SEVERITY OF COVID INFECTION AND FEATURES OF LIFESTYLE, WORK ACTIVITIES AND COMORBID BACKGROUND IN PATIENTS IN ARCTIC CLIMATE CONDITIONS

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Abstract

When large outbreaks of infection occur, it is always necessary to identify risk groups. A formal approach to identifying and isolating these groups can cause a number of economic and social problems. The aim of our study was to determine the degree to which comorbid conditions, lifestyle, and work activities of patients influence the severity of COVID-19. A total of 136 respondents were surveyed in the Murmansk Region who had recovered from COVID-19 before vaccination. The survey questions covered both the patient's health and lifestyle (sleep duration, physical activity, smoking status, stress level), as well as work conditions (presence of confirmed hazardous conditions). It was shown that, along with well-known factors such as blood type, age, gender, and chronic diseases (diabetes, hypertension, asthma, etc.), lifestyle, specifically physical activity and sleep duration, can also influence the severity of COVID-19. The frequency of acute respiratory viral infections (ARVI) in each individual patient is also an important factor. For the first time, it has been shown that low sleep duration increases the severity of COVID-19 infection. No effects of smoking, hazardous working conditions, the use of immunotropic medications, or adherence to anti-epidemic measures were found. The study results can be used to identify risk groups and develop measures to prevent the spread of coronavirus infection.

Keywords : Coronaviruses, pandemic, comorbid background, disease prevention

I. Introduction

Coronavirus pandemic COVID -19 has affected nearly every person on the planet and caused significant economic damage in many countries. Major difficulties were associated with the introduction of quarantine measures, which were often imposed only on formal grounds (age, presence of diagnosed chronic diseases).

Coronavirus infections were first described as animal diseases that were not dangerous to humans [8, 14, 16, 23, 25]. The mortality rate of such infections was, in some cases, extremely high. For example, in 1949, a mouse hepatitis virus affecting the gastrointestinal tract was described; death occurred in 80-100% of cases in both domestic and wild animals [2, 6].

In 1965, when in Great Britain, using organ culture of the embryonic trachea to isolate

viruses from the oropharyngeal swabs of patients with acute respiratory infections, the strain of the first human coronavirus (HCov - Hum a n c o r o n a virus), "B814", according to the name of its marking [18]. In 1966, the results of isolation of strain 229 E from a person with ARVI were published in Chicago [10]. In 1967, a large series of strains safe for humans were isolated, designated as OC 1, OC 2, OC43 , etc. [3, 14]. In 1968, a taxonomic proposal was published in the journal Nature to combine IBV , MHV , B 814, 229 E , OC 43 into the group "coronaviruses" due to the characteristic morphology of the virions - a jagged (crown-shaped) frame of round pleiomorphic particles [3,25]. In 1976, coronaviruses received the status of a family. Until recently, they were veterinary pathogens, harmless to humans. In 2002, the severe acute respiratory syndrome virus (*SARS-CoV) was recognized as the etiologic factor of the epidemic in China [1, 23]* . Human infection originated from Himalayan civets [25]. Further study of the ecology of the virus established that it is a natural focal agent, the reservoir being bats, which excreted the virus with biological fluids, infecting small mammals used for food and everyday life in Southeast Asia [13]. In 2004, human coronavirus NL 63 was described in the Netherlands [19]. In 2005, a new coronavirus (Betacoronavirus) was detected in Hong Kong in a patient with acute respiratory infection and bilateral pneumonia *[20] . In 2012 , an outbreak of* MERS - Cov caused by a modified virus was registered in the city of Jeddah , Saudi Arabia [24].

COVID -19 pandemic began in late 2019. The first case was registered in Wuhan, China, on December 8, 2019 [15]. On January 3, 2020, the WHO reported 44 cases, and on January 7, 2020, the causative agent of the infection was identified as a representative of *Coronaviridae* , naming the new disease COVID -19 [21]. On January 30, 2020, the epidemic outbreak in Hubei Province was declared an international problem, and the overall mortality rate worldwide was about 2-3%. On March 11, 2020, the WHO officially declared the start of the COVID -19 pandemic [23].

Back in 2003-2004, Hong Kong virologists Donnelly CA, Hedley AJ, Zou Z., Yang Y., Chan JW, Leung G. et al. proved that **age, gender** , concomitant pathologies and genetic characteristics influence the course and outcome of coronavirus infections [7].

During the current pandemic, scientists have confirmed that a predisposition to complications and high mortality from COVID -19 are observed in elderly individuals with comorbidities and immunodeficiencies [11, 12]. They have a significantly higher risk of severe disease and death. Mortality in women is 1.5 times lower than in men due to immune system differences, hormonal factors, and high immune cell activity. The mortality rate for patients with diabetes, cardiovascular disease, and lung disease was 46%, compared to 11% in individuals without comorbidities [5, 22].

The ethnicity of patients is also significant. African and African-American populations have proven to be the most susceptible to coronavirus infection. ACE2 polymorphisms are directly linked to cardiovascular and lung pathologies, altering the interaction between angiotensinogen and ACE2 [9].

There is also evidence that the risk of death from SARS-C o V-2 in Africans is higher than in Europeans and Asians due to the specificity of the genotype [9, 17].

In the Arctic climate, self-discipline and disease prevention are particularly important. The Murmansk Region is home to mining and processing industries, where working conditions are often considered harsh and harmful to human health. Working on fishing and transport vessels is also extremely difficult. Therefore, we have focused on the development of COVID-19 among workers in various professions.

II . Materials and methods

The aim of this study was to identify the degree of combined influence of comorbid background, lifestyle and work characteristics of patients on the severity of COVID-19 infection **.**

To achieve this goal, the following tasks were set:

- to identify the factors that have the most significant impact on the severity of coronavirus infection

- justify the need for a differentiated approach to the isolation of citizens and other measures to prevent the spread of COVID -19

The study was conducted by surveying citizens who had recovered from COVID - 19 before vaccination. Respondents were selected from among Murmansk Arctic State University employees and their family members. Potential respondents were contacted through the heads of the university's departments. The survey was anonymous, and each respondent was assigned a number. A total of 136 people participated in the survey. Respondents were aged 18 to 75 years and residing in the Murmansk region. Respondents completed a questionnaire covering their history of COVID-19, chronic illnesses, lifestyle factors (physical activity, sleep duration, stress levels, and bad habits), as well as the use of immunotropic medications, seasonal flu vaccination, compliance with anti-epidemic measures, and travel to other regions.

The survey results were processed using the Excel program , traditional methods of primary statistical processing were used, average values of parameters were calculated, and the value of the correlation coefficient between values was calculated.

The study was approved by the ethics committee.

III . Results and their discussion

The survey results are presented in Table 1. An analysis of the relationship between age and COVID-19 severity showed that age is a very important factor. Most patients with mild COVID -19 were under 45 years of age (Table 1).

Table 1. ***Survey results***

Age , full years			
Gradation factors	Respondents with asymptomatic course of the disease, %	Respondents with moderate disease severity (fever, cough), %	Respondents with a severe form of the disease (long-term hospitalization, artificial ventilation), %
6:30 PM	64	7	0
31-45	26	38	4
46-55	2	25	26
56-65	0	20	43
66-75	0	8	12
More than 75	0	2	15

Group blood			
I	31	19	23
II	26	46	49
III	26	26	17
IV	17	9	11
Frequency of acute respiratory viral infections over the past 2 years			
0-1	43	19	0
2-3	38	34	7
4-5	19	29	43
6 or more	0	18	50
Stress level, points based on respondents' subjective assessment			
0-2	0	5	32
3-5	14	47	57
6-7	50	38	11
8-10	36	10	0
Level of physical activity, points based on respondents' subjective assessment			
0-2	14	21	2
3-5	60	42	18
6-7	20	30	32
8-10	6	7	48
Sleep duration			
Less than 4 hours	2	10	18
4-5 hours	18	21	59
6-7 hours	42	49	18
More than 7 hours	38	20	5
Comorbid background			
Arterial hypertension	6	23	64
Respiratory diseases	2	8	25
Diabetes mellitus	0	5	39
Varicose veins	0	3	9
Osteochondrosis	4	8	23
Gastrointestinal diseases	12	25	41
Skin diseases	0	5	5
Ischemic heart disease	0	8	25
Oncological diseases (in remission)	0	0	9
Not specified diseases	82	0	3
Overweight			
Normal weight	82	57	34
Overweight	6	38	14
Obesity	0	5	52

Source : data obtained by the authors during the study.

As expected, the largest number of patients with severe and moderate forms of coronavirus infection had blood type A , while those with blood type AB were less common. However, among patients with severe forms of the disease, there were respondents with all four blood types, suggesting that blood type is difficult to pinpoint as a decisive factor. The proportion of respondents with blood types I and III among those with severe forms of the disease was also quite significant.

It is clear that patients who have had more than six acute respiratory viral infections in the last two years have an increased risk of developing a severe form of COVID -19, which is likely due to a weakened immune system and damage to the airways and lungs during the development of these diseases.

Physical activity also significantly influences the severity of the infection: respondents who rate their physical activity level as low experience a more severe course of the coronavirus infection. Patients with high stress levels also often experience a more severe course of the disease.

Sleep duration is also significant among respondents. Patients with severe forms of the disease experience a significant proportion of sleep deprivation.

However, it should be emphasized that our survey did not confirm a correlation between the clinical presentation of coronavirus infection and adherence to sanitary and epidemiological norms and regulations, occupational risks, the number of trips to other climate zones, living conditions, smoking, or the use of immunotropic medications. Of the 136 respondents, 121 adhered to sanitary and epidemiological regulations to varying degrees; immunotropic medications (immunoglobulins, immunomodulators) were taken by 51 people across all three groups.

Among patients who experienced severe COVID -19, comorbidities were 69.5% more common than among those who experienced moderate COVID-19 and 95% more common than among those who experienced mild COVID-19. Patients who experienced mild COVID -19 had virtually no comorbidities.

87% of survey participants who experienced mild or asymptomatic coronavirus infection had no underlying medical conditions. Serious illnesses such as diabetes, coronary heart disease, and cancer were not common among respondents in this group.

Respondents who had experienced moderate COVID -19 infection had a greater comorbidity profile than those in the previous group. Gastrointestinal diseases, respiratory pathologies, and hypertension were more common.

In this group of respondents, almost no individuals without comorbidities were identified. The most common conditions were hypertension, coronary heart disease, gastrointestinal diseases, diabetes, and cancer in remission.

It is noteworthy that excess weight was present in the majority of those who had suffered severe forms of COVID -19, while it was virtually nonexistent among those who had suffered mild forms.

The results obtained generally correspond to a well-known pattern: genetic factors (blood type) and a history of chronic diseases, some of which may also be hereditary, are the most important factors determining the severity of COVID-19 infection [5, 22]. This suggests that harsh climates do not significantly affect the course of the disease. The patient's immune status, in particular the frequency of acute respiratory viral infections over the past two years, is also significant [11, 12]. Our research shows that the frequency of acute respiratory infections and the lifestyle of each respondent also play a significant role. A decrease in

immune status is one of the decisive factors determining the severity of not only COVID -19 but also other infections [4]. However, identifying cause-and-effect relationships is difficult, as low levels of physical activity do not always indicate laziness and an unwillingness to pay attention to one's health and disease prevention. Perhaps patients with high comorbidities have various contraindications to physical activity or experience severe pain from exercise. Furthermore, the introduction of self-isolation did not promote increased physical activity, but rather decreased it. The impact of stress levels is also of interest: it is impossible to unequivocally assess this effect, as it is clear that people with high comorbidities who experienced severe COVID-19 infection try to avoid stress in their daily lives to prevent exacerbation. Respondents without chronic illnesses, however, are more active professionally and socially, and therefore experience stress more often. Furthermore, it is important to understand that the stress level assessment was based solely on respondents' self-reported responses. As is well known, most people tend to attribute stress only to emerging conflict situations and overwork, while ignoring other types of stress, such as temperature. Contrary to our expectations, we were unable to identify any significant patterns between the course of the disease and working conditions. This result may be due to the fact that respondents with severe cases of the disease usually have multiple chronic diseases, so they cannot be hired for jobs with hazardous working conditions.

When assessing the risk of infectious disease spread, factors that are weakly related to a person's individuality and their attitude towards their health are typically considered, with only formalized parameters such as gender, age, and the presence of diagnosed chronic diseases being considered. This approach results in the unjustified isolation of some individuals and an unjustified lack of restrictions for others. In particular, even the pattern of the influence of blood type on the severity of the disease, established at the very beginning of the pandemic [7], was not reflected in the regulations governing isolation. Also, the transfer of young pregnant women to remote work was not provided for when such measures were introduced for individuals over 65 years of age, while the scientific literature does not provide convincing arguments that pregnant women are not at risk. Measures to prevent the spread of coronavirus infection have also provoked a host of negative reactions from citizens. Our results support the opinion that the decisive factor is not the presence of a specific chronic disease in the patient's medical history, but rather the combination of multiple diseases in the patient [5, 11, 12, 22]. Table 1 highlights the fact that the sum of the percentages of respondents with a specific illness among those with severe cases of the infection significantly exceeds 100%, indicating that these patients had multiple chronic conditions. Therefore, timely diagnosis of illnesses for personalized, rather than formal, risk assessment is an important measure for preventing the spread of infection. Underestimating the impact of respiratory infections suffered prior to the pandemic could also have contributed to the severe course of the coronavirus infection and the development of multiple complications. The lack of correlation between respondents' compliance with the measures prescribed for preventing the spread of infection and the severity of the disease is also noteworthy.

Most companies used a formal approach to determining which categories of employees were required to switch to remote work, as they belonged to specific risk groups. The procedure for self-isolation for certain categories of workers was determined by non-medical personnel, and not by the heads of organizations, departments, or HR departments. Justifying the need to switch to remote work inevitably led to a breach of medical confidentiality, as information about employees' chronic illnesses became known to individuals not authorized to access this information.

In our view, a more nuanced approach to isolation orders and other preventative measures is warranted: the rationale for the need for isolation can be formulated by a local

physician based on available information about the patient's health status and combination of past and chronic illnesses. This would allow for the timely isolation of those who truly need it and, conversely, avoid the unjustified isolation of individuals not in risk groups and the resulting decline in the company's production performance.

Furthermore, many citizens value the importance of their own actions in preventing the spread of disease: by increasing physical activity, paying attention to sleep duration, and taking measures to normalize weight, citizens would not only reduce the likelihood of developing a severe illness but also achieve health benefits.

Thus, the results of our research confirm the need for a differentiated approach to determining preventive measures and can be used to develop ways to reduce the negative consequences of the spread of infectious diseases.

V. Conclusion

The results of the study allow us to draw the following conclusions:

1. Based on our survey, the most important risk factors for developing a severe form of COVID -19 were: age over 55 years, the presence of comorbidities, excess weight, physical inactivity, low sleep duration, and frequent acute respiratory viral infections (more than six times in the past two years).

2. Taking immunotropic medications (immunoglobulins, immunomodulators), compliance with sanitary and epidemiological rules, influenza vaccination, the number of trips to other climatic zones in the past two years, occupational risks, dietary habits, smoking, and living conditions did not have a significant impact on the severity and course of coronavirus infection in respondents.

To identify risk groups and plan preventive measures to prevent coronavirus infection, it would be advisable to consider the frequency of acute respiratory viral infections in addition to age and chronic illnesses. Data on colds is available at healthcare facilities, and using an electronic database, risk groups can be identified quickly and with minimal effort. This would allow for a more nuanced approach to quarantine decision-making: isolating those at higher risk and allowing the free movement of those who rarely suffer from respiratory infections.

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