REVIEWS

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Mental Health of Population in the COVID-19 Pandemic: Trends, Consequences, Factors, and Risk Groups

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Abstract. The purpose of the study is to analyze the mental health losses of population during the COVID-19 pandemic. Based on the systematization of foreign and Russian studies regarding the pandemic impact on mental health, two major burdens (neuro-psychiatric and psycho-emotional) and three levels of ill health manifestations (physiological, mental, and behavioral disorders) were revealed. We used the method of analyzing articles from international electronic databases on the topic of mental health loss due to the new coronavirus pandemic and other epidemics. The scientific novelty of the study consists of the identification of psycho-emotional and psycho-neurological burden of the pandemic, determination of a three-level structure of mental ill health manifestations, and a comprehensive approach to the analysis of losses (includes the characterization of emerging mental health disorders, risk factors and groups, as well as the search for its prevention areas). We achieved the following results: neuropsychiatric burden is manifested in damages to the central and peripheral nervous system, neuropsychiatric and cerebrovascular complications, and changes of mental status due to the neurotoxic effects of the SARS CoV-2 virus. The psycho-emotional burden of the COVID-19 pandemic reveals itself physiologically – in somatic reactions to a stressful situation. At the mental level, there is a debut or relapse of panic, anxiety, depressive disorders, adaptation disorders, and symptoms of post-traumatic stress disorder. The behavioral level is associated with an increase in cases of domestic violence, various addictions, suicidal and protective behavior, changes of food habits, etc. The authors conclude that most negative consequences

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are preventable. The practical significance of the research is to prepare a list of mental health disorders during the pandemic, groups, and risk factors for its loss. Findings about groups and risk factors will allow substantiating the structure of further sociological research. The results obtained (including a list of ways of reducing the burden) can be used by authorities in the development of programs to strengthen population's mental health, including high-risk groups. Their implementation will reduce the burden on the medical network, improve population's quality of life, preserve the labor potential and social stability of society necessary for the post-pandemic economic recovery, and prevent the psycho-emotional burden of future epidemics. Research perspectives are cross-country comparison of the psycho-emotional burden of the pandemic and its dependence on the anti-epidemic policies implemented by governments (introduction of strict self-isolation measures, lockdown, media activities, mandatory testing, etc.).

Key words: COVID-19 pandemic, mental health, psychoemotional burden, mental disorders, neuropsychiatric disorders, suicide, depression, anxiety, domestic violence, infodemic.

Introduction

2020 was a year devoted to the fight against the new coronavirus infection. Attempts to limit the SARS CoV-2 spread led to the introduction of severe restrictions on movement and social distance measures. Ultimately, the COVIND-19 pandemic seriously damaged human health, the healthcare system, and the economy.

Several scientists call a lockdown, which was introduced in many countries, a largest psychological [1, p. 46] (or psychosocial [2]) experiment, and they are only beginning to analyze its results.

Unclear, invisible threat of a previously unknown virus, combined with an inability to take clear active actions, increases fear and anxiety, can provoke the onset or relapse of anxiety, depressive, obsessive-compulsive, and other mental disorders, pathological addictions and suicide. Some authors even mention the risk of mass psychosis. The mechanisms of imitativeness and suggestibility, which are usually necessary for efficient regulation of social behavior, contribute to the triggering of psychoses while experiencing fear and distress in a large group [3]. RANS Academician, Dr. Sci. (Med.) I. Gundarov calls the current situation "social schizoid psychosis" in his numerous speeches in mass media. N. Solov'ova, speaking about mental disorders provoked by the pandemic, introduces the "coronavirus syndrome" term, which will affect up to 10% of population involved in the pandemic. In her opinion, the situation and its consequences are similar to those observed in Russia during the perestroika, since the causes of mental disorders are not specific traumas localized in time, but long-term neurotic experiences that go beyond ordinary experience, changes of social ties and life plans, instability and uncertainty of the future, as well as a large amount of unconstructive disturbing information in the media [4].

We need to learn more about the impact of COVID-19 on population's mental health to successfully counter current and future pandemics.

The purpose of the study is to analyze population's mental health losses due to the impact of the SARS CoV-2 virus and measures, taken to combat it, and to find ways to decrease them.

Research objectives:

1) consider the main components of psycho-emotional and neuropsychiatric burden of the COVID-19 pandemic;

2) identify predictors of negative psychological outcomes in the outbreak of a new coronavirus infection and the most vulnerable groups of people;

3) identify ways to reduce population's mental health losses due to the COVID-19 pandemic.

The object of the research is foreign and Russian scientific studies on mental health of population during epidemics and emergencies. **The subject** is human mental health during the COVID-19 pandemic.

Research methodology

The information was collected in the electronic databases PubMed, Elibrary, and Ciberleninka using the search terms "COVID-19", "mental health", "mental disorders", "neurology", "suicide", "depression", "anxiety", "stress", "risk factor" in English and Russian in different combinations. In total, more than four thousand foreign and more than a thousand Russian-language links were received. Most of them are theoretical explorations of various aspects of the studied problem. At the time of writing (late December 2020), the databases contained the results of 647 cross-sectional and two longitudinal studies on the negative impact of the COVID-19 pandemic, various epidemics, and emergencies on public mental health. To prepare the review, we studied 165 articles (in English, Chinese, Italian, German, French, and Indian).

Overall, we considered 74 studies on the impact of the pandemic on covid-positive patients (in the Russian Federation at the time of the review – only a few [5]), mentally ill people, medical professionals, students and other groups, as well as general population. 18 of them reflected case-control compared to the norm, while the rest had no control groups. Two retrospective studies were based on the analysis of several million electronic medical records.

Some results of these surveys are heterogeneous due to differences in locationsб timing, and the methods used (mostly anonymous online surveys, patients' self-reports). The collection of data on the psychoemotional state was conducted using the following methods: A.S. Zigmond and R.P. Snaith's The Hospital Anxiety and Depression Scale (HADS), General Anxiety Disorder Scale (GAD-7), Zung Self-Rating Depression Scale (SDS) and Anxiety Scale (SAS), Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI), Depression Anxiety Stress Scale (DASS21), Perceived Stress Scale (PSS), Stress Reaction Questionnaire (SRQ), Stanford Acute Stress Reaction Questionnaire (SASR), Patient Health Questionnaire (PHQ-9 and PHQ-4), Impact of Event Scale – Revised (IES-R), Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Social Support Rating Scale (SSRS), Symptom Check List (SCL-90-R). Most surveys are cross-sectional, and their results are preliminary, which means that they are supported by well-developed longitudinal studies [6]. Nevertheless, they deserve attention since they allow assessing the risks of the virus and the countermeasures for population's mental health.

We relied on the fact that the emergence of COVID-19 is similar to the outbreaks of closely related coronaviruses of 2003 acute respiratory syndrome (SARS or "atypical pneumonia") and 2012 Middle East respiratory syndrome (MERS). According to most scientists, we should expect similar emotional and behavioral reactions among population. We also analyzed articles reflecting psycho-emotional outcomes of other epidemics (Ebola, Spanish flu, swine flu, etc.) and emergency situations (natural disasters and terrorist attacks).

The main advantage of some prominent foreign journals, such as The Lancet Psychiatry, is the speed of the latest studies publishing (first online and then in print), which allows the whole world to timely learn its results that have not lost its relevance in a constantly changing pandemic. In this regard, a major part of the presented review includes foreign information sources.

The scientific novelty of the work is the author's understanding of the psycho-emotional burden of the pandemic and its structure, based on three levels of reactions/changes (physiological, mental, and

behavioral); generalization and structuring of foreign and domestic experience of studying a group of coronaviruses from the point of view of their psycho-neurological and psycho-emotional burden; a comprehensive approach to the analysis of the issue – a study of negative consequences (of the SARS CoV-2 virus and its containment measures), risk factors and groups, and areas for strengthening mental health.

The practical significance of the work is a list of violations of public mental health during the pandemic, groups, and risk factors for its loss. The conclusions will allow justifying the structure of further sociological research of this problem.

The results obtained (including a list of ways to reduce the burden) can be used by authorities for developing programs to promote health among population, including ones for high-risk groups (medical staff, citizens who have been ill with COVID-19, people with chronic diseases). The implementation of these programs will help to reduce the burden on the medical network, reduce several cases and duration of temporary and permanent disability, preserve the labor potential needed in the subsequent period of economic recovery and social stability in society. Everything aforementioned will lead to the reduction of the disease burden. Conclusions about groups and risk factors will allow justifying the structure of further sociological studies on this problem, planned by the Vologda Research Center of RAS for 2021.

Results of the research

Considering studies on various negative effects of a new coronavirus infection outbreak on population's mental health, we can divide the pandemic burden into two types: psycho-emotional and psycho-neurological. Neuropsychiatric burden of the COVID-19 pandemic implies the damage of the central nervous system caused by the neurotoxic SARS-CoV-2 virus. Psycho-emotional burden means psycho-emotional disorders caused by the virus itself and/or measures to contain it. Considering the fact that the psycho-emotional state is a set of changes occurring in a body and mind, including behavioral reactions to a situation, we will study manifestations of mental disorders at three levels: physiological, mental, and behavioral. Let us take a look at them in more detail.

The first level – physiological. This section includes not only "classic" bodily reactions to a stressful situation (increased heart rate, increased blood pressure, increased blood sugar, impaired appetite, sleep disorders, headache, body aches, endocrine disorders, etc.), but also psycho-neurological disorders that emerged due to the impact of the SARS CoV-2 virus, because they manifest themselves at the level of physiology and affect mental well-being.

It has long been known that an infection not associated with the central nervous system (CNS) can cause neuropsychiatric signs. The Spanish flu epidemic of 1918–1919 provoked a sharp increase in the incidence of post-encephalitic parkinsonism [7]. Coronaviruses, closely related to COVID-19, are biologically neurotropic, clinically neurotoxic, and they cause neurological disorders [8–10]. The new coronavirus infection, in addition to changes in lungs, leads to various lesions of all body systems[1] [11]: thrombotic complications, myocardial dysfunction (cardiomyopathy) and arrhythmia, acute coronary syndromes, acute kidney damage, gastrointestinal symptoms, hyperglycemia, ketosis, vasculitis, eye and skin damage, and neurological disorders.

However, a consequence of COVID-19 is of particular importance – cerebrovascular complications, i.e. acute disorders of cerebral circulation (strokes). They are observed during some acute

[1] Meeting the psychological needs of people recovering from severe coronavirus (Covid-19). *Official website of the British Psychological Society*. Available at: https://www.bps.org.uk/sites/www.bps.org.uk/files/Policy/Policy%20-%20Files/Meeting%20the%20psychological%20needs%20of%20people%20recovering%20from%20severe%20coronavirus.pdf (accessed: January 21, 2021).

severe viral diseases (for example, influenza [12; 13]). The main predictors of their development are arterial hypertension, diabetes mellitus, coronary heart disease, and diseases of the respiratory system [14; 15].

Another cause of brain damage during COVID-19 may be encephalopathy of various etiologies, which is also natural for viral infections [16; 17]. Cytokine storm is considered a mechanism of encephalopathy development in coronavirus [18; 19].

Several authors note a possible link between human coronaviruses and the development of multiple sclerosis [20; 21].

CNS lesions more often occur in the group of "severe" patients. Thus, according to a retrospective study in Wuhan, 36% of hospitalized patients had symptoms of CNS disorders, in the "severe" group – 45% [22]. Rogers found evidence of delirium (65%) and agitation (69%) among ICU patients. Every fifth resuscitation patient was diagnosed with altered consciousness (all of them subsequently died) [23].

A study, conducted by a group of scientists led by Varatharaj, of "severe" hospitalized Covid-positive patients in the UK revealed that 62% of them had a violation of cerebral circulation (mostly ischemic stroke – 3/4 of cases). A third of hospitalized patients had an altered mental status (23% of them – unspecified encephalopathy, 18% – encephalitis, remaining 59% – neuropsychiatric disorders). The vast majority of the latter (92%) were diagnosed for the first time (psychosis, neurocognitive syndrome, affective disorder) [24].

Moreover, SARs-CoV-2 virus can lead to lesions of the peripheral nervous system (twice as common in the mild course of the disease [15]). These include damages of olfactory nerves, which were also observed in the exposure to the related coronavirus SARS-CoV-1 [25].

Moreover, according to most researchers, loss of the sense of smell may be an only clinical manifestation of COVID-19[2] [26]. Data on taste changes [15] and oculomotor nerve damage among Covid-positive patients [27] are also interesting.

Patients who were experiencing Covid for two months or more have persisting physiological symptoms: weakness (53.1%), shortness of breath (43.2%), joint pain, muscle pain (27.3%), chest pain (21.7%), as well as cough, loss of smell, dry eyes and oral mucosa, runny nose, red eyes, taste disorders, headache, sweating, loss of appetite, sore throat, dizziness, diarrhea [28].

Thus, acute neuropsychiatric reactions of a body to the neurotoxic COVID-19 virus often lead to severe complications (post-Covid strokes, heart attacks, encephalopathy, etc.), somatogenic mental and neurotic disorders, disability and even death of a patient. Therefore, they reflect and expand the spectrum of the disease burden.

The second level – mental. The spread of the new coronavirus infection and the measures to contain it contribute to the emergence of anxiety and depressive disorders (panic disorder, generalized anxiety disorder, phobias, panic attacks), which constitute the group of the most common comorbidities in various epidemics and emergency situations [29].

Forced isolation has an extremely negative impact on people's mental well-being. Currently, there is more and more data on the increase in symptoms of distress during and after quarantine. Thus, S. Wang and colleagues revealed that 53.8% of people in forced isolation believe that their psychological state has seriously deteriorated [30].

Overall prevalence of anxiety symptoms among Chinese population during the pandemic, according to the results of a longitudinal study, was 35% (5% in 2019), depressive symptoms – 20% (3.6% in 2019), sleep disorders – 18% [31; 32].

[2] Loss of sense of smell as marker of COVID-19 infection. *Official website of the ENT UK.* Available at: https://www.entuk.org/sites/default/files/files/Loss of sense of smell as marker of COVID.pdf (accessed: January 29, 2021).

In the United States, there was the increase in a number of prescriptions for anxiolytic (anxiety-reducing) drugs (by 34%), antidepressants (by 19%), and sleeping pills (by 15%) in the first month of the pandemic[3].

In Italy, after a three-week lockdown, the population showed symptoms of post-traumatic stress disorder (PTSD; 37%), severe stress (22.8%), adaptation disorder (21.8%), anxiety (20.8%), depression (17.3%), and insomnia (7.3%) [28].

Every second resident of Britain and America experienced a significant level of anxiety at the end of March 2020[4].

The resulting mental disorders may be prolonged. Thus, every tenth person who was in the center of the SARS epidemic in 2003 met the diagnostic criteria for PTSD a year later [33; 34].

Based on a systematic analysis of the literature, it can be noted that, among population in China, the United Kingdom, the United States, Spain, Italy, India, Denmark, Turkey, Iran, and Nepal, relatively high rates of symptoms of anxiety (from 6 to 51%), depression (from 15 to 48%), post-traumatic stress disorder (from 7 to 54%), psychological distress (from 34 to 38%), and stress (from 8 to 82%) were recorded during the fight against the pandemic [35].

In Russia, several cross-sectional studies were conducted in 2020 to assess the psycho-emotional state of population. According to the results of one of them, clinical values of anxiety and depression were found among 9.3 and 6.1% of respondents, subclinical – in 12.6 and 15.1%, respectively [36].

According to the results of the study of the staff of the Scientific Center for Mental Health [37], 22.3% of respondents (among the residents of the capital – every third one [38, p. 116]) felt a need for psychological assistance. They have significantly higher levels of phobic reactions, somatization, and suicidal risk, but lower levels of stress-reducing coping strategies. Moreover, there is a statistically significant trend of the growth of depressive symptoms with the development of the COVID-19 pandemic (from 0.75 to 0.93 on the SCL-90R scale) [39]. At the same time, there is a negative dynamic of an ability to objectively assess what is happening and comfort oneself, which makes it difficult to resist stress [38, p.118]. The authors conclude that a prolonged pandemic will lead to an increase in ineffective ways to reduce psychopathological symptoms –aggressive behavior especially.

The third level – behavioral. At the initial stage, behavioral reactions to a stressful pandemic situation may include increased anxiety, inattention, slowness of action, frequent anger. Subsequently, an ability to solve problems, work fully, and critically perceive information decreases (which puts a person at risk of cyber fraud); defensive (avoidance) behavior [40], panic purchases, constant monitoring of news [41], smoking, alcohol abuse, aggressive behavior, gambling, suicidal thoughts and attempts, etc. occur [42]. Moreover, all these reactions appear not only during the pandemic: they become a "long-lasting" burden, stretching over years and even a person's entire life [43]. Let us overview the most dangerous types of destructive behavioral reactions during the COVID-19 pandemic.

Forced isolation, financial difficulties, and alcohol abuse are the causes of increased ***domestic violence***, which, in turn, entails a threat not only to physical, but also to mental health [44; 45, 46]. People in a confined space take their anxiety and irritation out on their loved ones – especially women, children, and elderly people.

[3] Luhby T. Anti-anxiety medication prescriptions up 34% since coronavirus. *CNN*. April 16, 2020. Available at: https://edition.cnn.com/2020/04/16/health/anti-anxiety-medication-us-demand-coronavirus/index.html (accessed: January 29.01.2021).

[4] Schwartz B.J. New Poll: COVID-19 Impacting Mental Well-Being: Americans Feeling Anxious, Especially for Loved Ones. *APA News*. March 25, 2020. Available at: https://www.psychiatry.org/newsroom/news-releases/new-poll-covid-19-impacting-mental-well-being-americans-feeling-anxious-especially-for-loved-ones-older-adults-are-less-anxious (accessed: January 21, 2021).

Thus, in the Chinese province of Hubei, a number of police calls during the quarantine have tripled. In France, only in the first week of quarantine, a number of domestic violence cases increased by a third; in the UK, a number of calls to the helpline of the organization for combating domestic violence grew up by a quarter [47]. In Australia, people were 75% more likely to score the query "what to do in a situation of domestic violence" in the Google search bar, in Brazil – by 50% [46]. In Denmark, Spain, and Cyprus, women also began to seek help more often[5]. According to the Ombudsman in the Russian Federation, a number of victims and cases of domestic violence increased by 2.5 times in April.

More data suggest that a correlation between mental illness and domestic violence exists [48; 49]. Nearly a quarter of people who committed family homicides had been in contact with psychiatric services for a year prior to the crime, and a third had psychiatric symptoms at the time of the crime [50]. This correlation is largely caused by an influence of alcohol and psychoactive substances (surfactants) [43], and it proves the urgent need for continuous provision of qualified support to mentally ill and potential victims of domestic violence – even during quarantine measures and self-isolation.

Continuing the topic of alcohol dependence, we add that, according to the team of scientists led by J. Rehm, at the first stage of the fight against COVID-19, the scenario of a decrease in the level of ***alcohol consumption*** due to the decrease in its physical and economic availability was more likely. However, in the United States, there was an increase in alcohol sales in February – March [51; 52], in June – more than 13% of respondents reported that they started or increased drug use to cope with stress or emotions associated with COVID-19, and among those under 24 years of age – every fourth, and in the age group of 25–44 years – every fifth [53].

[5] Nazarova N. Locked together. How victims of domestic violence live in quarantine. April 7, 2020. Available at: https://www.bbc.com/russian/features-52184701

Increased psychological distress on the background of financial difficulties, social isolation, and insecurity feeling, according to Rehm, can further exacerbate alcohol use and increase the associated harm in the medium- and long-term perspective [54; 55].

For example, a year after the SARS pandemic in China, nearly 5% of men and 15% of women reported increased alcohol consumption [56]. The risks are particularly high among medical workers. For those employees who were either quarantined or worked in the "red zone", the risk of alcohol disorders, was about 1.5 times higher than that of other hospital employees even three years after the "SARS" outbreak [57].

Any increase in alcohol consumption in the current situation will not only increase the usual burden of diseases associated with it [54; 55], but also strengthen the risks of contracting COVID-19 by weakening the immune system [58].

Despite a low mortality rate from the SARS-CoV-2 virus, fear of the outcome, stigma, and financial losses often cause people to suffer, and it leads to impulsive decisions [59]. The pandemic, being a chronic phenomenon with uncertain and persistent biopsychosocial consequences for several months, can contribute to the increased ***suicidal behavior*** [59; 60]. There is evidence of an increase in the suicide rate during the epidemics of bubonic plague [61], "Spanish flu" [62], "SARS" [63], Ebola [64]. Suicide cases are reported in China, India, Bangladesh, Italy, and the United States of America [65–68].

According to an online survey, conducted in the United States in late June, one of ten (10.7%) respondents seriously considered suicide in the last month. The share of such people is noticeably higher among those aged 18–24 (25.5%), people without education (30%), racial/ethnic minorities (15.1–18.6%), persons who provide free adult care (30.7%), and those who work (21.7%). Moreover,

only 22–24% of them had been observed by a specialist earlier for anxiety or depression, 44% – for PTSD [53].

Torales' review [69] reported increased self-harm thoughts among medical professionals working with COVID-19 [70].

A Pakistani study revealed 29 cases of suicide, 16 of which were directly related to COVID-19. The majority of suicides, according to the authors, occurred due to the economic downturn caused by the lockdown. Fear of infection was the second factor contributing to suicide [71].

A study conducted in Canada predicted an increase in unemployment in 2020–2021, which will lead to an increase in the number of suicides to the level of 11.6–14.0 cases per 100,000 people in 2020 and to 13.6 in 2021. As a result, 2114 "extra" suicides will occur in 2020–2021 [72].

These results show that suicide prevention in the context of COVID-19-related unemployment is a top priority. In addition, timely access to mental healthcare, financial support, and social/work support programs, as well as optimal treatment for mental disorders, are urgently needed.

Domestic studies on suicidal behavior are not so numerous. In April 2020, the staff of V.P. Serbsky National Medical Research Center for Psychiatry and Narcology conducted a comparative study on the frequency of suicides in five entities of the Russian Federation. It showed that the mortality suicide rate even decreased compared to the period in 2019. According to the authors, this was caused by "the mobilization of a body's internal reserves, aimed at preserving humanity as a biological species" [73, p.4].

The staff of the Mental Health Research Center revealed a statistically significant increase in the frequency of suicidal thoughts among Russians as the pandemic progressed (the frequency of serious intentions was noted among 4.5% of respondents in late March, and every tenth respondent mentioned it late June). The increase in the severity of suicidal thoughts lags behind the growth of depressive symptoms. Probably, suicidal ideas do not appear or increase immediately, but act as a delayed effect of stress [39, p. 12]. It is not explained by an "objective" threat of infection and fears for life, but it is experienced as an "indefinite" anxiety associated with measures to counteract the pandemic – restrictions of social interaction, loneliness, uncertainty [39].

According to E.B. Lyubov and his colleagues from the Moscow Research Institute of Psychiatry, we should expect "an increase in suicides in Russian regions with relatively low suicide rates. In recessive regions with chronic economic stagnation and depopulation, the "contribution of the Coronavirus", on the contrary, may not be that noticeable due to adaptation to stressful events ("if you have not lived richly, you will not have to get used to it"), low availability of medical care, and epidemiological records. Experts believe that mortality rates and suicide rates may remain increased for several years, and regional indicators may be increased only after an acute phase of the pandemic – especially in high-risk groups" [74, p. 36].

Suicide factors during the pandemic constitute two groups:

1. ***Psychological:*** social isolation, anxiety, fear and uncertainty (infection/infection of others/availability of specific treatment or vaccination in the near future), poor sleep quality and eating habits [75], previously diagnosed mental health problems, relapse of a disease due to violations of a treatment regime and restrictions on access to help, alcohol, and psychoactive substances use [76].

2. ***Social:*** financial crisis, unemployment, limited supplies of basic necessities, domestic violence, school closures, exposure to vulnerable groups (homeless/unemployed/children/elderly), COVID-19 diagnosis, hospitalization in COVID-19 intensive care units, burnout among frontline medical workers, death of family members, stigmatization and discrimination due to the

outbreak, restrictions on participation in religious meetings or visiting religious places, and the "infodemic" phenomenon [77–80].

Healthcare workers, elderly people, migrants, homeless, economically vulnerable, and people with pre-existing mental disorders, substance abuse, and a family history of suicide are at higher risk of suicide.

Another behavioral response to the COVID-19 problem may be ***"avoidance" or defensive behavior***. After the end of the quarantine period, many participants continue to behave in such a way to avoid its repetition. More than half of them avoid those who cough or sneeze, a quarter of them do not visit crowded places, and every fifth avoid all public places for a few weeks after the quarantine period [81]. For some, the return to normal life has been delayed for many months.

Several scientists call ***changes in habits*** another type of behavioral response to a pandemic situation. Thus, an Italian study revealed that a third of respondents had an increased appetite during the lockdown period, while 18%, on the contrary, had a reduced appetite. As a result, almost half of the study participants experienced weight gain. Nearly 3% of smokers quit smoking during this period, probably due to fear of an increased risk of respiratory distress and mortality from COVID-19 [82].

Thus, we summed up possible disorders of a body (physiological, including neuropsychiatric changes due to exposure to the virus), and the psyche (mental and behavioral) of a person, mostly caused by measures introduced to combat the pandemic, which characterize the damage to mental health caused by the COVID-19 pandemic.

Let us analyze ***the factors provoking adverse mental outcomes among some population groups***.

1. COVID-19 disease, according to the results of most studies, may provoke psychological instability [23; 83–88]. More severe symptoms are observed during acute illness, due to exposure to the virus itself and fear for one's life, loneliness, forced isolation, poor health: confusion (on average, 28% of patients), depressed mood (33%), anxiety (36%), memory impairment (34%), insomnia (42%) [23]. One study revealed that the level of post-traumatic stress symptoms (PTSD) among Covid-positive patients in the initial period of the disease was extremely high (96.2%) [89].

In the post-disease stage (after suffering from coronavirus infections, such as SARS and MERS), the symptoms are less pronounced, but they persist. Insomnia was identified among 12% of respondents, irritability – 13%, depressive or anxiety disorder – 15%, memory impairment and fatigue – 19%, traumatic memories – 30%, PTSD symptoms – every third respondent [23].

According to another retrospective analysis of more than 60 thousand electronic medical records of Covid-positive patients, conducted by M. Taquet and colleagues in 2020, the frequency of any psychiatric diagnosis after 0.5–3 months after a positive test for COVID-19 was 18% (a third of which was a first-time diagnosis). The most frequent one was anxiety disorder (especially adaptation disorder and generalized anxiety disorder, less often – panic and post-traumatic stress disorder) [84].

There is evidence that patients who have experienced COVID-19 in intensive care units have numerous neurological, cognitive, and psychological symptoms [90]. However, it should be noted that high rates of post-traumatic symptoms of anxiety and depression were also reported from clinically stable people discharged from the hospital after recovering from COVID-19 [91].

2. Psychiatric predictors. A medical history of mental disorder is a significant risk factor for relapse during the pandemic [92–95]. Individuals with pre-existing mental health problems have reported increased symptoms and decreased access to services and support since the beginning of the COVID-19 pandemic [68; 96–99].

Moreover, studies indicate that many people had undiagnosed diseases during the introduction of quarantine measures – including psychiatric ones [100]. Thus, during the lockdown period in the UK in March 2020, there was a 50% decrease in referrals for mental health problems compared to the expected demand. In turn, diagnostic delays among patients, for example, with depression can cause increased mortality, including suicides [101].

The reasons for the vulnerability of a group of mentally ill people during a pandemic may be as follows: (1) such people are more susceptible to emotional responses due to their high stress sensitivity compared to general population; (2) neurotoxic SARS-CoV-2 virus can cause a violation of the stress system regulation [102]; (3) mental disorders (especially attention deficit hyperactivity disorder, bipolar disorder, depression, and schizophrenia [103]) may increase the risk of SARS-CoV-2 infection [68; 104–109] (by 1.6 times [84]), pneumonia [68], and death [110; 111] (2–3 times more often [112]); (4) physical distancing reduces the availability of many types of drug, family, social, and psychiatric support [68; 98; 113; 114]; (5) serious functional disorders prevent access to medical care and compliance with a doctor's instructions [115; 116]; even a patient with depression is about three times more likely to not follow the treatment recommendations [117]; (6) inpatient psychiatric facilities are often outdated; (7) resources are diverted from patients with chronic diseases (including mental disorders) to fight COVID-19; (8) most primary care physicians in COVID-19 are not able to work with neurocognitive and mental disorders.

Patients with dementia, Alzheimer's disease, people in a suicidal crisis, patients with obsessive-compulsive disorder [33], panic attacks and other anxiety disorders, eating disorders [118], and autism spectrum disorders [119; 120; 121] are *especially vulnerable in the group of mentally ill patients*.

3. Professional and labor risk factors. Work on the front line, especially in medical institutions, closely to sick people is the main risk factor for psycho-emotional problems during a pandemic. The so-called frontline health workers can be affected by the fear of infection, lack of protective equipment, death of patients and colleagues, understaffing, need to make extremely difficult decisions, including ethical ones [122], separation from families, loneliness, and physical fatigue.

They experience great stigmatization, feelings of helplessness, guilt, loneliness, fear, anger, exhaustion, detachment, anxiety, irritability, insomnia, poor concentration and indecision, poor productivity, and unwillingness to work. In the future, they are more likely to exhibit "avoidance" behavior [122; 123].

Most studies on the mental health of medical workers during previous pandemics also show an increase in their distress, depression, anxiety, and post-traumatic stress[6] [124–127].

According to the results of a Chinese study, during the COVID-19 pandemic, symptoms of anxiety disorder were detected among 36% of medical workers, depressive disorder – 20%, poor sleep – 24% [32]. According to the results of another study, the prevalence of depression and anxiety is even higher (51 and 45%, respectively), insomnia – 36%, and stress-related symptoms – 74% [128]. These symptoms were more common among female junior medical employees directly involved in the diagnosis and treatment of COVID-19 [129].

In general, according to various studies, 9–51% of medical professionals experienced symptoms of depression, anxiety – 15–45%, sleep disorders – 8–36%, excessive stress exposure – 7–72%,

[6] Murphy J., Spikol E., McBride O., et al. The psychological well-being of frontline workers in the United Kingdom during the COVID-19 pandemic: first and second wave findings from the COVID-19 Psychological Research Consortium (C19PRC) Study. *PsyArXic Preprints*. Available at: https://psyarxiv.com/dcynw/ (accessed: January 29, 2021).

PTSD – 8–50%[7]. Even three years after the SARS outbreak, this group still had symptoms of post-traumatic stress [57], depression, and alcohol dependence [130].

However, three studies did not reveal an increase in mental disorders among healthcare professionals due to COVID-19 compared to general population[8] [131].

Several scientists believe that the increase in distress among doctors amid the pandemic may be temporary, not pathological. Distress can be normalized through peer support, Schwartz rounds, and active monitoring, rather than formal psychiatric interventions [132]. These findings were repeated in 2020 in Wuhan, where health professionals reported the need for adequate rest and personal protective equipment, rather than mental health interventions [124]. Studies have shown that full breaks for food and sleep affect mental well-being more than a number of hours worked [133].

Other risk factors for health workers include lack of social support and communication, maladaptive coping strategies, and insufficient training [129]. In turn, negative emotions experienced by staff treating infected patients are assessed by them as trigger events that lead to errors and delays in providing care to patients [134], which also increases the burden of COVID-19.

4. Financial and economic prerequisites. The loss of financial stability during the pandemic due to self-isolation and quarantine creates serious socio-economic prerequisites for the development of psychological disorders symptoms, anger, and anxiety not only during this period, but also after a few months [71; 135–139].

Thus, in Russia, according to several public opinion polls conducted in late June by various organizations, economic problems are extremely urgent. Nearly 84% of respondents were concerned about the pandemic-related economic crisis[9]. Seven out of ten respondents assessed the threat of a pandemic as significant for the Russian economy, and for their personal financial situation – more than 40%[10]. 42% of respondents noted the deterioration of their family's financial situation over the past three months, with one of three forced to borrow, and one in five – to take out loans. A third of respondents reported wage cuts, and a quarter – layoffs[11]. Population's expectations are quite pessimistic (63% expect further deterioration of the financial situation). More than half are convinced that the state is taking insufficient measures to provide material support to the population in the current situation[12].

The importance of the economic factor is also discussed in foreign studies. For example, among those who lost their jobs and income in the United States, more than half reported anxiety or stress; people with lower incomes were more likely to report serious negative consequences for mental health.

According to Pierce, in the lowest-income households, an average level of mental disorder was 13.9 points (among high-income people – 12.0); among the unemployed – 15.0; economically inactive – 15.3 (employed – 12.5 or retired – 11.1).

[7] Recommendations for medical professionals who are under conditions of increased psychoemotional stress during the COVID-19 pandemic. Moscow, 2020. Available at: https://edu.rosminzdrav.ru/fileadmin/user_upload/specialists/COVID-19/dop-materials/13-5-20/Rekomendacii_dlja_medrabotnikov.pdf (accessed: January 21, 2021).

[8] Jia R., Ayling K., Chalder T., et al. Mental health in the UK during the COVID-19 pandemic: early observations. *BMJ medRxiv,* 2020 (preprint published online May 19). DOI: https://doi.org/10.1101/2020.05.14.20102012. Available at: https://www.medrxiv.org/content/10.1101/2020.05.14.20102012v1.full.pdf (accessed: January 29, 2021); Kwong A.S.F., Pearson R.M., Adams M.J., et al. Mental health during the COVID-19 pandemic in two longitudinal UK population cohorts. *BMJ medRxiv,* 2020; (preprint published online June 18). DOI: https://doi.org/10.1101/2020.06.16.20133116. Available at: https://www.medrxiv.org/content/10.1101/2020.06.16.20133116v1 (accessed: January 29, 2021).

[9] Data of Russian Public Opinion Research Center.

[10] Data of the RANEPA monitoring.

[11] Data of the Levada-Center.

[12] Data of the RANEPA monitoring.

Although the rates of mental disorders were higher among people who were unemployed or engaged in other economically inactive roles before the isolation, the greatest increase was recorded among those who worked before the pandemic [131].

In addition, numerous theoretical models link the projected increase in unemployment and the financial crisis with the increase in suicides [140–143]. Thus, due to unemployment in 2010–2011 (after the 2008 economic crisis), the suicide rate increased by 20–30% [144].

Russian economists, politicians, and experts also agree that the consequences of the 2020 crisis will be more dramatic than those of the 2008–2009 crisis[13]. They forecast mass unemployment. Its level may jump to 8–10% of the labor force (a pessimistic scenario), about 15 million of Russians may suffer or lose their jobs[14]. Preliminary estimates of the International Labor Organization indicate that the growth of global unemployment may range from 5.3 million (low scenario) up to 24.7 million people (high scenario)[15].

Given that, according to WHO, every suicide among population is accompanied by more than 20 attempts, we may soon expect an increased load on mental healthcare services [144]. The readiness of all healthcare facilities can be vital to understanding and preventing it.

5. Media (infodemic) predictors. Most people around the world now have easy access to information thanks to an Internet connection and electronic media, which helps to share information – about the pandemic too. Many researchers speak of a parallel infodemic (i.e., overabundance of information (accurate and not)). Like an epidemic, it spreads between people through digital and physical information systems [145]. As in the previous SARS (2003), H1N1 (2009), and MERS (2012) pandemics, media have significantly contributed to the COVID-19 infodemic [146; 147], provoking a surge of numerous rumors, hoaxes, conspiracy theories, and misinformation regarding the etiology, outcomes, prevention, and treatment of this disease. The spread of misinformation masks healthy behaviors and promotes erroneous practices that increase the spread of the virus and ultimately lead to the destruction of mental health [148]. Media position COVID-19 as rather an exceptional threat, which exacerbates panic and stress among general population, provokes the onset or relapse of anxiety, obsessive-compulsive, and post-traumatic stress disorder [149]. Social networks play a significant role in the infodemic phenomenon [19]. Their consumption increases the chances of anxiety (by 1.7 times) and depression (by 1.9 times) [150]. Thus, the high prevalence of mental health problems (depression – 48.3%, anxiety – 22.6%) during the outbreak of the new coronavirus infection in Wuhan correlated with the frequent use of social networks (nearly 80% of those who have problems) [150]. According to another study on people with dysfunctional anxiety (which arose during the pandemic), every fifth respondent spent 3–5 hours watching the news daily, a quarter – 5–7 hours, and another 20% – more than 7 hours. At the same time, two-thirds of them had never suffered from such a disease before and had not sought treatment for anxiety [151].

Several studies show that the commonness of television exposure can provoke not only an increase in stress levels [152], development of PTSD symptoms, and the risk of suicide [153], but also

[13] Dynkin A., Telegina E. Black swan dance: world premiere. Available at: https://scientificrussia.ru/articles/rossijskie-spetsialisty-ob-ekonomicheskih-aspektah-pandemii (accessed: January 21, 2021).

[14] On the medium-term forecast of the development of the Russian economy in the context of the coronavirus pandemic and a possible crisis of the world economy. Report of the Center for Macroeconomic Analysis and Short-term Forecasting. Available at: http://www.forecast.ru/Forecast/fore052020.pdf (accessed: January 21, 2021).

[15] Available at: https://www.interfax.ru/business/703088 (accessed: January 21, 2021).

new cardiovascular diseases within 2–3 years after a stressful event [152].

Anxiety and uncertainty caused by the infodemic, in turn, may lead to additional media consumption, creating a vicious circle. Media-fueled distress can have a negative impact on the healthcare system (for example, provoking an increase in referrals and visits to emergency departments) [6].

The role of media and communications in the field of public health needs to be comprehended and studied further, as they will become an important tool in the fight against COVID-19 and future outbreaks [146]. Most researchers emphasize the importance of informational reliability disseminated through the media and social networks, as well as the search for viable strategies to counter disinformation during a pandemic [19; 145; 147; 150]. The response to the COVID-19 pandemic and related infodemics requires rapid, regular, systematic, and coordinated actions by various sectors of society and government, and it must be monitored by regulatory and law enforcement authorities, along with the provision of telemedicine services that provide accurate information about COVID-19 [148].

6. Socio-demographic prerequisites for mental health deterioration are ambiguous. According to most studies, young urban women are more vulnerable to the impact of the pandemic on their psyche [32; 131; 154; 155]. For example, there has been a steady increase in the level of psycho-emotional disorders among general population (from 16.7% in 2014–2015 to 18.9% in 2018–2019) in recent years in the UK. It was much more pronounced in 2020, especially among women aged 16–24 years (from 32% in 2017–2018 to 44% in April 2020) [131]. Psycho-emotional vulnerability of young women in crisis periods is also confirmed by the results of previous studies [156–159].

Several authors reveal an increasing number of mental health problems among children and adolescents during the pandemic [77; 160; 162]. In previous pandemics, quarantined children were more likely to suffer from acute stress disorder, adjustment disorders, and grief than those not quarantined [163]. An increased number of young people contacting the helpline with anxiety symptoms has also been reported[16].

However, Y. Wang and his colleagues revealed an increased risk of anxiety among, on the contrary, people older than 40 years (40% higher than among younger people) [42]. Given that elderly people are at particularly high risk for severe COVID-19 and its associated mental health consequences (some cognitive impairments), they should also receive significant attention from mental health professionals during the pandemic [113].

In some studies, no correlation between adverse psychological outcomes of the pandemic, gender and age was found.

The scientists also revealed higher scores of the mental distress level among people who are single or do not live together with a partner, as well as among those having one little child [131]. According to another study, the presence of one child in a family contributes to distress during the coronavirus pandemic, and the presence of more than three children, on the contrary, increases psychological stability [154].

An additional stressor during a pandemic is, of course, a quarantine, especially if it is a prolonged one. People experience fear of infecting their relatives, boredom, frustration, lack of food supplies, stigmatization, difficulties in distance learning, a sense of lack of freedom and restrictions on their own rights and worry about their health.

[16] Weale S. Sharp rise in number of calls to ChildLine over coronavirus. Available at: https://www.theguardian.com/world/2020/mar/27/sharp-rise-in-number-of-calls-to-childline-over-coronavirus (accessed: January 21, 2021).

Considering studied increased risk factors, it is possible to identify the main population groups vulnerable to the psychosocial and psycho-emotional consequences of the pandemic the most:

- those infected with COVID-19 and their quarantined family members;
- relatives of those who died due to the coronavirus;
- people with pre-existing psychiatric problems, including those dependent on alcohol and surfactants;
- healthcare workers who take care after infected people;
- people with low income, financial instability, migrant workers, unemployed;
- victims of domestic violence;
- lonely people;
- socially isolated groups (prisoners, homeless people, refugees, etc.);
- elderly people;
- children and teenagers;
- patients with concomitant somatic diseases;
- people with disabilities.

After studying and summarizing the results of numerous studies on the psycho-emotional burden of the COVID-19 pandemic, we present **several main directions for strengthening mental health** in this crisis period:

1) creation of a formal, integrated, unified platform for mental health counseling during a pandemic;

2) integration of mental health services into the COVID-19 care system;

3) provision of employment and material support for population;

4) development of a strategy for informed media policy on pandemic reporting;

5) events aimed directly at vulnerable groups;

6) promotion of a healthy lifestyle;

7) mitigation of a negative impact of quarantine on human psyche;

8) further scientific research.

There is a need for interdisciplinary well-coordinated work of representatives of all mental health sciences with the involvement of people with an experience of solving problems. The neuro-psychiatric and psycho-emotional burden of the pandemic should be comprehended and studied – not just now, but in the future. The results of direct studies could help to develop responses to future waves of infection in terms of preventing the damage they cause to population's mental well-being and reducing the burden of the disease.

Conclusion

By late 2020, there were thousands of articles in electronic databases on various aspects of a negative impact of COVID-19 on population's mental health. Their results are sometimes contradictory due to differences of the methods used. Some of them are based on the results of cross-sectional studies, a small part – on longitudinal ones. In some works, the biological impact of the virus itself on the human nervous system is considered. Others, similar to the current work, are overviews, and they are devoted to many aspects.

Nevertheless, we have not found a single study that characterizes all the transformations which occur as a result of the spread of the COVID-19 virus, measures taken to combat it (neuropsychiatric, psycho-emotional, behavioral) and lead to the loss of mental health as the "psycho-emotional burden of the pandemic". The authors of the current work have done it for the first time. Also, possible negative manifestations of mental health loss were structured into three main blocks: physiological, mental, and behavioral. It is the author's contribution to the development of theoretical science.

As a result, the burden of the new coronavirus pandemic in terms of mental health loss can be expressed in the following indicators:

1. Physiological level:

a) physical reactions to a stressful situation (increased heart rate, blood pressure, and blood sugar; impaired appetite, sleep, headache, body aches, endocrine disorders);

b) increased damages of the central and peripheral nervous system, neuropsychiatric and cerebrovascular complications (strokes, encephalopathy), changes of mental status (as well as disruption of the cardiovascular, digestive, and endocrine systems of a body) due to the neurotoxic effects of the SARS CoV-2 virus.

2. Mental level:

a) increased anxiety, unease, fear, anger;

b) onset or relapse of panic, anxiety, depressive disorders, adjustment disorders, and appearance of PTSD symptoms.

3. Behavioral level:

a) increase in aggressive behavior (surge of domestic violence);

b) auto-destructive behavior (alcohol and drug addiction, suicidal behavior);

c) internet and computer addictions;

d) avoidace (defensive) behavior;

e) change of food habits;

f) panic purchases, panic calls to the emergency service, etc.

These disorders in a body, psyche, and behavior inevitably lead to a significant deterioration of victims' mental state, decrease in their quality of life, disability, and even death. This puts an increasing strain on the healthcare system, diverting such limited resources needed to fight the pandemic. In addition, the healthcare crisis has led to many potentially missed or delayed diagnoses of high-risk diseases if they are not promptly diagnosed and effectively treated. Primary and secondary healthcare services should be prepared for a large influx of patients and increased severity of their diagnoses [77; 100; 164].

All this will entail direct and indirect economic costs for society (for treatment and rehabilitation, reducing the share of the working-age population), expanding the burden of the disease. It is important that the state loses the labor and human potential necessary for the economic recovery after the pandemic.

Most consequences of the pandemic regarding mental health are preventable if we develop a system for early diagnosis of mental health problems (especially in COVID-19 institutions), psychological support for population and risk groups (those who have had coronavirus and their families; healthcare workers; people suffering from mental disorders and those in a suicidal crisis; lonely people; those who lost income and jobs; victims of domestic violence; elderly people; children and adolescents; socially isolated groups; people with concomitant somatic diseases and disabilities). Prevention of the socio-economic consequences of the pandemic is extremely important.

We need further research on how the psychoemotional burden of the pandemic can be mitigated now and later, as mental health consequences will take longer to manifest themselves, and they peak after the pandemic. As economic consequences of isolation develop, vacations turn into layoffs, tax and mortgage breaks expire, and a recession takes effect, should we expect not only sustained distress and clinically significant mental health deterioration [131] among some people, but also well-described long-term impact of the economic downturn on mental health, including an increase in suicide rates [165]. According to experts, up to 70% of the world's population may potentially need psychological help during the f COVID-19 spread[17].

Nevertheless, several researchers also note a new positive experience of people gained during the coronavirus outbreak. This is a pride that we have shown resilience and coped with difficulties, a sense of community against one misfortune, and a deep satisfaction after helping each other. There is also a

[17] Axelrod J. Coronavirus may infect up to 70% of world's population, expert warns. March 2, 2020. Available at: https://www.cbsnews.com/news/coronavirus-infection-outbreakworldwide-virus-expert-warning-today-2020-03-02/ (accessed: December 21, 2020).

decrease in the stigmatization of mental disorders. Many people now experience psychological problems that they could talk about. According to experts, it should contribute to their earlier detection and treatment, and therefore reduce the burden of the disease.

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