

Stress and sleep disturbances in COVID-19 pandemic, current neurology and psychology aspects: a narrative review

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ABSTRACT

Pandemic is a phenomenon that has been occurring for decades. In the past two years, the world has again faced a pandemic situation due to coronavirus disease-19 (COVID-19) caused by severe acute respiratory syndrome coronavirus (SARS-CoV). The COVID-19 pandemic has brought the world to a standstill. People also experience psychological stress conditions in the form of anxiety, worry, and anger due to the social impacts caused by the COVID-19 pandemic as has happened in other countries. Social distancing regulations lead to an increase in psychiatric symptoms, including stress, anxiety, depression, and sleep disturbances. Sleep disturbances can also have a negative impact on health, quality of work, and the risk of bad behavior or events in the workplace, as well as the risk of work-related accidents or injuries. There is a correlation between the SARS-CoV-2 pandemic and the neuroendocrine stress axis. The ability of an organism to adapt to the stressors encountered involves the sympathoadrenal system and the hypothalamic-pituitary-adrenal (HPA) axis. The interactions between these two systems play an important role in adaptation. Excessive or chronic activation of the endocrine stress axis, which also causes feedback loop disruption, triggers and contributes to a variety of stress disorders and conditions in humans, including anxiety, sleep disorders, post-traumatic stress disorder, major depressive disorder, and job burnout.

Keywords: COVID-19, neurology, sleep disturbances, pandemic, psychology

INTRODUCTION

Pandemic is a phenomenon that has been occurring for decades. The previous pandemic occurred in 1918, namely the Spanish flu which infected 500 million people and caused the death of as many as 100 million people worldwide. In the past two years, the world has again faced a pandemic situation due to coronavirus disease-19 (COVID-19) caused by severe acute respiratory syndrome coronavirus (SARS-CoV) [1,2]. This outbreak initially appeared in China in December 2019 and was later declared as pandemic by World Health Organization (WHO) in March 2020. In Indonesia, the first case was confirmed on March 2, 2020, until finally on December 29, 2021 in Indonesia, the number of infected people has reached 4,262,351 with 144,081 deaths. The vaccination coverage that has been given has reached 260,762,328 doses [1].

The COVID-19 pandemic has brought the world to a standstill. Since the beginning of 2020, social life

has changed for many people around the world. New social restrictions and norms lead to reduced mobility [2], avoidance of public transportation, cancellation of most major events such as concerts, festivals, religious and sporting events, and temporary closure of meeting places such as cafes, restaurants, museums or theatres. The outbreak of COVID-19 and the steps taken by almost all countries in the world pose a threat to the psychological well-being of people; therefore, a focus on our immediate social environment is urgently needed [3]. Decreased social relationships and negative emotions are closely related to mortality and overall disease outcomes, and the threat of SARS-CoV-2 can exacerbate anxiety [4]. Indonesian people also experience psychological stress conditions in the form of anxiety, worry, and anger due to the social impacts caused by the COVID-19 pandemic as has happened in other countries [5].

COVID-19 pandemic has also caused sleep disturbances in the general population, health workers,

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and workers in the non-health sector. Sleep patterns, sleep quality, the diagnosis and management of sleep disorders are all greatly affected by the COVID-19 pandemic. Fear and anxiety about infection, social distancing and quarantine cause sleep disturbances in both the general population and health workers [6]. Sleep disturbances can affect a person's immune status, mental health, quality of life, and productivity. In addition, sleep disturbances can also have a negative impact on health, quality of work, and the risk of bad behavior or events in the workplace, as well as the risk of work-related accidents or injuries. In summary, the COVID-19 pandemic has caused mental health problems and sleep disturbances globally [7]. Therefore, this review would like to further discuss the psychological stress and sleep disturbances that occur during the COVID-19 pandemic.

STRESS DURING COVID-19 PANDEMIC

Stress and psychological response during the COVID-19 pandemic

The COVID-19 pandemic is causing stress for many people. Excessive fear and anxiety about this disease gives rise to strong emotions. By healthy coping mechanisms, stress will create a stronger society and community. The way a person responds to an outbreak or pandemic situation varies greatly according to their respective backgrounds and communities. Some populations have stronger responses to pandemic stress, including the elderly, individuals with chronic illnesses who are at higher risk for COVID-19, children and adolescents, healthcare professionals, and individuals with mental health conditions. Pre-existing mental health problems can worsen the impact of the stress due to pandemic. In addition, older people, especially those with decreased cognitive function, can become increasingly agitated and irritated in isolation. Children can feel fear and sadness from not being able to socialize and have to adjust to new routines at home⁸. Stress during pandemic can manifest as fears and worries about health, changes in sleep and eating patterns, sleep disturbances and, worsening health problems chronic conditions, and increased intake of alcohol, smoking, or other substances [8,9]. The most common manifestations of stress are unstable mood and irritability. Although stress is a normal response during a crisis, stress is known to cause a decrease in the immune system and immune dysregulation, which can decrease or worsen the body's condition [10]. During this pandemic, stress can be caused by knowing the number of deaths from the virus, frequent monitoring of media or social media reports, feeling isolated during quarantine, unable to see family, and experiencing financial difficulties. Thus,

mass quarantine is significantly increase anxiety or other mental health conditions [5].

Nowadays, WHO and various public health organizations around the world have made substantial efforts to tackle the COVID-19 pandemic and the stress it causes. WHO has provided a brief that summarizes the main mental health and psychosocial support considerations related to the COVID-19 pandemic. One thing to emphasize is that during a pandemic, feeling stressed and worried is common for every individual. Therefore, it is important to have good resilience and mental support during this situation. In addition, professional health workers are also assigned to prepare guidelines for handling mental health problems that will arise during the pandemic [11,12].

Stigma against the patients also leads to social avoidance or rejection. As a result of this, patients can become hopeless, avoid medical treatment, and are reluctant to adopt healthy behaviors. Stigma is usually directed at infected individuals, family members, as well as health care workers and other front-line workers [12]. WHO has published guidelines on how to reduce this negative stigma. First, WHO forbids attaching any ethnicity or location to disease names, such as "China Virus" or "Wuhan Virus." Second, avoid referring to individuals infected with the disease with the words "victims" or "cases". Third, disseminate accurate information about COVID-19, based on evidence. Finally, speak positively and try to emphasize the effectiveness of prevention and therapy for COVID-19 [13-15].

Despite all the negatives due to COVID-19, positive effects have also been observed all over the world. Societies around the world have demonstrated remarkable altruism and cooperation. Community activities during the COVID-19 outbreak include helping maintain social contact with people in self-isolation by phone calls or text messages, sharing factual messages within the community, and providing care and support to people separated from family and caregivers [9].

To overcome the COVID-19 pandemic, the Indonesian government announced a large-scale social restriction policy and urged the public to work, study, pray, and basically stay at home [16]. This new situation certainly requires adjustment and becomes a challenge for the community. Individuals with mental health problems are more likely to experience worsening and may be affected by the emotional responses evoked by the COVID-19 pandemic due to their higher susceptibility to stress compared to the general population. In addition, people with mental health disorders need to go to an outpatient clinic for regular check-ups, medication, and psychotherapy. Due to the pandemic situation and social restrictions, these regular visits have become more difficult or even impossible. Such conditions make individuals

with mental health disorders more susceptible to developing other mental health conditions such as anxiety, depression, substance addiction, or behavioral disorders [17].

Children and adolescents who are physically active will find it difficult to limit activities at home. School and extracurricular activities have been conducted online. This raises concerns that children are less physically active, longer screen time, irregular sleep patterns, unhealthy eating patterns, and a lack of social interaction with peers. All of these situations will have a potential effect on the physical and mental health of children, as well as on the well-being of the family system [18].

Based on a survey conducted by the Association of Indonesian Psychiatry (PDSKJI) on May 14, 2020 with the General Anxiety Disorder-7 questionnaire, Patient Health Questionnaire-9, and Posttraumatic Stress Disorder Check List-Civilian version-17 in DKI Jakarta, Banten, West Java, Central Java, and East Java, the most common anxiety symptoms reported by respondents included feelings of anxiety that something bad would happen, overly worried, irritable or irritated, and difficulty relaxing. Sleep problems, lack of confidence, fatigue, and loss of interest are the most commonly reported complaints of individuals with depressive symptoms [9,19,20].

SLEEP DISTURBANCES DURING THE COVID-19 PANDEMIC

During the COVID-19 pandemic, various public health policy have been implemented to reduce transmission of the virus in the community, including advice to stay at home, quarantine, and social distancing. This strategic decision had big impact for economic and social, including disruption to jobs and education. In addition, this restriction also has significant neuropsychiatric consequences for the population as a whole. Social distancing regulations lead to an increase in psychiatric symptoms, including stress, anxiety, and depression. This association appears to be due to the loneliness associated with prolonged periods of isolation or quarantine, maladaptive lifestyle changes, including sleep disturbances [21]. The idea that the COVID-19 pandemic is leading to global sleep disturbances is not surprising, given that sleep is critical to recovery, and physiological adaptation to chronic stress during wakefulness [22]. The bidirectional relationship between sleep and emotional brain function is supported by the findings of numerous studies on long-term clinical observations of co-occurring mood and sleep disorders [23].

In a study before the COVID-19 pandemic that analyzed sleep data from 41,094 subjects, socio-economic problems, ethnic minority background, shift work, unhealthy lifestyle, poor health, depressive

symptoms and obesity were found to be the main risk factors associated with poor sleep quality. The study also showed that about one-third of the total effect of socioeconomic problems on poor sleep quality is mediated through depressive symptoms [24]. Thus, susceptible individuals are at greatest risk of developing sleep disturbances due to these factors, and may experience acute, long-term sleep disturbances, and other neuropsychiatric disorders [23].

One of the earliest studies on the effects of the COVID-19 pandemic reported findings from a survey of 2,254 participants, aged 16–75 years. This survey for the first time shows the possible significant short- and long-term impact of the COVID-19 pandemic on sleep quality and anxiety levels in the UK. In the survey, six in ten people reported suffering from disturbed and unrefreshing sleep, of either shorter or longer duration, with vivid dreams [25]. A study based on a cross-sectional online survey of the UK adult population also found that 69.4% of the 843 participants had disturbed sleep patterns. Among survey participants, less than half about 44.7% had refreshing sleep, 45.6% more sleepy than before the lockdown and 65.2% reported an impact on mental health, with 25.9% reporting more alcohol consumption during the lockdown. Respondents with suspected COVID-19 were also found to have more vivid nightmares and abnormal sleep rhythms [26]. Similar findings were obtained in an online web-based study in Italy of 5,988 adults which revealed that disturbed sleep patterns were associated with higher dream memory, as well as nightmares. Other important psycho-social predictors of nightmares in this study included: anxiety, depression, quitting work, and having friends/relatives who were infected or died from COVID-19 [27]. These findings when combined, are in line with the dream continuity hypothesis as discussed further in below [23].

Some of the symptoms of sleep disturbances reported during the COVID-19 pandemic (e.g. lucid dreams) may reflect a biological response to the stress and uncertainty facing society. The structure of rapid eye movement (REM) sleep, in which most of our dreams occur, is the first to change during chronic stress, and the changes are greater than any other measurable characteristic of sleep. In addition, REM sleep plays a role in recalibrating the sensitivity and specificity of the brain's response to emotional events at both ends of the positive and negative spectrum, suggesting a two-way impact of the REM sleep disorder [28].

Neurobiological aspects affected by stress

Steenblock et al. argue that there is a correlation between the SARS-CoV-2 pandemic and the neuroendocrine stress axis. The ability of an organism to adapt to the stressors encountered involves the sym-

pathoadrenal system and the hypothalamic-pituitary-adrenal (HPA) axis. The interactions between these two systems play an important role in adaptation. At the systemic level, stressors activate the sympathetic branch of the autonomic nervous system, followed by activation of the HPA-axis. Activation of the splanchnic nerves triggers chromaffin cells in the adrenal medulla to release catecholamines, namely epinephrine and norepinephrine, to mediate the rapid response. When the HPA-axis is activated, corticotropin-releasing hormone (CRH) and arginine vasopressin (AVP) are secreted from the paraventricular nucleus of the hypothalamus. CRH and AVP then activate the anterior pituitary to secrete adrenocorticotropic hormone (ACTH), which in turn stimulates the adrenal cortex to produce corticosteroids. Glucocorticoid receptors are expressed in several brain areas in adults such as the hypothalamus, pituitary, hippocampus, and amygdala, all of which are involved in glucocorticoid feedback. An appropriate response during acute stress is critical for survival, but excessive or prolonged activation can convert the functional effects of the stress system into deleterious effects [29,30].

Excessive or chronic activation of the endocrine stress axis, which also causes feedback loop disruption, triggers and contributes to a variety of stress disorders and conditions in humans, including anxiety, sleep disorders, post-traumatic stress disorder, major depressive disorder, and job burnout. In addition, gonadal steroids can affect the HPA axis differently, resulting in different responses to stress between the sexes. Animal models and human studies show that men are at increased risk for behavioral or neurodevelopmental disorders in response to stress in prenatal and early life, whereas women have an increased risk in adolescence and throughout adulthood, especially if they have experienced life difficulties or trauma [29].

From previous coronavirus outbreaks, it is evident that survivors and health care workers are at higher risk of developing mental health disorders years after the outbreak. The long-term impact is thought to be due to morphological changes in the brain and in the hypothalamic-pituitary-adrenal (HPA) axis, coupled with very different responses to different genders. It has also been suggested that permanent epigenetic changes in stem cells may occur due to actual infection, and may also result from various forms of severe stress, further suggesting the long-term effects of the current pandemic that warrant further research [23,29].

The impacts of the COVID-19 pandemic on sleep and circadian rhythm

The COVID-19 pandemic and social distancing have resulted in restrictive lifestyle changes, with

changes to sun exposure, food, social interactions, and exercise resulting in further disruption of chronobiological rhythms. Restrictions at home also occur in an environment of anxiety, with fears of contracting COVID-19, job security, finances, and concerns about family well-being. All of these events have an impact on quality, by influencing each of the three sleep regulatory processes: the homeostatic sleep drive, the circadian rhythm, and the arousal system [23].

In the early days of the pandemic in early 2020, there were interesting differences regarded sleep changes that reported around the world. Studies from Europe, USA, and UK have reported increased sleep opportunities and sleep duration during the pandemic. These positive changes are most likely due to changes in social and environmental factors, including changes in employment practices, such as remote and flexible working. Data of 2.9 million sleep records from smartphone taken from participants on different continents showed an increase in sleep duration during the early stages of the pandemic, compared with a year earlier [31]. In one global survey, nearly three-quarters of respondents indicated that sleep patterns had also changed due to lockdowns, with the majority indicating that their bedtime and waking hours were delayed compared to before the pandemic, and 43% of respondents indicating that bedtime now is more in line with their body clock³². The increased flexibility of sleep-wake routines is clearly beneficial for members of society who are sleep deprived due to work and lifestyle commitments. However, for some, bedtime flexibility has led to irregular sleep-wake times, which are known to have adverse effects on academic performance and health outcomes. Although some benefits were reported in the early days of the pandemic, the majority of the population has shown disturbed sleep patterns and decreased sleep quality compared to pre-pandemic sleep patterns worldwide [23].

In a global survey, 73% of respondents reported poor sleep quality, with a score of >5 on the Pittsburgh Sleep Quality Index (PSQI), with approximately 57% of respondents saying sleep is worse now than before the pandemic [32]. This finding is in line with prevalence estimates from poor sleep quality by 50-55% in Italy, but much lower rates were reported around the same time in China (36%) [33,34]. This difference may be due to the majority of female respondents in some surveys potentially increasing the prevalence of poor sleep quality. Poor sleep quality has been linked to poor mental health, both before the pandemic and during the pandemic. In the same global study, it has been shown that individuals with >8 points on the PSQI have a 3-fold increase in the prevalence of significant anxiety, stress, and depressive symptoms. Further longitudinal studies are

needed to reveal the direction of this relationship. Currently, addressing sleep disturbances during social distancing can help reduce adverse effects on mental health [23].

In addition, for people who stay at home during social distancing, circadian rhythm disturbances and increased digital screen time were found. Both of these have affected the time and quality of sleep. Increased napping is also seen during social restriction and has been shown to reduce sleep stress (i.e., homeostatic sleep drive), resulting in delayed sleep time, and prolonged sleep onset latency. Arguably, slower sleep times can also adversely affect slow-wave sleep and impact overall sleep quality [35]. Thus, circadian and homeostatic factors that interact to regulate overall sleep are negatively impacted by social distancing [23].

Supporting factors and susceptible groups to sleep disorders during the COVID-19 pandemic

Recent evidence has found significant differences in sleep difficulties and mental health in certain groups. In South Africa, it is reported that the lockdown is causing significant economic hardship, especially in the poor and vulnerable groups. In addition, restrictions on mobility and the risk of transmission of COVID-19 in health care facilities in South Africa have led to a large decline in the use of health services, thereby disrupting the continuity of care for patients with HIV, tuberculosis and chronic non-communicable diseases [36]. The COVID-19 pandemic has also had a significant impact in Alzheimer's Disease (AD) and other dementia patients globally. This population has proven to be highly vulnerable not only to SARS-CoV-2 infection, but also to the negative effects of measures and policies taken to control the spread of the virus, where feelings of loneliness and isolation exacerbate and accelerate the clinical picture [37].

Globally during the pandemic, trends have been reported for slower sleep times, delayed sleep onset, reduced total sleep time and quality, and increased daytime naps. Feelings of loneliness, uncertainty, depression and anxiety related to COVID-19 are some of the important psycho-social factors that underlie this change. These changes are more pronounced in the younger population, women, populations with pre-existing neurological and psychiatric conditions, and frontline workers, the unemployed, and populations living in poor-welfare countries. This suggests that this group may be more vulnerable to the acute and long-term effects of the pandemic. The younger population (aged 45 years) was more affected during the

pandemic, with reported higher levels of stress, anxiety and depressive symptoms in that group compared to the older age group. In addition, loneliness and financial difficulties were also associated with higher mental health symptoms in this age group [23].

Similar to the gender differences in insomnia prevalence found before the pandemic, the study found women's sleep was more affected by lockdowns. In a longitudinal study in Italy, the severity of insomnia and mental health symptoms was reported to be greater in women than men during the early stages of lockdown, and these findings are in line with various other reports worldwide [38]. Both before and during the pandemic, sleep disturbances have been associated with financial difficulties, disability, and increased alcohol consumption. Behavioral factors also tend to have a direct impact on sleep during lockdown. For example, decreased sun exposure, regular exercise, and increased phone use before bedtime have been associated with poorer sleep quality [32].

CONCLUSION

There are various psychological responses in a pandemic. Stress can affect the neurological axis which can affect many things including sleep disturbances. Sleep disturbances reflect a biological response to the stress and uncertainty facing society. Sleep disturbances that occur affect the entire process of sleep regulation: homeostatic sleep drives, circadian rhythms, and arousal systems and manifest as slower sleep times, prolonged sleep onset latency, poor sleep quality, increased daytime naps, and circadian rhythm disturbances. Mental health education and psychological support from all walks of life, including the government, health workers, and the public, are urgently needed during a pandemic. Various communities need to work together to address mental health problems and sleep disorders that have occurred during the COVID-19 pandemic, by advocating good sleep practices and maintaining mental health. On an individual level, everyone needs to develop a positive outlook on this pandemic situation and try to implement the strategies that have been suggested by various health organizations to adapt to the new normal situation.

Conflict of interest

There were no financial supports or relationships between authors and any organizations that could pose any conflict of interests on this article.

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