Sleep, Memory, & Learning in Children: A Synthesis of the Scientific Literature

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I. **The Important Role of Sleep in Memory Consolidation: A Scientific Overview**

Many of us wish we had a better memory, particularly the night before a big exam or project. Conventional wisdom tells us to "get a good night's sleep," but this old adage seems outdated in our fast-paced world. The purpose of this summary is to review the neurobiological evidence supporting "a good night's sleep" as one of the critical supports to optimize learning and memory. And, the good news is that many aspects of our sleep routine and schedule are under our control and can be improved with disciplined practice, thereby improving our sleep quality and memory.

We spend approximately 1/3 of our lives sleeping, but that time remains inaccessible to our consciousness making the functions of sleep somewhat mysterious. Nevertheless, recent neuroscience research has made impressive progress in clarifying the nature of sleep and its functions, highlighting its role in learning and memory. New memories are fragile until they are "consolidated," meaning that the memory is "stabilized and stored" (Hernandez, 2011) and integrated with existing memories, facilitating retention and later recall. Sleep is critical to this consolidation process. If you think about the vast array of experiences and information that we encounter in our day, and how much of it 'falls out' of memory soon after, it is not surprising that a consolidation process is needed to store and retrieve this information efficiently. A technology metaphor may serve to illustrate the purpose of consolidation. Think of a specific piece of information that you encountered in your day and would like to remember as akin to a useful website that you have discovered while surfing the internet. This website is important and you would like to remember it for the future, but the challenge is that this website is embedded within a complex array of additional information (i.e., the internet). Consolidation is akin to the process of moving this website to a bookmark folder, organizing it with other related websites, and tagging it for easy retrieval. Without this consolidation process, it would be difficult to find this website again, particularly if you wanted to return a few days or weeks after discovering the site. In other words, consolidation is key for memory retrieval; memories are only useful to our learning if we can retrieve them when needed. Sleep is the brain's internal organizing process, grouping old and new information and tagging the information for retrieval in the future.

Memories can be divided into two types: episodic and procedural. Episodic memories involve specific memories of facts, events, and experiences, such as math facts, dates from history, or your previous birthday party. Procedural memories are memories of particular actions, such as riding a bike, tying your shoes, or playing a new scale on the piano. Importantly, sleep is critical for the consolidation of both types of memories, although there are differences in the brain regions that accomplish this task and in the phases of sleep that are most beneficial for each type of memory. Slow-wave sleep (SWS) which is concentrated in the first part of the night, is most strongly linked to improvements in episodic memory, whereas rapid eye movement (REM) sleep is most strongly linked to improvements in procedural memory (Diekelmann, 2010; Payne, 2011). These patterns mean that a full night's sleep is necessary to gain the maximal benefit for both episodic and procedural memory.

The role of sleep in memory consolidation has been worked out through experiments that carefully control for the effects of time of day and the passage of time while isolating the effects of sleep. The consensus of this research is that performance on episodic and procedural memory tasks improves after episodes of sleep, compared to a matched period of wakefulness (Diekelmann, 2010). This improvement is remarkable considering that the research participants in the sleep conditions did not rehearse the information or practice the task further, they only
slept. There are very few instances in which our learning and memory improves without a lot of concentrated effort, but sleep seems to be one of them.

How does the brain accomplish consolidation? Research in animal models and humans suggests that neural circuits that were active during the initial encoding of information are re-activated during consolidation. This re-activation process is believed to “stabilize” the memory. In humans and animal models, it is clear that the spatial layout and timing of neural firing that accompanies the initial learning is re-activated during sleep (Wilson, 1994; Peigneux, 2004); that is, the brain appears to repeat the initial neurological process, and “re-learn” during sleep. These results imply that our brain works in a sequenced and organized manner to consolidate memories while we are sleeping.

One controversy in the area of sleep research is whether sleep is passive or active in the consolidation process (Diekelmann, 2010). In other words, does sleep facilitate consolidation by simply preventing interference from other information while unconscious, or does sleep actively participate in the consolidation process? Although the controversy continues, evidence pointing to a new understanding of previously learned information after sleep supports the active consolidation argument. For example, many of us have experienced an “aha” moment regarding a difficult problem after a night’s sleep. These anecdotal experiences are supported by research documenting an increase in problem-solving ability after sleep compared to an equivalent time of wakefulness.

Taken together, the evidence is clear that sleep is important for memory consolidation across different forms of memory, both facts and events (like historical facts and autobiographical memories) and motor memories (playing a sport, learning a musical instrument). Although we think of sleep as a time of rest, in reality, our brain is working in a methodical, organized fashion to consolidate memories while we are sleeping. After a period of sleep, even without any additional practice, performance improves on memory tasks. The improvement in performance may even be accompanied by a new insight into a difficult problem or a discovery of new relationships between previously unconnected pieces of information. Societal pressures and technological innovations have been gradually eroding the value we place on sleep and our sleep habits. Nevertheless, the neurobiological evidence suggests that time spent sleeping is far from wasted, but instead is critical to efficient cognition. The recommendation to “sleep on it” predates much of this neurobiology, but continues to be wise advice.

For further reading:


II. **Sleep: We all do it—but WHY?**

We all do it... maybe at different times of the day or night... or for varying stretches of time, but we all sleep! Exhausted parents falling into bed, barely catching a glimpse of the evening news before quickly drifting off; wakeful children who resist bedtime and need “just one more story” before resting; night owl adolescents who beg and plead for “10 more minutes” of the latest TV show, text messaging time, or computer video game; whichever you are, quality sleep is needed in order to restore our bodies and minds.

The use of EEG’s has allowed scientists to study the electrical activity of the brain during sleep and determine that sleep is indeed a dynamic behavior. Sleep science research is certainly technical, but it can be agreed that there are two main types of sleep: NREM or “non rapid eye movement” and REM or “rapid eye movement.” All sleep cycles begin with NREM, which has three distinct stages.

➢ **N1:** This stage occurs right after a person dozes off to sleep and lasts 1-7 minutes
➢ **N2:** This stage is characterized by the development of sleep spindles, which are brief bursts of fast activity that activate specific areas of the brain such as the hippocampus and prefrontal cortex. Both of these areas are critical for learning. N2, also known as “spindle sleep” is the time when memory consolidation occurs. N2 lasts approximately 10-25 minutes, but is typically the stage in which we spend our most time sleeping due to the ascent through the N3 and N2 stages on the way to REM sleep.
➢ **N3:** This is the deepest stage of sleep and is sometimes referred to as “delta” “deep” or “slow wave sleep.” Sleep spindles now take the form of large, slow waves versus the N2 short, fast waves. In N3, memory reorganization takes place; moving memories (or learned activities) from temporary storage to long-term storage through memory consolidation (Diekelmann & Born, 2010). During this stage it is difficult to wake someone and upon waking from the N3 stage, most feel very groggy and disoriented, as this is NOT the ideal stage for waking. N3 sleep typically lasts 20-40 minutes.

Once N3 has been completed, sleepers cycle back through N2 and then hit the REM or “rapid eye movement” stage of sleep. REM is characterized by small, fast, eye movements and is considered an active stage of sleeping. It is during that REM that we dream. This stage comprises 20-25% of our total sleep per night and is the ideal stage from which to wake in order to feel rested. Throughout the night, our sleep cycles alternate NREM and REM with the first cycle lasting approximately 70-100 minutes and all subsequent cycles 90-120 minutes.

It is important to be aware of recommended hours of sleep –

- 5-12 years of age: 10-11 hours per night
- 12-18 years of age: 8.5-10 hours per night
- Between 12 and 18 years old, adolescents circadian rhythms delay the sleep phase so that they prefer to go to sleep later and wake later, which often leads to sleep deprivation due to schools early start times. (Gomez, Newman-Smith, & Bootzin, 2011)

Yet, research has shown that the QUALITY of sleep one gets each night is more important than the QUANTITY of sleep. Spending too little time in N2 and N3 sleep cuts off spindle activity and has been linked to delayed vocabulary development, lower grades and school performance in general, lower intelligence scores, and compromised working memory performance (Gomez, Newman-Smith, & Bootzin, 2011; Owens et. al, 2013). There are several factors that can
contribute to poor sleep quality including stress, anxiety, medication, exercise, melatonin inhibiting devices (such as ipods, phones, video games, and television exposure immediately before going to sleep), excessive movement during sleep, and snoring (Thakker, 2013).

III. **There’s an app for that!**

Current sleep research is focusing on how sleep gives our brains time to consolidate and summarize our daily experiences into long term memories. The brain also builds associations and connections between new and old memories during sleep. These brain functions occur during the deepest part of our regular sleep cycles called slow-wave sleep. These critical periods of sleep typically occur every two hours during normal sleep. Sleep disruptions can interfere with slow wave sleep reducing the opportunity for memory consolidation.

As the importance of sleep quality, not just sleep quantity, becomes more clear, finding ways to measure the nature of the sleep we do get becomes important. As part of our investigations into sleep we experimented with Sleep Cycle, an app that both logs the number of hours of sleep we get and also gives snapshot of the quality of that sleep. It monitors the amount of movements you make while asleep using the accelerometer motion sensors on digital devices and then analyzes the data to show your sleep cycles throughout the night.

After a week of monitoring the app can provide a quality of sleep index each morning. It also provides an alarm clock function that will wake you up at the optimal point in your sleep cycle. By setting a window, say between 6:00 and 6:30, for the alarm to sound, you avoid waking up from your deepest sleep. There is also an option to enter notes on your sleep such as your mood upon waking and any other variable you might want to track.

The app provides interesting but perhaps simplistic information to help us improve our sleep habits. But many of the tools it provides are useful and might help a child take more ownership of their sleep rituals. Just recording the number of hours we are asleep is useful. And experimenting with the app to see if the amount of caffeine, chocolate, exercise, stress, light, noise, etc impacts the daily sleep report can give us a better understanding of our sleep habits.
We expect to see more sophisticated, purpose built devices and apps in the near future that will more accurately measure the nature of our sleep patterns. Devices and software to directly analyze the different components of our sleep such as REM and slow-wave sleep could give us better information and tools to understand sleep patterns and improve sleep quality. In the mean time, sleep apps can be a useful tool for all of us to become more aware of our sleep habits and be better rested, focused and alert during the day.

IV. **Is Your Child Sleep Deprived? What Sleep Deprivation Looks Like During the Waking Hours**

Sleep deprivation is a chronic problem in our modern culture. The signs and symptoms of sleep deficits can vary depending on the age the person, in addition to there being individual differences. A sleep deficiency can also look much like an attention deficit disorder. Moreover, children diagnosed with attention deficit disorders and/or sensory processing disorders often also have difficulty with the quality or the amount of sleep they get. So, the question is what does sleep deprivation look like during the waking hours in our younger children and teenagers?

Sleep deprivation in children can look strikingly different than it does in adults, making it difficult to recognize. Children experiencing lack of sleep often exhibit hyperactivity (being overly active), a symptom less commonly seen in adolescents and adults. Children also often have problems paying attention or concentrating and they sometimes can exhibit excessive emotional reactions, frequent mood changes (mood dysregulation), poor impulse control, and behavior problems. School performance may be poorer. Furthermore, children may be more prone to accidental injuries.

Adolescents experiencing sleep deficits may be more likely to experience excessive daytime sleepiness and poor concentration. They may appear depressed or anxious. Poor sleep quality has also been associated with higher risk of automobile crashes in adolescents, as well as increased risk-taking behaviors. Academic performance is frequently impacted, and research is currently looking into the impact of sleep deprivation on executive functioning skills. The hyperactivity observed in younger children is not as frequently seen in adolescents.

As is the case with adults, snoring or any other sleep-related breathing problem in children or adolescents may lead to sleep disruption. Sleep deprivation, even in young children, may be thus due to Obstructive Sleep Apnea (OSA). Research into the effects of various breathing disorders on sleep in children (under the umbrella term ‘Sleep Disordered Breathing,’ or SDB), is being conducted, as well as on other disorders such as Restless Leg Syndrome (RLS), and Periodic Limb Movement Disorder (PLMD). As mentioned earlier, sleep deprivation may look like an attention deficit disorder, and research is finding links between the two.

Sleep deprivation can have a profound impact on children and adolescents, although the symptoms may differ among age groups. Being alert to the varying and sometimes misleading signs of a sleep deficit is the first step towards improving sleep, and the many aspects of life it affects.

**Useful websites related to this topic include:**

http://www.nhlbi.nih.gov/health/health-topics/topics/sdd/howmuch.html
http://www.helpguide.org/life/sleeping.htm

Some useful articles found on these websites:

- What Are the Signs and Symptoms of Problem Sleepiness? National Institutes of Health (NIH), Health Information for the Public

- ‘Children and Sleep,’ National Sleep Foundation Sleep Facts and Information

The following table, from the article ‘The Neurocognitive Effects of Sleep Disruption in Children and Adolescents’ by Louise M. O’Brien, Ph.D, notes the daytime effects of sleep disorders.

<table>
<thead>
<tr>
<th></th>
<th>Hyperactivity / Impulsivity</th>
<th>Inattention</th>
<th>ADHD Symptoms</th>
<th>Aggression / Conduct Problems</th>
<th>Poor School Performance</th>
<th>Depression / Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor sleep hygiene</td>
<td>√</td>
<td>√</td>
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<td>√</td>
<td>√</td>
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<tr>
<td>Sleep restriction</td>
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<td>√</td>
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<td>Circadian rhythm problem</td>
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<td>SDB</td>
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<tr>
<td>RLS/PLM</td>
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<tr>
<td>Narcolepsy</td>
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<td>Insomnia</td>
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</tbody>
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Abbreviations: √, published literature supports association; -, nonpublished data; ADHD, attention-deficit hyperactivity disorder; RLS/PLM, restless leg syndrome/periodic leg movements; SDB, sleep-disordered breathing.

The following table is from the article ‘Sleep Disorders in Children and Adolescents,’ http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1432166/.
When should a general practitioner refer a child to a sleep specialist?

- The child chronically feels unrefreshed on waking up in the morning
- The school age child finds it difficult to stay awake in the classroom
- The school age child habitually falls asleep in the classroom or while riding in a car or train for less than half an hour, or naps on returning home from school
- The child habitually snores
- The child has difficulty falling asleep or staying asleep through the night that lasts over a month
- The child has unexplained night time behaviors that keep family members awake

NIH recommendations for amounts of sleep by age are as follows. This chart can be found at http://www.nhlbi.nih.gov/health/health-topics/topics/sdd/howmuch.html.

<table>
<thead>
<tr>
<th>Age</th>
<th>Recommended Amount of Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborns</td>
<td>16–18 hours a day</td>
</tr>
<tr>
<td>Preschool-aged children</td>
<td>11–12 hours a day</td>
</tr>
<tr>
<td>School-aged children</td>
<td>At least 10 hours a day</td>
</tr>
<tr>
<td>Teens</td>
<td>9–10 hours a day</td>
</tr>
<tr>
<td>Adults (including the elderly)</td>
<td>7–8 hours a day</td>
</tr>
</tbody>
</table>
V. **Sleep & ADHD: The State of the Science**

It is well-established in the learning disabilities community that Attention-Deficit/ Hyperactivity Disorder (ADHD) and learning disorders co-occur to a significant degree. Studies have found that anywhere from 15 to upwards of 30% of students with diagnosed learning disorders also exhibit significant enough symptoms of attention, hyperactivity, and/or impulsivity to meet criteria for ADHD as well. Where we find learning problems, we often find attention problems as well.

One pattern that has been less well-known until recently involves the relationship between sleep and ADHD. Over the past several years, however, researchers have begun to investigate the phenomenon of sleep disturbances in children with ADHD, and have unearthed some striking patterns.

For example, research studies have documented sleep difficulties in an estimated 25% to 50% of children and adolescents with ADHD. Those numbers are high enough to warrant thorough sleep interviews by primary care providers for all children diagnosed with ADHD. These sleep difficulties can take a variety of forms. The sleep difficulties most commonly associated with ADHD include delayed sleep onset (or bedtime resistance), night awakening, sleep disordered breathing (Obstructive Sleep Apnea, or OSA), and restless leg syndrome. The causal nature of these relationships is yet to be determined, and is currently being investigated by researchers. In general, there are three specific patterns of causality, which may explain these relationships.

One pattern has symptoms of ADHD either causing, or exacerbating, sleep difficulties. This is best illustrated by the relationship between ADHD and delayed sleep onset. Children with ADHD are often characterized by restlessness, difficulty settling down, and high energy levels. Many parents can attest to the fact that this level of energy often does not quiet down in the evenings, as bedtime approaches. As a result, it can often be difficult –a battle, even – to get these children to calm down and prepare for bed at a reasonable time. When this pattern of bedtime resistance becomes chronic, it is termed delayed sleep onset, which can lead to reduced sleep overall as well as to a host of other daytime symptoms, including irritability, inattention, poor concentration, and memory difficulties. In a nutshell: ADHD symptoms lead to sleep difficulties, and chronic sleep difficulties lead to greater ADHD symptoms. The cycle continues, and we see restless, hyperactive, overtired children who habitually have trouble settling down for bed at night, and their frustrated, exhausted parents.

The second causal model involves sleep problems leading to, exacerbating, or even mimicking, ADHD symptoms. This hypothesized connection may be at play in children with obstructive sleep apnea (OSA), or sleep-disordered breathing. OSA occurs when breathing repeatedly stops and starts during sleep. The most noticeable sign of OSA is snoring, and it is most common in individuals who are overweight. Importantly, OSA interferes with the essential restorative functions of sleep. That is, the normal brain wave patterns present during sleep – including both Rapid Eye Movement (REM) and Non-Rapid Eye Movement (NREM) phases – play a number of critical roles during our waking life. One of these functions involves allowing the brain, particularly the prefrontal cortex, to recover from its daily activities. The prefrontal cortex is the area of the brain most associated with executive functioning; that is, the brain’s ability to focus, sustain and shift attention, inhibit impulses, and remain on-task. Another brain function that is dependent upon these sleep cycles is the consolidation of memories formed during the day. In
other words, OSA interferes with the nightly neural processes that are central to sustaining and directing attention, managing impulsivity, and consolidating memories. If OSA leads to disruption in these neural processes, is it possible that, in some cases, what we see during the day as ADHD, might be the daytime result of breathing problems occurring during sleep? This is one of the questions being addressed by researchers studying sleep and ADHD.

The final model of causality between sleep and ADHD that is currently being investigated can be termed the ‘common pathway model.’ This hypothesis involves the presence of a risk, or causal, factor for both ADHD and dysregulated sleep. There are several different ways that such a relationship can manifest. For example, researchers have found that up to 44% of children with ADHD have symptoms of restless leg syndrome, a common form of sleep disturbance, and there is evidence that the two disorders might share a neurotransmitter dysfunction. Specifically, patients with restless leg syndrome and a particular subset of children with ADHD might share a common dysfunction in the dopamine system that could produce ADHD and restless leg syndrome. These findings are still preliminary, but they point to an intriguing possibility that ADHD and sleep disturbances co-occur because, at times, they result from a common genetic or neurotransmitter-related factor.

These models are in no way exclusive of one another. That is, the relationship between ADHD and sleep disturbances are clearly complicated, and take a number of forms. And, scientists are just beginning to understand how these, and other, disorders are related to one another. What is exciting is that it is a relationship that has previously been largely overlooked by both researchers and clinicians, is now beginning to be understood. This growing literature has garnered increasing media attention in recent years (http://www.nytimes.com/2013/04/28/opinion/sunday/diagnosing-the-wrong-deficit.html), with important implications for both the medical providers who work with these children, and the parents trying to figure out how best to help them.

These new directions hold great promise for both our children, and their families.
VI.  **The Impact of Improved Sleep on Memory & Learning: Even a little helps a lot**

Sleep loss and memory
Numerous studies have shown that sleep plays an integral role in memory and attention. A long line of research tells us that a good night’s sleep can be critical in helping the brain to solidify memories learned during the day, and effects of sleep loss can be observed even if one loses sleep for just a few nights in a row. When sleep loss occurs for longer periods of time a range of symptoms may appear, including: reduced academic performance, weaker memory for both learned information and for behaviors, attention difficulties, and reduced performance in a range of neurocognitive skills.

**Does my child need more sleep?**
Chronic sleep loss is a widespread issue for children in America with busy after-school schedules and early wake-up times for school. While some kids may actually need more or less than the recommended amounts of sleep, the National Sleep Foundation recommends 10-11 hours of sleep for the school-aged child, and 8.5-9.25 hours for teenagers. That means that a school-aged child who wakes up at 7am would need to be asleep by 9pm -- and therefore in bed before that time -- to get a sufficient night’s sleep. Factoring in after-school activities, homework, and social networking, it is clear that a large number of kids and teenagers receive far less sleep than this on a regular basis. In addition, it is important to consider not just the number of hours of sleep, but whether this sleep is mostly undisturbed. It is best to consult with your child’s doctor if you suspect a disturbance in quality of sleep. If your child is already getting the recommended hours of undisturbed sleep, then increasing sleep will probably not result in any functional academic changes.

**Even a little can help a lot**
In the case where a child is not getting enough sleep, research suggests that the negative side effects of sleep loss are reversible when length and quality of sleep are restored. In fact, in some cases improved outcomes can be observed with as little as three nights in a row of increasing sleep by 30-60 minutes. When sleep quality is improved over longer periods of time, research shows that memory and attention weaknesses associated with this sleep loss are reversible.

**Will a nap help?**
Incorporating naps into your child’s schedule may also counteract the effects of insufficient sleep, though research on the timing and quality of a nap has been inconclusive so far. While napping has been shown to help solidify some types of memories, if the nap is not timed correctly it may cause drowsiness following the nap and may make it more difficult to fall asleep at bedtime. Some children may experience increased drowsiness following a nap especially if it is too short or too long. Even though the research is inconclusive on the timing of naps, it may be worthwhile to experiment with incorporating naps into your child’s schedule. If your child is tired throughout the day or has difficulty waking up in the morning, try adding a nap of at least 30 minutes and take note if there are any differences in attention or wakefulness.

**Take Notes**
Determining if your child is getting enough sleep is no easy task. Before making changes to your child’s schedule, it may be helpful to just keep track of how much sleep your child is getting along with anecdotal notes such as “sleepy today” or “difficulty paying attention while doing homework.” Then, continue taking notes when changing a bedtime or adding naps. Remember,
you are unlikely to see changes after one day and it may take a few days or even longer to notice a pattern. Apps such as Sleep Cycle or Sleepbot can help with keeping track over a longer period of time.

VII. **Sleep Hygiene**

**What is Sleep Hygiene?**

Sleep hygiene is a term to describe the behaviors, habits and environmental factors that surround sleep.

Healthy sleep hygiene involves the choices and decisions we make that promote healthy sleep and at the same time help to prevent the emergence of sleep problems, such as struggling to fall asleep, insomnia, and waking in the middle of the night. Helping children and teenagers develop healthy sleep hygiene is one of the less talked about, but on less important, aspects of parenting.

**Why is Sleep Important?**

Adults are recommended as needing 7-8 hours per night of sleep, teens are recommended as needing 9-10 hours per night and school-aged children are recommended to receive at least 10 hours per night. However, it is important to remember that good sleep is not simply the length of time one is asleep but also the quality of the sleep. Individuals need uninterrupted sleep in order to experience the normal sleep cycle in several waves over the course of the night. Frequent interruptions can interfere with the benefits of sleep, leaving a person tired and fatigued during the day.

**10 Tips and Strategies for a Healthy Sleep Routine:**

1. Aim to have your child go to bed at the same time each night and rise at the same time each weekday. It is also important that weekend bedtime routines not be too different from weekday schedules, as it can lead to difficulty transitioning between routines at the beginning of the week. This will help to set your child's internal clock/biological rhythm and use natural light as a natural biological signal. When it is light out we are awake and the body suppresses the making of melatonin that helps to control sleep and wake cycles. When it is dark the body increases its production of melatonin through much of the night, and then decreases it during the early morning hours.

2. Create a bedroom environment for your child that is quiet, dark, and relaxing with a comfortable bed/space. You want your child to use their bed primarily for sleep and to limit such activities as doing homework, watching TV/playing video games, and listening to music in bed. Many kids and teenagers do homework and use electronic media on their bed, which can make falling asleep and staying asleep more difficult. The goal is for their bed to be associated with relaxation, not stimulation. Sleeping in their bed each night, rather than falling asleep on the couch, in someone else’s bed, or in front of the television, promoted good sleep as well.

3. Create a relaxing bedtime routine that helps to settle your child both physically and mentally. This routine will provide your child with a transition period when they can
prepare themselves both mentally and physically for going to sleep. The transition period from wake to sleep may help to settle/distract the mind from day to day worries or concerns. For example, have your child spend fifteen or twenty minutes changing their clothes, washing up, putting things away, and reading or listening to a book for a few minutes before turning the light off.

4. Do not have your child go to sleep until they are actually tired. If you try to force your child to go to sleep when they are clearly not tired they will most likely just toss and turn and become frustrated and even more awake. If they do go to bed and can’t fall asleep after twenty minutes, have them get up and get out of bed and engage in a relaxing activity, such as reading or listening to calming music; avoid screen or social-networking activities at this time, which tend to promote wakefulness. The important point is not to let bed and bedtime be a focus of frustration.

5. Avoid eating a large meal before bedtime, although a small snack may help your child to settle. Indigestion has been found to interfere with sleep. In addition, it is OK to have your child drink enough liquid before bedtime so as to not wake up thirsty but not too much that will result in needing to use the bathroom in the middle of the night.

6. Have your child avoid strenuous exercise four hours before bedtime because it will stimulate them. However, some exercise can support good sleep. Vigorous exercise earlier in the day can contribute to your child being tired when it is time to go to sleep, and relaxing exercise just before bedtime such as yoga can aid in their sleep. In addition, you can have your child practice relaxation techniques before bedtime, such as deep breathing, progressive muscle relaxation, or visualizing a peaceful or relaxing memory.

7. Have your child avoid caffeinated/high sugar sodas and drinks before bedtime. Caffeine and high sugar drinks stimulate the body and make it more difficult to fall asleep.

8. If your child needs a nap during the day, the earlier the better. We want their body to be tired at bedtime and lengthy naps or naps close to bedtime will interfere with their body’s short-term need for sleep.

9. Help your child limit or avoid screen time immediately before bedtime. The use of video games, TV, or the use of social media can act to stimulate the brain interfering with a child’s ability to relax. In addition, light has been found to suppress the production of melatonin that is necessary for the onset of sleep.

10. Avoid stressful conversation and topics before bedtime. Emotionally stressful conversations and thoughts and worries will actively interfere with a child’s ability to mentally settle themselves for sleep. Postponing troubling conversations or scheduling
time to address specific concerns the following day may help to place your child in a calm and relaxed state, which is a necessary first step to falling asleep.

Developing a healthy sleep routine and practicing good sleep hygiene is a very individual process. It is important to think about what your child is currently doing to foster positive sleep behaviors and habits and whether their bedroom environment may support or hinder this goal. The tips and strategies listed above are widely reported to be important aspects of sleep hygiene that promote healthy sleep. If your child is experiencing chronic sleep issues, it is recommended that you consult with a medical doctor to rule out a medical cause for your child’s sleep problems.