerous) working conditions. Solving these problems requires the cooperation of health authorities and occupational health services, as well as the development of methods of interdisciplinary work [33].

Today, complex social problems are associated with employees who continue to work (for economic and other reasons) being ill, which poses a risk of infection for colleagues and the population [34]. The researchers described presenteeism during the pandemic among self-employed workers, workers with an unstable form of employment [35]. Psychological factors play an important role in the development of this phenomenon: fear of losing a job, professional stress, burnout, insomnia, social isolation, depression, anxiety, PTSR [35–37].

On the other hand, patients who have undergone COVID-19 change their working hours, reduce working hours, take sick leave, quit (or are fired).

[5] Pan American Health Organization. Mental health and psychosocial considerations during the COVID-19 outbreak. Washington, D.C.: PAHO; 2020. https://www.paho.org/en/documentos/consideraciones-psicosociales-saludmental-durante-brote-covid-19

[6] Gamberini L. et al. Health-related quality of life profiles, trajectories, persistent symptoms and pulmonary function one year after ICU discharge in invasively ventilated COVID-19 patients, a prospective follow-up study. *Respiratory Medicine.* 2021; 189: 106665.

[7] 24th Collegium Ramazzini statement prevention of work-related infection in the COVID-19 pandemic. *The Fellows of the Collegium Ramazzini Italy.* https://doi.org /10.1136/ oemed-2020-106724

[8] World Health Organisation. Mental health and psychosocial considerations during the COVID-19 outbreak. Geneva. World Health Organisation, 2020.

[9] Coronavirus (COVID-19): Mental health support for employees. 2021. https://www.cipd.co.uk/knowledge/culture/well-being/supporting-mental-health-workplace-return#gref

At the same time, they have difficulties finding a new job due to their health condition. As a result, the financial stability and socio-economic status of employees are undermined [23, 38, 39].

The psychological consequence of a coronavirus infection is absenteeism [36, 37, 40]. According to Direct Health Solutions (DHS), up to 50% of Australian workers experience increased levels of anxiety and stress when returning to the workplace, which leads to a sharp increase in absenteeism in some industries[10].

The absenteeism leads not only to a loss of efficiency and productivity of an individual employee and an entire organization, but also to an additional financial burden [41].

At the same time, the high prevalence of presenteeism, especially among medical professionals, also affects labor efficiency.

A study conducted in China among nurses revealed an almost 100% prevalence of presenteeism, manifested by a decrease in job satisfaction, professional burnout, decreased productivity and an increase in the financial burden of medical organizations [42].

In the post-COVID period, the quality of life (Quality of Life) decreases in patients due to multi-organ and/or multi-system manifestations of post-COVID syndrome, covering various aspects of life: physical health, psychosocial well-being, functional independence, financial situation and the state of the environment [43].

The decline in the quality of life of patients who have undergone COVID-19 makes it difficult to return to work and maintain their ability to work in the profession.

Return to work. Examination of professional suitability. In the context of a pandemic, the problem of safe return to work is important for workers. We believe that the most rational approach is a personalized approach that takes into account the general state of health, the type and intensity of symptoms of post-COVID, concomitant diseases, as well as working conditions. For example, an employee engaged in harmful working conditions in the fire department needs more time to recover [44].

Physical labor workers need to assess their fitness to perform official duties after suffering COVID-19, especially in the presence of residual functional disorders of the respiratory and/or cardiovascular systems [37].

In foreign practice, during the solving issues of professional aptitude examination experts take into account the following indicators: occupational risk of infection with SARS-CoV-2, vaccination status, psychosocial and economic factors, subjective assessment by an employee of his health and the possibility of returning to work, objective information about work capacity and workload (taking into account the *Work Ability Index)* in the form of a level functional stress of the central nervous system and resistance of the employee's body [45], support of the employer [44, 46, 47], ensuring the adaptation of working conditions to the capabilities of the employee[11].

Unfortunately, even with a gradual return to work, adaptation of working conditions or transition to remote work, it is not always possible to achieve a positive result. Patients report difficulty in continuing to work with the same efficiency, psychological problems, and relapses of post-COVID symptoms after going to work [48].

The need for remote work that has arisen is possible for certain professions (computer systems, law, architecture, management, etc.) or has limited opportunities for others (catering, education, healthcare).

Nevertheless, sectors such as education, services or healthcare have adapted their ways of working in the context of the spread of COVID-19, and Remote Workers have retained their jobs and productivity with the help of modern technologies [49, 50].

Currently, we consider the possibilities of adapting the workload to an isolated environment during remote work in order to preserve, first of all, the mental health of employees, their productivity and well-being [51, 52].

There are recommendations for maintaining the productivity of working from home [53].

Experts suggest the formation of a comfortable online working environment, the creation of workplace network structures and resources available to employees through social connections with colleagues [54].

During the pandemic, temporary and low-paid workers deserve attention in connection with the possible recovery of the economy and their return to their jobs [55]. The impact of COVID-19 on the labor market is felt more strongly among working women, as well as among those employed in temporary and low-paid jobs[12].

Problems arising in connection with changes in work related to COVID-19 require occupational health and safety specialists to conduct a proactive large-scale analysis of the work plan (design), risk analysis, laws, instructional and best practices to ensure the protection of workers' health in the future [56], development and implementation of measures to promote involvement in work by strengthening the autonomy of employees in the workplace [57].

One of the debated problems during the COVID-19 pandemic is the return to work of medical workers after infection with SARS-CoV-2. The most pragmatic approach may be to use a combination of serological testing and cessation of clinical symptoms. This will allow health workers to return to work, protect colleagues and patients, especially the most vulnerable of them, as well as limit staff turnover during a pandemic [58].

Experts are discussing the issue of returning to work after a coronavirus infection in connection with the emerging social stigma against Covid-19, which leads to patients hiding their positive tests, and for the healthcare system — to delays in treatment and an increase in the spread of the virus.

With insufficient health education, bias spreads against people who have been cured of COVID-19, even against medical workers. This makes it necessary to provide both the employee and the employer with information to combat this stigma [59].

In Russia, in order to resolve the issue of admission to work of a person who has been ill with COVID-19, it is necessary to conduct an examination of the professional suitability of an employee, taking into account the results of mandatory medical examination in accordance with

[10] Managing absenteeism during a pandemic. White Paper. URL: https://www.dhs.net.au/news/managing-absenteeism-during-a-pandemic

[11] FOM Guidance. Guidance for healthcare professionals on return to work for patients with long-COVID. URL: https://www.fom.ac.uk/wp-content/uploads/longCOVID_guidance_04_small.pdf

[12] Statistics Canada. (2020e) Labor Force Survey, June 2020: context: COVID-19 restrictions gradually ease. The Daily; 10 July 2020.

regulatory legal documents[13, 14]. The Medical Commission of a medical organization makes one of the following decisions on the recognition of an employee: "fit — temporarily unfit — permanently unfit" according to health conditions for performing certain types of work.

When determining temporary unsuitability, it is necessary to indicate the rationale for this decision and the timing of temporary unsuitability with recommendations for additional studies: consultations of specialist doctors and (or) appropriate treatment.

The employer may refer an employee after disability due to the transferred COVID-19 for an extraordinary medical examination[15], followed by a check on professional suitability.

Occupational risk of post-COVID syndrome. Examination of the connection of the disease with the profession. The problem of occupational risk of post-COVID syndrome remains one of the many unresolved health problems and there is insufficient data on this issue today.

The conducted studies reveal a high prevalence (from 45% to 71%) of post-COVID syndrome in medical workers [60, 61]. It is not uncommon for those who have had mild COVID-19 to have debilitating symptoms that interfere with work and other aspects of daily life for several months [62].

Among non-medical professions, the zone of possible risk includes workers who are in close contact with a large number of people during a shift and/or are in an unfavorable production climate: social workers, transport workers, trade workers, meat and poultry processing enterprises, slaughterhouses, emergency services and security services [46].

The severity of the post-COVID syndrome increases under the influence of adverse production factors, such as aerosols, chemicals that provoke respiratory disorders and delayed regression of the pathological process in the lungs. At the same time, the frequency and severity of post-COVID syndrome manifestations are closely related to the length of work experience in unfavorable working conditions [63]. In occupational risk groups of COVID-19 infection, there is a need to establish a causal relationship between the disease and the profession.

In a number of foreign countries: Belgium, Italy, Germany, South Africa, Canada, experts considered COVID-19 as a consequence of the professional impact of SARS-CoV-2 on the body [64]. Today, experts consider Covid-19 as a new occupational disease that entitles employees to compensation. Experts suggest recognizing this all over the world [65].

In Russia specialists conduct an examination of the connection of covid-19 with the profession, taking into account the principles of diagnosis of occupational infectious diseases and relevant regulatory documents. However, in modern conditions, when determining the connection of COVID-19 with the profession, difficulties arise in assessing the epidemiological history, identifying the consequences of a coronavirus infection, and formulating a diagnosis.

For a qualitative examination of the COVID-19 connection with the profession, it is necessary to develop a list of clinical conditions that can be considered as complications of a previous infection, and to determine the timing of their formation [7].

Post-COVID syndrome and medical rehabilitation. COVID-19 coronavirus infection is a new problem for the rehabilitation service, which required a change in the format of work due to an increase in workload due to the appearance of a special contingent — patients who have undergone COVID-19 [66].

According to forecasts, a significant surge in demand for care and rehabilitation during the recovery period will occur following a surge in hospitalizations of patients with COVID-19 [67]. Evidence that patients who have undergone COVID-19 have long-term consequences after the acute phase of infection, regardless of the severity of the disease or the duration of hospitalization, increases the need for rehabilitation services worldwide [68].

Due to the diversity of the post-ovoid symptom complex, it is relevant to create multidisciplinary individual rehabilitation programs with an emphasis on physical, psychological and psychiatric aspects of rehabilitation [69].

In the context of the spread of a new coronavirus infection, it is important to concentrate efforts on the proactive restoration of patients' health, the widespread use of telecommunications technologies, and telerehabilitation programs.

Experts recommend starting medical rehabilitation of patients with coronavirus pneumonia in intensive care units when the patient's condition is stabilized and continuing after completion of treatment in a hospital, also at home[16] [16, 70–72].

Conclusion. *The currently known features of the development and course of a new coronavirus infection (long-term symptomatic and post-COVID syndromes)[17], the formation of severe forms of the disease in risk groups (elderly patients, persons with comorbid diseases), polymorbidity of post-COVID syndrome (long-term pathological manifestations persisting for three months or more after infection) allow us to assess the prognosis COVID-19. This, in turn, creates prerequisites for the scientific justification of therapeutic and preventive measures based on the accumulated knowledge about the new coronavirus infection.*

Before the COVID-19 pandemic, there was the concept of healthy aging[18] in the world as a process of developing and maintaining the functional abilities of elderly workers. Pension reform in various countries and in Russia has consolidated the longevity of the working population. However, the pandemic may raise the question of the possibilities of creating a new concept

[13] Federal Law No. 323-FZ of 21.11.2011 (as amended on 01.04.2020) "On the basics of protecting the health of citizens in the Russian Federation" (with amendments and additions. introduction. effective from 12.04.2020)

[14] Order of the Ministry of Health of the Russian Federation No. 282 dated May 05, 2016 "On Approval of the Procedure for Conducting an Examination of professional Suitability or Unfitness to perform certain types of work"

[15] Order of the Ministry of Health of the Russian Federation No. 29n dated 28.01.2021 "On Approval of the Procedure for Conducting Mandatory Preliminary and Periodic Medical Examinations of Employees Provided for in Part Four of Article 213 of the Labor Code of the Russian Federation, the List of Medical Contraindications to Work with Harmful and(or) Dangerous Production Factors, as well as works in which mandatory preliminary and periodic medical examinations are carried out inspections" (section III Procedure for periodic inspections, paragraph 19).

[16] Temporary guidelines of the Ministry of Health of Russia "Medical rehabilitation in case of a new coronavirus infection (COVID-19)". Version 2 (31.07.2020)

[17] COVID-19 rapid guideline: managing the long-term effects of COVID-19 NICE guideline Published: 18 December 2020 www.nice.org.uk/guidance/ng188

[18] WHO. (2015.) World report on aging and health. Geneva, Switzeland: World Health Organization.Retrieved from http://www. who. int/aging publications

of healthy aging, since older workers who have been ill with COVID-19 may not return to work after the pandemic.

The new coronavirus infection makes a significant contribution to the formation of premature aging of citizens of various age groups. The risk of death from coronavirus increases depending on age: the course of the disease becomes more severe with age.

In the post-COVID period, previously healthy people develop diseases characteristic of old age, in particular, cardiovascular diseases, diabetes mellitus, mental disorders. In this regard, the prevention of premature aging of workers of various age groups, the development and implementation of a concept of healthy aging adapted to new conditions are becoming relevant.

The COVID-19 pandemic has posed unprecedented challenges and demands to specialists in both practical healthcare and occupational health services, which requires the search and development of new effective ways of interdisciplinary work and continuous cooperation.

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