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Review Article

Brain fog and affecting factors in health care workers

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Abstract

Brain fog was first described in the 1850s as a form of mental fatigue, particularly observed among individuals engaged in occupations requiring intensive cognitive effort. The present study aims to examine the occurrence of brain fog among healthcare professionals—who are required to perform multiple tasks simultaneously and make critical decisions—and to identify contributing factors through a review of the current literature. Accordingly, a traditional literature review was conducted by retrieving articles published between 2019 and 2025 from the PubMed database using the keywords “brain fog”, “cognitive impairment” and “mental fatigue”. Brain fog is characterized by forgetfulness, difficulty concentrating, impaired multitasking ability, and diminished cognitive functioning. Healthcare professionals constitute one of the occupational groups most frequently exposed to brain fog. Physicians, nurses, and other healthcare personnel are subjected to various stressors and adverse working conditions that may precipitate brain fog, including time pressure, uncertainty in patient treatment and care processes, extended working hours and insufficient nutrition. Given that healthcare professionals are responsible for improving and maintaining individual health and quality of life, the experience of brain fog within this group poses risks to patient safety due to the cognitive symptoms it entails. Examining brain fog and its associated factors among healthcare professionals is essential for implementing preventive strategies, enhancing the quality of patient care, minimizing errors during clinical practice, and improving job satisfaction and quality of life among healthcare personnel. Furthermore, investigations may provide a foundation for developing evidence-based strategies to mitigate brain fog in healthcare settings.

Keywords: Confusion, factors that affect brain fog, healthcare workers, mental fatigue

1. INTRODUCTION

Cognitive dysfunction refers to the impairment or deterioration of cognitive abilities, including attention, memory, executive functions, and decision-making [1]. Brain fog is another term that refers to a decline in cognitive functions. Although it is not a formal medical term, the term encompasses a range of symptoms including lack of concentration, confusion, slower-than-normal thinking, forgetfulness, word-finding difficulties, and mental fatigue [2]. One study emphasized that brain fog represents an altered state of consciousness in which the individual is less alert and less vigilant than usual [3]. Brain fog has emerged as a prevalent condition among healthcare professionals and the general populace, particularly in the post-COVID-19 era. Brain fog has emerged as a prevalent condition among healthcare professionals and the general

populace, particularly in the post-COVID-19 era. The underlying mechanisms of how and why COVID-19 leads to brain fog symptoms are not yet fully understood; however, evidence indicates that COVID-19 may invade the brain through several possible pathways. This process triggers neuroinflammatory responses capable of activating cells such as astrocytes, a critical type of glial cell in the brain, thereby contributing to the neurological symptoms observed in patients with COVID-19 [4]. One study reported that 32% of patients exhibited brain fog among the mid- and long-term neurological manifestations following COVID-19 [5]. Another study highlighted the prevalence of various neuropsychiatric symptoms associated with COVID-19, including 43.3% fatigue, 27.8% memory impairment, 27.1% cognitive dysfunction, 24.4% sleep disturbances, 23.8% concentration difficulties, 20.3% headache, 16% dizziness, 15.9% stress, 14% depression, 13.2% anxiety, and 13% migraine [6]. In individuals recovering from COVID-19, neurological symptoms characterized by impairments in mental functioning—collectively referred to as *brain fog*—encompass a wide range of cognitive disturbances such as confusion, short-term memory loss, and concentration difficulties [4]. Recent studies suggest that brain fog may also develop in association with various diseases and conditions beyond COVID-19. It can additionally be triggered by factors such as malnutrition, strenuous physical activity, and fear of income or job loss [7, 8]. For this reason, it is crucial to detect the brain fog among healthcare professionals, who directly provide services to individuals, play a pivotal role in human and public health, and whose responsibilities include improving health, maintaining existing health status, and enhancing quality of life. Any potential error may not only result in the loss of human life but may also be irreversible. Demanding occupational conditions that often result in burnout, shift work system, stress caused by emergency management, risk of infectious diseases and injuries have been found to be correlated with lower work efficiency and productivity. It is also shown in a study covering cognitive functions and work endurance in healthcare workers, healthcare professionals experience significantly high levels of mental deterioration, thus exhibit low resilience [9]. Determining the brain fog experienced by healthcare professionals as a result of various contributing factors also necessitates the development of systematic procedures aimed at its mitigation. Such measures are not only essential for enhancing the quality of life of healthcare workers but also for improving the overall quality of care, thereby contributing to advancements in both public and individual health. This review aims to discuss the factors that influence brain fog experienced by healthcare professionals and to provide insights that may guide future preventive and supportive strategies.

2. BRAIN FOG

Brain fog is characterized by poor attention, difficulty in self-control and concentrating, decreased mental acuity, challenges in thinking and communicating, and problems with long- and short-term memory [10, 11]. Brain fog is defined as a cognitive disorder similar to mental fatigue that impairs performance in cognitive tasks [4]. Brain fog further includes mental confusion and fatigue, poor concentration, decreased motivation, sleep disorders, and disruption of cognitive processes [12]. Individuals afflicted by brain fog cannot work effectively, experience difficulty in thinking and decision-making, decreased cognitive processing speed, and difficulty in multitasking [13]. Consequently, these people perceive themselves as insufficient in their professional and social spheres and experience psychosocial problems [7].

The underlying mechanisms of how and why COVID-19 gives rise to brain fog symptoms are not yet fully understood; however, evidence indicates that COVID-19 may affect the brain through several possible pathways. Memory problems observed after COVID-19 are thought to result from multiple interrelated mechanisms, including neuroinflammation that disrupts hippocampal function, impaired neurotransmitter activity, and sleep disturbances. The hippocampus is vital for memory consolidation, learning, and neurogenesis through the production of neuronal stem cells, particularly in the dentate gyrus. However, this brain region is highly vulnerable to neurodegenerative processes and psychiatric disorders, and such susceptibility may be further exacerbated by

COVID-19 infection. Studies suggest that the neuropsychiatric and cognitive symptoms observed in association with COVID-19 are multifactorial in nature, arising from interconnected pathophysiological mechanisms. One of the distinguishing features of COVID-19 infection, neuroinflammation, is triggered by the activation of microglia and astrocytes; these cells release proinflammatory cytokines such as tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6). These cytokines disrupt synaptic plasticity and neuronal functions, which are critical for cognitive processes, and have been associated with both mood disorders and cognitive impairments. In addition, autonomic nervous system dysfunction has been shown to contribute to mood and cognitive disturbances. Such dysfunction, through alterations in heart rate and cerebral blood flow, may exacerbate symptoms including dizziness, fatigue, and attentional difficulties [6]. Continuous infectious or inflammatory signals transmitted via the afferent vagus nerve may trigger a neuroimmune response reflected in glial activation within the dorsal spinal cord. This phenomenon has been shown to be associated with persistent, unresolved symptoms lasting for months [14]. Impaired neurotransmitter activity also contributes to neuropsychiatric symptoms such as anxiety, depression, and stress, arising from dysregulation of neurotransmitters including serotonin and dopamine. Another critical factor influencing cognitive symptoms is endothelial dysfunction, which leads to microvascular injury. When combined with systemic inflammation, this vascular impairment is thought to further exacerbate neuropsychiatric and cognitive manifestations by disrupting cerebral perfusion. Additionally, there is evidence that hypertension and other vascular comorbidities may potentiate these effects, creating a vicious cycle that perpetuates symptom worsening [6, 15, 16].

Brain fog may further develop due to various factors, including COVID-19, autoimmune disorders, postural orthostatic tachycardia (POTS), hormonal fluctuations, heightened stress, chemotherapy, multiple sclerosis, chronic inflammation, traumatic brain injury, breast implant illness, fibromyalgia, depression, anxiety, sleep disorders, and elevated ferritin level [10, 17-24]. It may also be triggered by circumstances such as malnutrition, strenuous physical exertion, and anxiety due toincome loss and employment instability [7, 8]

Yelland (2017) reported in a nutrition article that mild cognitive impairments, including memory loss, attention deficits, problems related to executive functions such as planning and problem-solving, and cognitive processing speed, commonly observed in celiac patients, were termed brain fog. It was further concluded that these cognitive impairments improved with adherence to a gluten-free diet, although the precise mechanism remains undetermined [13]. Recent studies frequently employing the term “brain fog” have been associated with COVID-19. Brain fog is recognized as a primary symptom of sequelae that emerge following the acute phase of COVID-19 [25]. Mental and cognitive changes have been emphasized as the primary clinical findings in patients diagnosed with brain fog associated with COVID-19.

Although these sequelae are being increasingly acknowledged, effective strategies for their management remain scarce, and further research is required to develop targeted interventions. Pharmacological approaches constitute an active field of investigation, with ongoing clinical trials assessing the effectiveness of antidepressants, anti-inflammatory agents, and neuromodulatory drugs in the treatment of long COVID–related neuropsychiatric manifestations. Nonetheless, these studies are still at preliminary stages, and a standardized therapeutic protocol has yet to be established [6].

2.1. Brain Fog Experienced by Health Care Professionals

Healthcare professionals may intermittently experience brain fog attributable to mental fatigue induced by multiple factors associated with their occupational and life circumstances. A study conducted in the post-COVID-19 period emphasized that, as a result of the body’s extensive immunological response to infection, COVID-19 had adverse effects on healthcare workers in terms of attention and memory, leading to cognitive impairment [26]. In

the study conducted by Omar et al., attention and memory were found to be significantly impaired in the group of healthcare workers who had been affected by COVID-19. Symptoms of depression and anxiety were more frequently reported, and a direct correlation was identified between these symptoms and attention and memory scores [26]. A study conducted in Spain investigated the long-term effects of mild COVID-19 on the cognitive functions of healthcare workers and examined the potential association between emotional symptoms and individual performance. It was emphasized that the cognitive effects of COVID-19 are particularly more pronounced in severe cases requiring hospitalization. Although the study did not establish a direct association between COVID-19 infection and cognitive impairments, a strong relationship was identified between emotional symptoms and cognitive performance [27]. Another study found that individuals diagnosed with COVID-19 had significantly higher levels of anxiety and depression compared to those without a diagnosis. In the COVID-19 group, it was emphasized that fatigue, cognitive impairment, and persistent symptoms increased the psychological burden. Chronic fatigue, in particular, has been identified as a critical determinant of anxiety and depression by undermining social functioning and quality of life. This effect was shown to be more pronounced among healthcare workers. It is suggested that the heightened awareness of their own health status among healthcare professionals may increase their concerns regarding professional competence as well as their anxiety about fulfilling social roles [28]. However, health care professionals are expected to remain vigilant and attentive at all times on duty, promptly observing their surroundings, processing information, and making swift, accurate decisions to implement necessary interventions. Health care professionals are prone to mental and physical fatigue, burnout, impaired concentration, slowed cognitive skills, and amnesia as a result of their working conditions. Brain fog, which encompasses these concepts, is being incorporated into the literature as a contemporary term. Cognitive impairment and brain fog are significant factors that hinder the working process. Brain fog and cognitive impairment, observed due to various disorders, may also be affected by external factors [13].

2.2. Factors Affecting the Brain Fog Experienced by Health Care Professionals

Health care professionals face numerous challenges while performing their duties. Some of these challenges are directly attributable to the working environment. Research indicates that various task-related factors can lead to cognitive impairment, with a particular emphasis on the detrimental effects of job stress on the professional practices of healthcare professionals [29].

A study conducted in Lebanon indicated that work fatigue experienced by health care professionals negatively impacts cognitive functions [30]. Studies conducted in Egypt and Brazil indicated that the cognitive functions of health care professionals are impaired due to the stress they experience [29, 31]. Stress and burnout syndrome may further reduce physical and cognitive functions besides hindering productive and effective work. Decreased performance negatively impacts patient treatment, care, and safety [32]. Work-related stress, coupled with uncertainty regarding patients' treatment, contributesto anxiety and increases the potential for future depression. Depression and anxiety are other factors that contribute to cognitive impairment [7, 33]. Moreover, shift work represents an additional challenge that adversely affects healthcare professionals. Irregular working hours and the requirement to remain awake at night can result in cognitive impairments in memory and concentration, as well as social incompatibility, communication challenges, and difficulties in rapid orientation [34]. Health care professionals with irregular sleep patterns or shift work are reported to face nutritional issues. Skipping meals or eating late at night amidst a demanding schedule may result in the malnutrition of healthcare professionals [8, 35]. Therefore, inadequate and poor nutrition causes health care professionals to experience brain fog and cognitive impairment. Research indicates that health care professionals experience cognitive impairment, often referred to as brain fog, due to various factors including work fatigue, physical exhaustion, stress

from emergency management, uncertainty, anxiety, burnout syndrome, depression, sleep disorders related to shift work, nutritional deficiencies, malnutrition, insufficient social support, and multitasking demands [8, 29, 32, 35, 36].

2.3. Protective and Preventive Approaches

Mental fatigue impairs the individual's reactions, reduces the capacity to process information and concentrate, and is cited as one of the primary causes of decreased productivity and overall cognitive performance [37]. The effects of mental fatigue may lead to malpractice issues [38]. The acts of health care professionals within the health care team significantly impact individuals. Consequently, any misconduct arising from mental fatigue may result in severe consequences, including irreversible harm to or death of the patients under their care [39]. The brain fog experienced by health care professionals not only deteriorates the quality of health care services but also adversely affects their professional competence [40]. Research indicates that mental fatigue may lead to professional faults and negatively impact physical performance [38]. Identifying the factors influencing brain fog experienced by healthcare professionals further requires the development of protective and preventative solutions to mitigate its occurrence. Positive coping skills (relaxation exercises, positive thinking, and problem-solving), resilience-building interventions (adopting a proactive approach to problem-solving, being flexible and adaptable), are preventive approaches that directly impact not only individual well-being but also patient safety and the sustainability of the health care system [29].

2.3.1. Psychosocial Interventions

Health care professionals may encounter various stressors stemming from their professional and personal lives, often overlapping. These include exposure to violence, risk of infection, potential contact with chemicals or radiation, and dynamics within superior-subordinate relationships. These factors also include working in healthcare settings, performing long shifts due to staff shortages, having close and prolonged contact with infected patients, inadequate or improper use of personal protective equipment, as was also the case at the onset of the pandemic, working in enclosed and crowded environments, and poor or insufficient ventilation conditions [27]. Public health emergencies, in particular, highlight the critical importance of the mental health of healthcare workers. Anxiety and depression not only adversely affect individual well-being but have also been shown to reduce work efficiency and increase the risk of medical errors. Accordingly, healthcare institutions should establish routine mental health screening mechanisms—especially focusing on high-risk groups—and develop processes for early detection and intervention. Moreover, providing targeted psychological support such as counselling, group therapy, and stress management training, along with the implementation of personalized interventions specifically designed for healthcare workers, is of particular importance. Improving the work environment, ensuring reasonable work arrangements, and reducing occupational burnout should be included among preventive strategies [28]. Adults experiencing stress and related health issues may improve their health status by raising body awareness and learning stress management techniques through a mindfulness-based stress reduction (MBSR) program, thereby improving well-being and alleviating stress and symptoms [41].

2.3.2. Supportive Supervision and Counselling

A supportive work environment helps reduce job stress and maintain cognitive health [31]. Support provided by managers to health care professionals during the pandemic has demonstrated psychological protective effects [31]. The research indicated that health care professionals receiving adequate social support reported reduced levels of anxiety, depression, and depersonalization, whereas those lacking adequate social support exhibited increased levels of emotional burnout [41]. For this purpose, emotional solidarity and institutional psychological support among employees remain crucial across all sectors.

2.3.3. Organizational Measures

Shift work has been highlighted as a concern for both health care professionals working in shifts in hospitals and health care institutions. Sleep disorders due to shift work are associated with negative health

effects on healthcare professionals, including loss of productivity, increased medication errors, impaired perception of safety, and decreased quality of life. A study by Mazzotta et al. emphasized that shift work causes sleep disorders in health care professionals. The study further recommended a 48-hour rest period and regular rest hours following two night shifts, underlining their significance for healthy shift work and occupational safety [35].

Paying attention to care support, ergonomic arrangements, and family support, particularly in contexts necessitating prolonged and continuous effort such as during a pandemic, may foster a perception among healthcare professionals that their contributions are recognized and appreciated by authorities, thereby boosting morale and motivation [42].

2.3.4. Biological and Physical Health Approaches

Health care professionals engaged in shift work are at a higher risk for irregular eating patterns and metabolic issues due to their work schedules. They are at increased risk group for various physical and mental health issues, including obesity, type 2 diabetes, cardiovascular diseases such as hypertension, digestive disorders, depression, and anxiety [43]. Shift work alters eating habits. Meal frequency decreases, especially during night shifts. Consuming snacks to mitigate hunger and the consequent decrease in the frequency of primary meals fosters detrimental eating practices. Working with hospital dietitians to adjust daily nutritional requirements, adding a special extra meal for night shift professionals who have missed their main meal, and distributing healthy foods to clinics for snacks can help support the nutritional and overall well-being of shift-working health care professionals [44].

Health care professionals are also at risk for physical inactivity in their free time. Research highlights that certain health care professionals engage in physical activity during work hours; however, the time they spend on physical activity and exercise in their free time is comparatively limited. Research indicates that facilitating physical exercise for health care professionals through motivating workplace engagement organizations enhances sleep quality, decreases stress levels, and positively impacts mental, physical, and emotional well-being. Such programs and raising awareness about physical activity further improve the quality of life of health care professionals [45].

3. CONCLUSION

Maintaining cognitive health in the workplace is critical to the productivity of both individuals and institutions. Health care professionals strive to enhance an individual's health status, facilitate recovery, or sustain optimal quality of life in existing circumstances. Competencies such as decision-making on pivotal matters, emergency management, and analytical reasoning are essential for health care professionals in their duties. Research determined that brain fog, a form of cognitive impairment, might impair these skills and reduce the quality of care, potentially negatively impacting both patients and health care professionals. In addition to hindering healthcare professionals in fulfilling their responsibilities toward patients, brain fog adversely affects their quality of life, job satisfaction, and social well-being. Accurately identifying the factors affecting brain fog will facilitate suitable interventions. Health care professionals can experience brain fog, negatively impacting their attention and cognitive skills, due to various factors such as their working conditions or COVID-19. To mitigate the potential adverse effects of brain fog on the quality of treatment and care provided by healthcare professionals, it is advisable to reschedule working hours, encourage healthcare professionals to adhere to a sleep schedule, promote and control healthy eating habits, establish effective health screening programs, and implement workplace policies and interventions aimed at managing anxiety. Furthermore, structured protocols could be implemented to periodically evaluate healthcare professionals' physical and cognitive fatigue, anxiety, and sleep quality. Providing health care professionals with the requisite conditions to perform and sustain their daily activities healthily will improve the quality of treatment and care. We believe that identifying negative experiences and developing corresponding solutions can facilitate significant improvements in health outcomes.

Ethical approval

Not applicable, because this article does not contain any studies with human or animal subjects.

Author contribution

Conceptualization, Ş.E.A., D.E. and K.Y.; Writing, K.Y.; Supervision, Ş.E.A. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

The authors declared that there is no conflict of interest.

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