

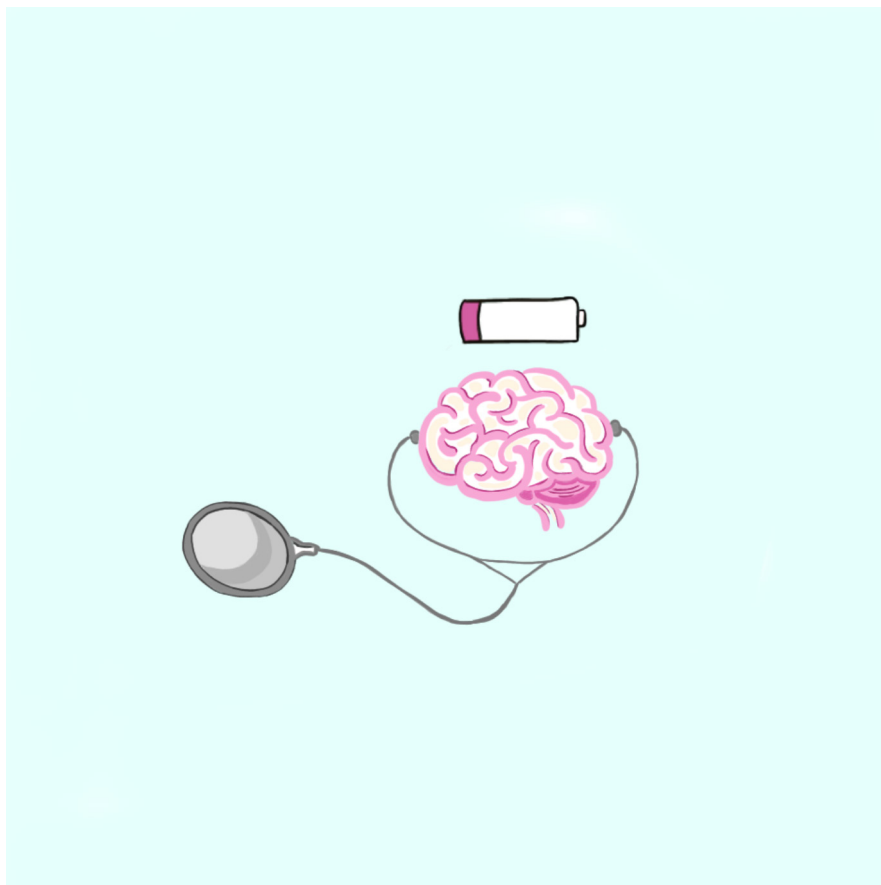
# A NEUROLOGICAL ANALYSIS OF CURRENT SOLUTIONS TO HEALTHCARE PROVIDER BURNOUT

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Most of us have all experienced situations involving high stress over an extended period of time that left us feeling exhausted. As a result, we might have felt withdrawn from our work, had low levels of energy throughout the day, and even experienced decreased efficiency. Everything felt like a never-ending chore due to the pressure. Neurological research has shown that our stress response is an innate process that is key to survival. This is performed through effects on our cognitive and physical states by influencing the brain, musculoskeletal system, and cardiovascular system [1]. However, our stress response can also lead to worsening impacts on our mental health when there are great environmental, physiological or emotional demands over a significant period of time [2]. The result of this is referred to as 'burnout syndrome' in the International Classification of Diseases [3]. Burnout syndrome is "a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed" [3].

One of the fields that is the most notable for burnout syndrome is medicine. Burnout syndrome in the healthcare industry is a well-reported issue that has been apparent for several decades. The American Medical Association (AMA) reports that most physicians work 40-60 hours a week with nearly one-quarter of physicians working 61-80 hours per week [4]. This statistic does not include the hours they have all spent working 24-hour on-call shifts repeatedly throughout their medical school and residency training. Moreover, nurses regularly work 12-hour shifts [5]. The high stress and long hours can lead to detrimental results, including workforce shortages, worsening of care for patients, and impacts on the physical, emotional and mental health of the providers [6]. It is important to manage the well-being of the healthcare staff to avoid these results. Two of the methods that have been studied to mitigate these outcomes include intermittent naps and increasing illuminance during overnight shifts [7-9]. This article will closely examine these enactments to observe whether they truly overcome provider burnout.



Sleep is a vital process for peak mental function and is characterized by a cycle known as the circadian rhythm. Our circadian rhythm describes the mental, physical, and behavioral changes that occur over a 24-hour period and is regulated by our sleep time and duration [10]. Functional magnetic resonance imaging (fMRI) is a class of imaging methods that are used to measure brain metabolism by pinpointing the regions of the brain where activity occurs over a period of time [11]. Using this method, we have found that frequent and long lapses between rest periods cause reduced metabolic activity within a network of brain regions, such as the prefrontal cortex, anterior cingulate, thalamus, basal ganglia and the cerebellum [12]. These areas play an important function on our cognitive speed, attention span, and working memory [13]. Not only the areas of cognitive speed, attention and memory are affected, but our vision and hearing are affected as well. Using fMRI techniques, a study by Chee and colleagues [14] has shown that there is significant decline in our visual activation in the occipital cortex, which is an area that is primarily involved in visual sensory processing. A decline in our visual activation affects our ability to "receive, segment and integrate visual information" [15]. The greatest decline in our visual activation during the study by Chee and colleagues [14] occurred during periods of sleep deprivation. Auditory temporal resolution is the ability to put two similar sounds in correct sequence and is seen as an aspect of auditory perception

that is affected by sleep deprivation, as shown by research from Babkoff and colleagues. This ability of auditory temporal resolution relies on the prefrontal cortex [16]. Babkoff and colleagues [16] found that one night of sleep deprivation is able to decrease function of the prefrontal cortex, which in turn reduced auditory temporal resolution by 28%. A disruption to the function in these regions can lead to underperformance in our mental and physical abilities. As a result, workers that report high fatigue levels from sleep deprivation are 70% more likely to be involved in a workplace accident [17]. Needless to say, improving the quality of sleep can have significant benefits on overall performance. Care providers that work overnight shifts are not able to follow regular sleep patterns and thus, are highly prone to these cognitive defects and workplace accidents. Although napping during shifts has been used throughout several industries, this method is very rarely used in healthcare. The Joint Commission [18] spoke on the topic of healthcare worker fatigue and patient safety in 2018 and reported that “the only way to counteract the severe consequences of sleep, is to sleep.”

A study by Geiger-Brown et al. [7] aimed to test the benefits of intermittent naps during shifts. This study was performed in one healthcare facility in the mid-Atlantic between the periods of 2012 and 2013. During this period, the researchers studied 153 naps and measured sleep level based on the Karolinska Sleepiness Scale, which is a universal scale used to assess the subjective level of sleepiness the participants are experiencing [19]. The researchers found that a high level of sleepiness was present at the beginning of 44% of these naps.

They additionally found that 1.3% of the total naps resulted in “very groggy or sluggish” feelings, 20.3% resulted in “a little bit of grogginess or sluggishness” and 56.2% resulted in feeling “alert and refreshed” by the end of the nap [7]. The researchers concluded that napping is feasible during night shifts and can result in decreased workplace sleepiness; however the perceptions and concerns of the facility managers must be addressed prior to successful implementation of naps during shifts [7]. Notably, this study only took place in one facility and included a sample of only nurses. Thus, further work should include group variance to investigate the effectiveness of this method.

Other strategies to avoid the feelings of drowsiness in healthcare workers include the use of bright lights. A main cause

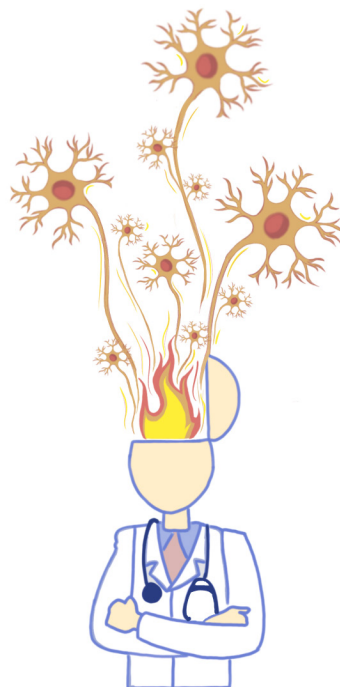
of sleepiness is melatonin, which is a hormone used to regulate circadian rhythm [20]. Melatonin is released in different amounts by the pineal gland and is dependent on light exposure [21]. Research has shown that melatonin is suppressed in the morning, increases during the evening, and is high during the nighttime [22]. A key method to block melatonin is through exposure to bright light [20]. A study published by Jensen et al. [9] tested the effects of light exposure on melatonin levels and sleep quality for 113 ICU nurses over a 10-day period. Their aim was to replicate the sunlight we face during daytime hours and alter the melatonin release from the pineal gland accordingly. They found that there were no significant differences in melatonin levels between both groups as measured by saliva samples. Through stimulation of the pineal gland that occurs within two hours prior to habitual bedtime, melatonin

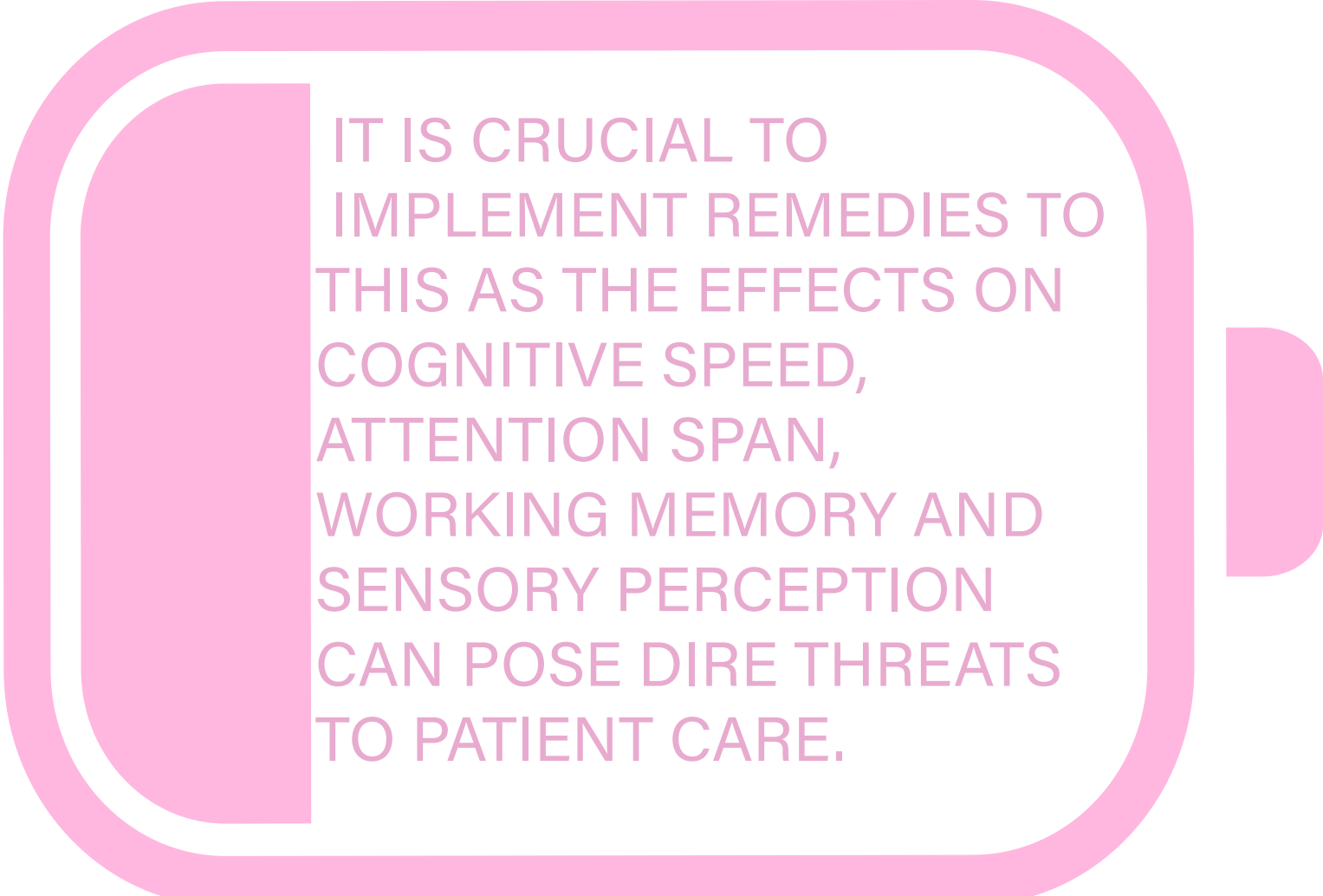
is secreted into the saliva [23]. Collection of this saliva can yield the level of melatonin during those periods. Despite this, the individuals that were exposed to bright light throughout the shift reported better sleep quality and felt more rested when awakening versus the control group that did not experience bright light throughout their shifts. Additionally, the individuals exposed to bright light experienced 16% less interruptions as they slept [9].

Another study conducted by Dr. Griepentrog’s team [8] was performed with a similar aim, except they measured psychomotor performance as well. This is the relation between cognitive commands and the motor skills that follows [24]. Among 43 nurses that were exposed to high illuminance lighting over a 24-hour period,

the level of drowsiness was much lower compared to the 43 nurses that worked through regular fluorescent hospital light based on the self-reported Stanford Sleepiness Scale [8]. This data is consistent with the previous study by Dr. Jensen’s team, which showed that bright light improved feelings of awakeness. However, the amount of errors throughout the shift increased for the individuals with high illuminance lighting. The researchers concluded that further studies are required to find the optimal amount of light that can decrease drowsiness without having any effects on psychomotor abilities [8].

All of the studies above have revealed that exposure to bright light and intermittent naps during shifts are promising solutions to decreasing sleep-related fatigue and in turn, decreasing





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burnout syndrome throughout healthcare workers. However, all the data remains inconclusive. It is crucial to implement remedies to this as the effects on cognitive speed, attention span, working memory and sensory perception can pose dire threats to patient care. This in turn can result in an increase in workplace errors through poor psychomotor responses. Actions must be taken to avoid these results. In review of the clinical studies discussed above, it is evident that the trials for intermittent naps and high illuminance lighting require further studies prior to being implemented. There is not enough evidence to support their efficiency in counteracting healthcare worker tiredness as outside factors (napping time and bright light exposure) affects each individual differently due to different genetic makeups. This paves way for additional approaches in counteracting healthcare burnout and can lead to improvement in patient care and provider well being. 🧠

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