

Neuropsychological symptoms related to the COVID-19 pandemic experienced by the general population and particularly by the healthcare personnel

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ABSTRACT



Undoubtedly, the outbreak of COVID-19 still represents an overanxious event for both society and population. The fear of getting infected is ubiquitous in the time of the pandemic. The population presented worrying thoughts related to the fact that the health care system was not able to provide enough services during the COVID-19 pandemic. The number of the hospital beds and ventilators was insufficient in order to ensure enough care, considering the increased number of COVID-19 cases that were admitted to the hospitals. Furthermore, people were fearful about the possibility of the global economy becoming decimated. The fright and also the feelings of anxiety related to the COVID-19 pandemic can become overpowering and create negative psychological states. In addition, mental health can be affected and influenced during outbreaks of infectious diseases and can be related to the misconception of symptoms, for example perception related phenomenon and corporal modifications. The population that could experiment these feelings, could instantly relate them to the coronavirus infection and express furthermore unpleasant sensations, in connection to more expressed anxiety and fear. Particularly affected were the healthcare workers of the medical system, who were the main combatants in this pandemic. The neuropsychological problems were difficult to avoid by the general population and this became even more difficult to be dealt with by the medical personnel.

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Introduction

The outbreak of the novel coronavirus 2019 (2019-nCoV) took place in December 2019 in Wuhan, and in the next period it spread rapidly around the world. The World Health Organization (WHO) named the disease caused by 2019-nCoV as coronavirus disease 2019 (COVID-19). Subsequently, on March 11th, 2020, WHO declared the beginning of a pandemic worldwide [1,2].

The population worldwide became restless and worried, not just because of the threatening conditions for human sanity, but also considering the social and economic relevance. There is an important consideration for the changes of the routines of the populations regarding daily

activities and their influence on health and comfort. This matter is better referred for the cases of self-isolation or quarantine, which are more prone to depression-like emotions and even normal reactions of fear, guilt, and anger [3].

Unlike other pandemics, the informational ways of spreading knowledge and information during this pandemic were assured by the ultimate technology [4-7]. Extensive worldwide networks and expansive media broadcasting conducted to collateral pandemic disaster reactions. A lot of wrong facts and events were transmitted in a fast manner through the publications and broadcasts representing COVID-19 disease spread and case numbers. A continuous presentation to such reports causes through

the media, expanded the psychological discomfort [8]. Increased degrees of approaching the COVID-19 pandemic in the media have been associated with depression and anxiety [9,10]. Especially increased values of online searches have been revealed to be related to the mentioned psychological issues. Furthermore, to the sudden impact of all these aspects, consequently, there will also be persistent repercussions. Various reports have described higher psychological disorders in the time and after the previous SARS, H1N1, and Ebola epidemics [11–21].

The pandemic is generated by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is spread through respiratory droplets and direct human contact and also through contacts with asymptomatic carriers. The frontline medical staff have to use special equipment: containing enhanced droplet/ airborne personal protective equipment, as N95 mask, fluid-resistant gown and eye protector which is effective and protective for physical measures, but consists of great psychological distress and brings risks of emotional matter [22]. The psychological distress amidst the HCWs is correlated with extended working time, unsure salaries, lack of Personal protective equipment (PPEs) and supplementary concern about self or family contamination with the disease [23, 24]. Worldwide reports have revealed the prevalence of anxiety ranging from 11.3% to 50% [25–28]. Healthcare workers have encountered uncertain, stressful situations, with an increased exposure to infection, and also isolation from society and stigma, patients with distressing emotional states, and fatigue. The astringent circumstance is generating mental health issues such as anxiety, depressive symptoms, inability to sleep and insomnia, and fear, and the mental status of medical healthcare workers has become a point of interest in the period of the COVID-19 outbreak [29]. The persons who were specialized and held high-risk positions and operated units, such as COVID-19 wards, infectious disease hospitals and clinics, emergency rooms, pulmonary medicine departments, or X-ray laboratories, were considered to present high-risk work exposure [30].

Following the direction of the human nature, it was presumed that people who presented a higher level of concern about getting infected with COVID-19 were more prone to express a weak psychological health. In the time of a pandemic, humans are frightened about becoming infected, expressing these concerns about themselves or their family members and also about the further consequences of the pandemic. Moreover, judgement and shame connected with infectious diseases can cause greater fear in getting infected, which may still influence their mental health status [31]. Literature studies amidst Italian [32] and Iranian [33] populations revealed that the fear of COVID-19 was unquestionably related with both

depression and anxiety. The studies were based on Hospital anxiety and depression scale and also, the authors described that fear of COVID-19 can become more advanced by synchronized depression and anxiety disorders.

The rapid spread and lethality of COVID-19 determine the occurrence of acute mental health impairments and the aggravation of chronic ones [34]. The data on mortality in various countries reveal death numbers increasing daily, loss of acquaintances, worry of transmitting the disease to relatives and friends, even constructing a new way of living at a distance from family in order to decrease the risks of transmitting the disease. For many people, deaths among colleagues, extra hours of work and in conditions of wearing protective equipment, and also stigmatization represent likely generating factors of psychological disturbances [35–39].

Discussions

The fact that medical workers had an appreciable and irreplaceable part in this large-scale public health crisis was generally accepted. The medical workforce has been on display for burden and tension, both physically and psychologically as a consequence of this important infectious worldwide health event [40–42]. A study revealed that 42% of the doctors who worked in Tertiary Hospitals in China faced very high levels of gathered tiredness [43]. Moreover, in the time of SARS-CoV-2 pandemic, the more abundant tasks and unsafety that medical workers were experiencing exacerbated the psychological burden, and especially mental disorders. The data in the literature indicated that hospital workers especially doctors and nurses were more likely to experience psychological impairments after taking part in the treatment of SARS patients over a decade in the past [44].

Medical workers are the most involved in treating patients infected with COVID-19. Daily, medical healthcare workers are an increased risk of getting infected as they are prone to lengthy and complicated work shifts in order to comply with health obligations and conditions. Concisely, they are prone to come in contact with an enduring cause of concern which could overcome their personal coping mechanisms, being able to develop in overload with prolonged time [45].

Medical healthcare workers presented increased prevalent levels of intense insomnia, anxiety, depression, somatization, and obsessive-compulsive symptoms in the time of the COVID-19 pandemic. Furthermore, healthcare workers presented risk factors for developing insomnia, anxiety, depression, obsessive-compulsive symptoms, and somatization. Thus, the presence of these disorders additionally to the life situation of constantly fighting COVID-19 indicated that they should cope with

psychological afflictions [45]. The mental stressor is correlated with the appearance of great efforts in falling asleep, agitated sleep, early morning waking up, loss of energy, vertigo, generalized anxiety, irritability, unhappiness, demoralization, severe dysfunction in social or occupational activity; and overpowering sensations experienced in relation with the obligations of daily life [45].

The implications of the psychological distress faced by healthcare workers could be connected with the many difficulties of performing the work activity safely, such as deficient first comprehension of the mechanism of action and spread of the virus, lack of knowledge of prevention and control, long-term workload, high risk associated with exposure to patients with COVID-19, lack of medical equipment [46,47], lack of rest [48] and the contact with painful life events, such as death.

Satisfactory working circumstances and rehabilitation modules, i.e., schedules that promote the activities needed to assure the ideal physical, mental, and social conditions so that medical workers can move towards a desirable state of health [49], are thought to be required. These facts offer assistance for the medical staff in order to adjust to the working climate rapidly and conserve more balanced mental and health levels that will help in their work, also providing better results for the treated patients. Adjusting work requirements and workload [50], while expanding job control and compensation could be of help in guarding the medical health workers from emotional harm and stress. However, there are still unknown individual interventions applicable to health care personnel in the present situation in which they carry medical equipment protection which will not be detached throughout working hours. Sharing stories [51] would be important, as well as strengthening people's positive assets. Ideas which can be applied simply and practically represent the most accurate ones for the actual context. Electronic devices, such as mobile phones and computers, can help in the labor of healthcare personnel.

Papers in the literature have revealed that the mental health condition of the medical staff was more affected than that of the general population [52,53]. To this regard, Kerrien M et al. [54] suggested that 27% of junior doctors were fighting depression, while 28.7% were confronting anxiety. Paiva CE et al. [55] revealed that 12.3% of doctors presented depression ($\text{HADS-D} \geq 11$), and 19.4% presented anxiety ($\text{HADS-A} \geq 11$). A systematic review which included 29 studies revealed that the majority of anxiety and depression cases among medical students in Europe, UK, and elsewhere in the English-speaking world outside North America was 7.7-65.5% and specifically 6.0-66.5% [56]. In an analogous matter, a cross-sectional survey revealed that the prevalence of anxiety symptoms among nurses was 43.4% [57]. Furthermore, an additional

cross-sectional survey showed that the prevalence of anxiety among female nurses was 41.1% [58]. A study by Maharaj S et al. [59] revealed that the prevalence rates of depression and anxiety among Australian nurses were 32.4% and 41.2% respectively.

The study by Osasona SO et al. [60] revealed that preceding mental disorders were significantly correlated with anxiety, depression, or general psychiatric morbidity in a sample of inmates in a Nigerian prison. Ahmed A et al. [61] described that an antecedent of depression and stress was correlated with depressive and anxiety symptoms in a sample of 615 women in Saskatchewan starting from pregnancy to 5 years postpartum. In a study by Stafford L et al. [62], it was revealed that women with a psychiatric history and high neuroticism experienced more significant risks for future morbidity subsequently the adjustment for confounders, such as age, education, and living alone.

A study by Mahmoud JS et al. [63] revealed that decreasingly non-adaptive coping conducts could bring the most beneficial effects on decreasing anxiety, depression, and stress among young adult college students. A study by Wang Y et al. [64] observed that noted stress had a beneficial impact on psychological affliction, and coping manners could be an intermediate means in this relationship among Chinese physicians. Moreover, the article by Holz NE et al. [65] concluded that stress exposure could increase the levels of depression and anxiety in adults, especially in females, and it was correlated with non-adaptive modifications in the anterior cingulate cortex (ACC), and at the same time, constructive coping behavior might be beneficial in order to develop the ACC volume.

There have also been reports in the literature regarding fatigue, insufficient sleep, fear, anxiety, depression and even post-traumatic stress symptoms (PTSD) among the frontline medical care personnel in the time of SARS and Ebola outbreaks [66-68]. Post-traumatic stress disorder subsequent to COVID-19 pandemic has been observed to be positively correlated with sleep disorders, anxiety and depression in Chinese and Italian populations, and also deteriorating the quality of life of both healthcare personnel and patients [69,70].

A study from China revealed that a considerable number of nurses working with COVID-19 patients presented nervousness, restlessness and sleeping disorders [71]. In an analysis of the literature, Qiu D et al. revealed that allied healthcare workers are more prone to sleep disorders than the general population in China [72]. A multi-center study that was performed in almost a month time period in 2020, revealed a significant correlation considering the frontline medical professions and mental health disorders [73].

Psychiatric disorders were still noted in approximately 51% of the medical workers in the time of the MERS commencement [74]. In the period of the outbreak of COVID-19, 28.8% of the general population in China revealed anxiety symptomatology, and 16.5% revealed depressive symptomatology [75,76]. Nonetheless, the prevalence of anxiety, depression and insomnia among the medical personnel was 44.6%, 50.4% and 34.0% respectively.

An inventory performed on 116 Taiwan nurses revealed that the quality of sleep was less satisfactory before the beginning of the pandemic for SARS patients, and remained unsatisfactory in the following 3 months [77]. An additional inventory revealed that the mean PSQI results of SARS clinic nurses varied between 7.2 and 5.2 in a 7-week period [78]. A study in the literature performed in the time of COVID-19 outbreak reported that the quality of sleep among the frontline medical workers was decreased with an average of 8.6 results obtained at the PSQI test, being compared to the results obtained among the regular Chinese population [79].

Emergency department nurses frequently experience excessive psychological distress because of the overpowering workload, prolonged hours, shift responsibilities and working in a rapid-paced and high-risk environment [80-82]. Nurses working under such physically and emotionally demanding circumstances repeatedly experience fatigue, burnout, mental tiredness, and emotional disconnection [83]. In the time of the COVID-19 pandemic, frontline clinicians including nurses, particularly the personnel that has direct contact with infected patients, has frequently experienced anxiety and depressive symptomatology, neurasthenia and sleep impairments because of the restricted clinical information on the new virus and the deficient supplies of protective gears and other medical equipment [84-86] which can lead to low morale at work, absence, indifference, and unsatisfactory work accomplishments which further on lead to patient dissatisfaction [87,88]. Since the outbreak of COVID-19, various studies have investigated the prevalence of psychiatric disorders among the frontline clinicians.

To this regard, a cross-sectional study revealed that the frequency of depression, anxiety, insomnia and broad distress symptoms was 50.4%, 44.6%, 34.0%, and 71.5%, respectively in frontline clinicians, nurses included [89]. Nonetheless, existent studies have not often explored mental disorders among frontline nurses working in various departments in the time of COVID-19 outbreak, even though the frequency estimates in separate departments are significant figures for health authorities to establish preventive methods and competent treatment procedures in order to relieve the unfavorable results of depression.

Research in the literature has also revealed that increased levels of anxiety are associated with changes in the quality of the sleep [90,91]. According to a study performed in the past, which showed the relationship between the depressive symptoms and sleep disturbance [92], the medical personnel that was diagnosed with depressive syndrome was 2.96 (95% CI 2.30–3.82) times more inclined to suffer from sleep disorders than the control group who did not present symptoms of depression. Moreover, sleep disorders, particularly insomnia, have been in both ways involved in the mood disturbance mechanism of development, showing that insomnia could be presented as a prognostic factor of anxiety and depression, and vice-versa [93]. Regarding the Chinese doctors, a cross-sectional study revealed that participants who have not had enough sleep (<6 h per day) were more likely to develop anxiety disorder (OR = 2.70, 95% CI: 1.51–4.83) and depression (OR = 1.58, 95% CI: 0.95–2.64) than those who had normal sleeping schedules (≥ 8 h per day) [94]. In the same manner, the actual improvement of sleep disorders could help decrease the involvement of consequent or pessimistic mood impairments and vice-versa [95].

The connected result of adjustments in lifestyle conducts to limitations in home environment due to government constraints regarding travelling and heightened levels of depression, anxiety and stress correlated with the ongoing COVID-19 pandemic, might present significant adverse effects on the quality of sleep. The stated situation was specifically apparent in the case of medical personnel, who was required to work for hours on-end in remarkably tense environments. A decreased and less satisfactory quality of sleep has been correlated with increased levels of depression, stress, and anxiety. Preserving the sleep quality is vital for maintaining good levels of immunity, therefore sleep disturbances consecutive to COVID-19-pandemic-caused stress might either enhance susceptibility to infection or diminish the healing process considering the infected persons.

Various psychosocial stressors, including health-related concerns and danger to the individual person and their family are highly correlated with pandemics. Moreover, there are some routine changes, estrangement from family members and friends, deficiency of everyday fundamentals, salary reduction, social separation, and school closure. Psychosocial reactions to infectious disease epidemic are changeable and might comprise perceptions of anxiety or instability, a misinterpretation of the possibility of infection, the exaggerated and improper adoption of safety methods [96,97] and a heightened request for health care assistance in times of deficiency [98]. Considering the other part of the problem, some people could disagree with the risks of infection and refuse to participate in suggested health conducts related to hand

hygiene and social distancing. A preferable and more appropriate comprehension of the psychological reaction to infectious disease pandemics within the society is fundamental for various reasons. Primarily, the increased predominance of psychological distress has been recorded amidst persons who are precisely likely to operate in very dangerous circumstances [99-101]. On the other hand, the development of the aforementioned psychological despair in a consequential distribution of the society could affect the everyday capacity of the concerned persons and lead to instantaneous social and economic results, being a loss for the job capacity and financial adversity. Tertiary, improved assuring of the psychological health of the society over functional mental health interference is critical in order to avoid or interrupt the transmission of diseases among healthcare personnel in the time of pandemics [102].

The COVID-19 pandemic could further lead to unfavorable changes in health conduct, including physical activity, smoking, alcohol use and sleep. Moreover, including the achievement of social quarantine and physical distancing limits in March 2020, the current locations to be bodily active, including gyms and outdoor enjoyment opportunities, were no longer available. Even though some people could have enough independent managing of physical activity in order to follow substitute activities (e.g., online fitness classes and various home performing physical activities), others might decrease their physical exercises because the deficiency of social assistance accessible or interests in getting the virus in the open environment. Furthermore, the people that were compelled to sustain their job activity from home might have no longer wasted time travelling to work and might have used the favorable circumstances in order to conceive new physical activity practices. Preferably, considering that exercise represented one of the few valid motives for having the possibility to exit the living place environment, various persons might have refined walking or cycling habits as an excuse to leave home. Studies in the literature showed clear beneficial correlations between physical activity and decreased psychological difficulty [6,7], the beginning or maintenance of physical activity in the time of the pandemic would probably help in decreasing psychological afflictions. Nonetheless, various considerations have been communicated considering the increased risks of respiratory disease among the people involved in high- and very-high intensity exercises as a result of the capacity for reduced immune reaction [103-105].

In opposition to health-developing conduct including physical activity, various parts of the population might manage civil quarantine and pandemic-associated psychological concerns by either initiating or developing unfavorable health-related habits including smoking or alcohol use. Taking into consideration that COVID-19 is

an acute respiratory illness, the initiation or continuation of tobacco use concurrently with the COVID-19 pandemic might lead to the exacerbation of the consequences for those infected with the virus [9]. Undeniably, previous evidence implies that the amount of current and former smokers is increased among those with severe diseases and also among those found in intensive care units and who require ventilation [10,11]. Detrimental amounts of alcohol intake contribute to neuromodifications which aggravate alcohol cravings in the course of stress exposure [12]. Therefore, social quarantine, along with modifications in the job status or ambiguity concerning the future might generate the enhancement of alcohol consumption for some individuals [13].

Studies in the literature consider psychological distress as a consequence of the COVID-19 pandemic. Several studies in China revealed increased stages of psychological disorders including stress and nervousness in the time of the primary evolution of the pandemic [20,21]; still, the correlation between psychological stress and health manners of conduct is still ambiguous. The initial documentation on the COVID-19 outbreak indicates beneficial correlations between increased physical activity and physical health and reversed correlations between inactive behavior and physical and psychological health consequences [22]. A more comprehensive examination of health conducts over the evolution of the COVID-19 pandemic might help direct forthcoming public health messaging develop beneficial conducts.

Besides the psychological aspects of the outbreak on society, the medical personnel are exposed to further stress as a result of participating directly in the treatment of infected patients and increased risk of contamination, concerns about transmission to their families, worries in relation to personal health or the health of the family members, considering the low self-esteem, rejection and also the physical and psychological burden. Furthermore, the growing number of instances and disease-linked deaths, tough assignments for prolonged periods of time and lack of healthcare protection equipment (PPE) lead to emotional and physical exhaustion in time.

The symptoms related to stress response including anxiety, depression, somatization and antipathy, being described by almost 10% of the medical personnel in the time of pandemics and after former pandemics [105].

The disproportionate workload is correlated with emotional responses. Consequently, it should be intended to assure suitable functioning hours, acceptable relaxing periods of time and alternating shifts for employees. The logistic support appears to be a separately correlated determinant with the mental prosperity of frontline doctors. Deficiency of PPE, risky job climate, unsatisfactory working environment might lead to elevated awareness of the risk for personal safety and the increased concern of

transmission to their families. This fact consecutively led to low ambition and pessimistic and adverse emotions including hopelessness and feelings of culpability.

Furthermore, employers could adopt a prioritizing measure assuring the protection of HCWs and also unify their elemental demands. Research has also showed that peer support and support from supervisors are still correlated with psychological prosperity. The ability to discuss with someone about their encounters and events, to talk about the emotional and physical challenges of their job, to tell their worries to other colleagues might be helpful in decreasing the feelings of isolation and stress. Working doctors shall be supported in expressing themselves in front of the others and support groups shall be implemented via the social media, if necessary. Lastly, feelings of working capability in the time of Covid-19 outbreak showed that tasks appear to be connected with the psychological concerns of employees. Supporting satisfactory job preparation for those who will perform medical services in the frontline, describing the precise information about the disease, risks of infection and methods of protection, implementing methodical diagnostic and treatment protocols with understandable directions might help alleviating stress and developing the occupational courage and determination.

This anxiety and depression in the treatment administered by the medical personnel might be encountered as recurrent concerning emotions and even panic attacks, or might be followed by physical symptomatology including shortness of breath and palpitations. In the involved case, if one person does not pay attention to this problem and the psychologist or the psychiatrist do not interfere in the matter, the person might develop the symptomatology through depression and even present feelings of incapability for one's self and for attending to the patients' needs. In some cases, he/she becomes exceedingly emotional to his/her physical symptoms and distorts his/her physical symptomatology. These feelings of fear and anxiety are further transmitted to the family and other friends, and the person might encounter pressure in relation with family and colleagues. In the stated case, this should be resolved professionally by applying gentle methods. Employees shall receive instructions in order to consult the authentic sources of information for data and information, considering that in stressful circumstances, the probability of people accepting rumors is increased. Advice in surpassing the acute states of depression and anxiety imply talking about the feelings and it might be helpful in the meetings with friends and family, but also with specialists. Another coping mechanism for stress would be spending hours with family at the distance from the cyberspace and avoiding stressful circumstances. Physical activity and exercise could help in controlling anxiety. This is not the first crisis to involve the treating staff, and in all crises, people are able to use the

adaptive methods they have acquired in the past. If the psychological symptomatology is severe and the employee's accomplishments are reduced, the person should be advised to be examined by a psychologist or psychiatrist in order to acquire professional help. Also, anxiety, stress and depression are often encountered in the evolution of many diseases, especially the neurological diseases [106-114] and coping with the symptomatology of these diseases is difficult even for the patients, therefore if a medical healthcare worker has found the coping techniques and mechanisms in order to rehabilitate after such neuro-psychological disorders, it would be easier to transmit the knowledge and courage to the patient as well. [115,116].

Conclusions

Even though a decline in the levels of positive cases and deaths have been progressively observed in some countries, the pandemic continues to maintain momentum in various parts of the world. Healthcare workers (HCWs) have contributed with an important range of services throughout the COVID-19 pandemic in order to decrease the number of deaths in the infected patients. HCW have provided their services in pandemic clinics, wards, operating rooms and intensive care units, non-pandemic clinics, in emergency departments, ambulances, family health centers and pharmacies. The infecting reports of the HCW were substantial and also the deaths have not spared the medical workers, despite their attempts of fighting the disease. Moreover, high infection rates among healthy people and reports of deaths among colleagues and family had a negative mental impact on the entire population, especially on HCW.

In conclusion, an increased prevalence of psychological symptoms was observed among the medical health workers in the time of COVID-19 including risk elements for them. The medical personnel need health protection and satisfactory occupational circumstances, e.g., supplies of essential and adequate medical protective equipment, adjustment of enough rest, including recuperation programs designed to enable the resilience and psychological comfort.

Conflict of interest disclosure

There are no known conflicts of interest in the publication of this article. The manuscript was read and approved by all authors.

Compliance with ethical standards

Any aspect of the work covered in this manuscript has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

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