Sleep: Adverse Childhood Experiences

Sleep is known as an important part of our daily routine. As humans, we spend about one-third of our life sleeping. Without sleep we cannot form or maintain the necessary pathways in our brain that allow us to learn, retain information, and develop. Sleep can also affect our brains, heart, lungs, immune system, mood, and disease resistance. We do not fully understand the necessity of sleep, but we do understand what happens when we sleep. When asleep, the brain uses several structures to consolidate and store memories. During this time, irrelevant information is removed from the brain, but for victims of traumatic experiences this is not the case. The brain continues to store memories, but fails to remove the “irrelevant information”, which in this case is the memories of traumatic events (Brindle, 2018). When constantly exposed to this stressor, it inhibits the ability for sleep, causing sleep disturbances. According to the American Psychological Association, up to 85% of children will experience trauma before they reach adulthood. The way children react to these forms of trauma is affected by cognition, emotional development, family dynamics, psychological background, and socioeconomic status. Understanding the implications of these factors can help create interventions for sleep health later in life.

Brain Structures

Several structures are involved within sleep within the brain. These structures are: the hypothalamus, brainstem, thalamus, cerebral cortex, pineal gland, basal forebrain, midbrain, and amygdala. The hypothalamus plays the role of a control center that affects sleep and arousal (Marshall, 2007). The brainstem communicates with the hypothalamus to control the transitions between wake and sleep (Merica, 2004) . The brain stem also plays a role in REM sleep, sending signals to relax muscles is essential for limbic movements, the thalamus acts as an information relay from the senses to the cerebral cortex, sending images, sounds, and sensations that fill our dreams (NIH, 2019). The pineal gland increases production of melatonin, which helps you sleep, and stay aligned with circadian rhythm. The amygdala is involved in processing emotions and becomes active during REM sleep.

Sleep Stages

While our brain is setting us up for “restful sleep”, we endure two stages. The two sleep stages are rapid eye movement (REM) and slow wave sleep (SWS) (Marshall, 2007). We cycle through all stages of SWS and REM several times during a typical night, with longer REM periods which occur as the morning approaches (Power, 2004). During the first stage of SWS sleep our brains are changing from wakefulness to sleep. This stage contains a short period of light sleep, while out heartbeat, brain, and eye movements slow relaxing our muscles. The second stage of SWS is where our brains transition from a period of light sleep to deep sleep. Our body temperature drops and eye movements stop. Brain wave activity is slowed, causing our brains to repeat sleep cycles in stage two. The last stage of SWS occurs in longer periods during the first half of the night. Our heartbeat and breathing is the lowest, and muscles are fully relaxed. The final stage of sleep is known as REM sleep. During REM sleep our brains are in 90 minutes cycles, and your eyes moves rapidly, brain waves become closer, and breathing is faster and irregular (McCracken, Poland, Lutchmansingh, & Edwards, 1997). Dreaming occurs during REM sleep.

As you age, sleep is occurred less in the REM cycle.

Sleep Mechanisms and Disturbances

Two internal biological mechanisms, circadian rhythm and homeostasis, work together and play a large role in regulating sleep. Circadian rhythms direct a variety of functions: wakefulness,body temperature, metabolism, release of hormones (Galavan, 2019). Our circadian rhythm controls the timing of sleep and the tendency to wake up in the morning with a 24-hour cycle, acting as the body's biological clock (Galavan, 2019). Circadian rhythm synchronizes with environmental cues about the actual time of day, but continue even with the absence of light. On the other hand, sleep-wake homeostasis keeps track of you need for sleep. The sleep-wake homeostasis reminds the body to sleep after a certain time and regulates sleep intensity.

There are many factors that influence sleep including medical conditions, medications, stress, environment, and food (Dahl & Lewin, 2002). Sleep involves, active, dynamic changing patterns and progressive stages that occur as the night progresses. Deprivation of REM sleep can cause excessive tiredness, fatigue, and emotional changes, similar to insufficient sleep. Sleep is especially important during periods of brain maturation during childhood and adolescence, making discussion of sleep relevant to understanding adolescent health and development. Adolescence is a period when problems such as distorted breathing, insomnia, agitation, and nightmares occur and interfere with sleep quality. Research has shown that lack of sleep, or poor sleep quality can increase our risk for disorders including, high blood pressure, cardiovascular disease, diabetes, depression, and obesity.

There are several studies that support general trends in normal sleep patterns across childhood (Dahl & Lewin, 2002;Sadeh, 2001). These trends reflect the physiological, developmental, and socio-environmental changes that occur across childhood. The changes that occur are: the decline in daytime and nocturnal sleep between 18 months and 5 years, a gradual shift in sleep-onset time between middle childhood to early adolescence, and irregularity of sleep patterns increasing between school and non-school bedtimes and wakefulness. There are also some evidence suggesting that sleep patterns and behaviors in children and adolescence change over time. In several studies the average sleep duration decreases across middle childhood and adolescence, and sleep duration in equivalent age groups declining over time (Owens, 2007). This trend seems to be correlated in school-aged children with later bedtimes, and adolescence with later sleep-onset.

There are various forms of sleep problems that occur throughout childhood that can be understood through the context of physical, cognitive, and emotional phenomena that occur during different developmental stages. For example, an increase in nighttime fears or waking within toddlers can be a manifestation of separation anxiety peaking during that developmental stage. Parental recognition and reporting of sleep problems in children also varies across childhood. Parents of infants and younger children are more likely to be aware of sleep concerns than those of school-aged children or adolescents. The definition of what behaviors form sleep disturbances are highly subjective and are determined by the amount of disruption in parental sleep.

The consequences of insufficient sleep have a particular impact on cognitive and emotional

functioning of adolescents. When adolescence don't have the proper amount of sleep, they have poor performance, lower grades, problems sustaining attention, and decrease in reasoning tasks (Gregory, 2011). Sleep deprivation also results in less control over emotional responses and increase in anger, irritability, and low tolerance (Mezzich, Tarter, Giancola, & Kirisci, 2001). As the evolutionary theory suggests, sleep is naturally restricted to times and places that feel safe. Safety promotes sleep, while feelings of threat of stress can inhibit sleep. Safety is particularly an issue that arises with adolescents who have been traumatized (Keeshin, 2019). Threats of safety after the loss of a close relative, or witnessing violence may likely cause short-term disturbances in sleep patterns. These threats that affect early childhood through adolescence is known as Adverse Childhood Experiences (ACEs).

Adverse Childhood Experiences

ACEs are traumatic events or stressors during childhood and early adolescence that create a pathway to a long list of behavioral, health, and social outcomes. ACEs are associated with the risk of mental disorders in one's childhood, and increase of psychopathology that enters adulthood (Green et al., 2010; McLaughlin et al., 2012; McLaughlin et al., 2013).ACE scores are cumulative, interrelated impacts on childhood development and impact a variety of health and social priorities in our country (Anda, 2008). As the ACE score increases, there is a causal increase of numerous health and social problems.

In 1995, the first ACE study demonstrated the effect of childhood maltreatment and household dysfunction on adult smoking, obesity, and excessive alcohol use. The CDC-Kaiser Permanente ACE study and subsequent surveys showed that an estimate of 59% of people have 1 or more ACE, and approximately 9% had 5 or more. The ACE pyramid represents the conceptual framework for the study and was designed to assess what was considered to be "scientific gaps" about the risk factors. The gaps have two arrows connecting ACEs to risk factors that cause health and social consequences higher up on the pyramid. The study was designed to provide data that would answer if these risk factors are not randomly distributed, but rather influenced by the development of ACEs. Through the research inspired by CDC-Kaiser Permanente there has been scientific information to fill the gaps. People with four ACEs- including experiencing an alcoholic parent, racism, bullying, witnessing violence outside the home, physical abuse, and parental divorce- have a huge risk of adult onset of chronic health problems such as heart disease, cancer, diabetes, suicide, and alcoholism. Other studies have evaluated individual ACEs as primary exposures and compared outcomes amongst people with or without ACE exposures. This method has the limitation of different referent groups for each individual ACE analysis, and thus no comparison can be made if the magnitude o f associations between outcomes and individual Aces. Findings from earlier studies demonstrate a high prevalence of ACEs in a nonrandom selection, establishing the prevalence of ACEs can provide help to target local prevention efforts.

Sleep and Trauma

In children exposed to trauma, the frequency of sleep disturbances measured by self-report or parent-report is higher than those reported a non-trauma exposed. A number of important child, parent, and environmental factors affect the type, severity and prevalence of sleep disturbances. Parental factors include parenting, mental health issues (maternal depression), medical issues, family stress, and education level can affect the child's sleep (Owens, 2007).

Environmental factors including sleep environment (space, noise, safety, surface, room), family size, and lifestyle issues also play a significant role.

Children sleep disturbances are important because they make children more irritable, disturb parent-child relationships and can lead to challenges in learning and problematic behavior with peers. Sleep disturbances are a common symptom of traumatic stress. Trauma related sleep disturbance require different understanding and responses by parents than non-trauma related sleep disturbances (Kovachy, 2013). Sleep disturbances are a key indicator of early difficulties that can worsen and resulting in long-lasting psychiatric disorders like PTSD and depression.

To cope with trauma related sleep disturbances there must be problems with pre-sleep and within-sleep. Pre-sleep is when children cannot fall asleep while in the state of hyperarousal (danger). Children avoid sleep because of trauma reminders during the day, or during their bedtime/sleep. These children are vulnerable at night and do not feel safe sleeping (Keeshin, 2019). They become afraid of sleep because they do not want nightmares or night terrors. During sleep disturbances, children experience the emotional distress of nightmares, making it difficult to go back to sleep interrupting REM cycles and SWS. Night terrors also play a frequent role in younger children, but are not a typical in older children and adolescents. Often these children are experiencing the feeling of relapse and lack of safety causing their difficulty in sleep.

Sleep and Childhood Sexual Abuse

Safety during sleep is compromised in cases of childhood sexual abuse, and may take place in the bedroom, which can therefore become a place associated with sexual violation l (Mezzich, Tarter, Giancola, & Kirisci, 2001). In addition, abuse tend to often occur at night although the child is sleeping possibly resulting in feelings of increased vulnerability during times set aside for rest. Research on the correlation between childhood sexual trauma and sleep disturbances are limited. Studies of children and adolescents who have been sexually abused report sleep disturbances being one of the varied symptoms of childhood abuse. Most studies examined the short-term effects of sexual abuse and has cautioned against focusing on the severity but rather the differential impact of abuse.

Female victims abused in childhood have reported physical and sexual victimization in adolescence and early adulthood at rates 3 to 5 times greater than those not abused. Being sleepy increases the tendency for brief mental lapses, short gaps in awareness or response, and micro sleeps. Research has shown that sleep deprivation results in the loss of attention focus, and can diminish impulse control. This connection has been established between decrease in control over emotion and lowered adolescent inhibitions. The potential connection between sleep disturbances and continued victimization of sexual abuse survivors is warranted.

Given that the adolescent period is where there are increasing demands for appraisal and responses to threat and danger, sleepy adolescents are likely placed at increased risk for revictimization. Sleep disturbances and revictimization in sexual abuse survivors is explained by the aggregate of impaired executive cognitive capacity, emotional volatility, and behavior under control. Noll et. al investigated sleep in 78 sexually abused children and 68 non-sexually abused children, the comparison between the two groups were measured using 6 self-reported questions that asked about staying asleep, trouble falling asleep, night terrors, middle of night

awakening, and feeling rested. The participants were ages 6 to 16 at the time of abuse. The results revealed significantly more sleep disturbances in sexually abused groups.

PTSD is a particular response to childhood sexual abuse, and has been identified in children immediately following the disclosure of abuse and as a long-term effect of sexual abuse(Kaplow, 2005). Further studies have linked PTSD to the adjustment problems in adolescents abused in childhood (Charuvastra, 2009). Studies attempting to connect sleep disturbance and sexual abuse should take into account persistent PTSD symptoms given then links between PTSD and sexual abuse.

Sleep and Childhood PTSD

Traditionally, sleep disturbances have been classified as a symptom of PTSD. It was presumed that treatment of PTSD would eliminate sleep disturbances. Current studies suggest sleep disturbances (insomnia and night terrors) play a key role in PTSD accompanying treatments and diagnostics. However, far more data exists on the prevalence and nature of sleep in adults with PTSD than children (Charuvastra, 2009).

Currently the knowledge sleep disorders in children with PTSD is very limited. One study suggests that 3.7% of males and 6.3% of females in a sample of 4,023 children aged 12 to 17 who had sleep disturbances met the DSM-IV diagnosis of PTSD (Kilpatrick,2003). Thabet, 2004 found that 20.3% of children between ages 3-15 reported sleep disturbances “sometimes”, and 31.6% reported sleep disturbances “most of the time”. A study conducted in Los Angeles after a playground sniper attack reported that 77.1% of children on the playground reported sleep disturbances one month following the trauma (Pynoos, 1987). After 14 months, a follow-up study showed that 57.9% of the children still reported sleep disturbances. However, there is a significant amount of variability among the studies in the amount of sleep disturbances ranging from 3% to 77.1% The broadness of results can be due to different populations, different levels of PTSD severity and diagnosis, nature and duration of trauma, sample size, age, and cultural demographics.

Most studies measure subjective sleep disturbances in children exposed to trauma (Kovachy, 2013; Kilpatrick, 2003; American Psychiatric Association, 2000). This means that not all subjects examined have developed or will develop PTSD even if they experience some symptoms of PTSD. In fact, only a small amount of individuals are diagnosed with PTSD; while others do not distinguish between individuals who have been exposed to trauma and those who have developed PTSD (Powell, 2018). Studies also varied in temporal duration between the trauma exposure and the time of sleep assessment, which also contributes to variable outcomes.

Further Research

There is relatively large-scale epidemiological data available that define normal sleep and wakefulness patterns and sleep duration in children and adolescence. Most of these studies are subjective, parent-reported, retrospective and/ or cross-selection surveys within selected populations. Although the studies yield important information regarding sleep within discrete age groups, they do not describe the evolution of sleep patterns over time; nor do they help elucidate the development from prenatal period to adolescence. There is more data provided

from studies using methods of measuring sleep quality and duration. Many of which were conducted before the establishment of sleep monitoring and scoring. These studies support several general trends in normal sleep patterns across childhood.

Findings from previous studies have shown a retrospective reports from adolescent participants of when and what adversity they were exposed to in relation to sleep disturbances. As a result there is a gap in memory or the lack of comfortability to share personal matters. This retrospective approach can change the results of the data, and it's true effect on sleep disturbances. Since children studies have shown the recall of age and event of adversity; in order to track its prevalence over time there must be a follow up of the exact participants.

Another limitation that is present within current childhood and adolescent studies, are the types of adversity (trauma). With the ACE score, the different types of traumas are grouped together and used to determine health outcomes. This means that the same can be used to determine sleep disturbances instead of isolating singular forms of adversity. Secondly, the age of first exposure should be examined in order to understand the notion of sensitive periods. The sensitive periods are when the effect of exposure to childhood adversity is most pronounced. In order to do this there must be the replication of previous findings, where there is an evaluation of dose-response relationships between the types of adversity and sleep disturbances. By examining these limitations in the future, physicians and providers may be able to reduce long term correlations between ACEs and sleep.