

Why children need more sleep

Children sleep an hour less today than 30 years ago – and it's having a dramatic effect on their intelligence, behaviour and obesity levels



A schoolgirl asleep at her desk. Even half an hour less sleep a night can affect children's ability to learn. Photograph: Getty

Morgan Fichter is a 10-year-old from New Jersey in the US. Her father, Bill, is a police officer on duty until 3am. Her mother, Heather, works part-time, -devoting herself to taking Morgan and her brother to their many activities.

Morgan plays football, but her first love is competitive swimming. She is also a violinist in the school orchestra, with two practices and a private lesson each week, on top of the five nights she practises alone. Every night, Heather and Morgan sit down to her homework, then watch the Learning channel.

Morgan has always appeared to be an enthusiastic, well-balanced child. But once she spent a year in the classroom of a very critical teacher, she could no longer unwind at night. -Despite a -reasonable bedtime of 9.30pm, she would lie awake in frustration until 11.30pm, sometimes midnight.

During the day, she was crabby and prone to crying easily. Occasionally, she fell asleep in class. Heather began to worry why her daughter couldn't sleep. Was it stress, or hormones?

Concerned about Morgan's well-being, Heather asked the paediatrician about her daughter's sleeping habits. "He didn't seem interested," she -recalls. "He said, 'So, she gets tired once in a while. She'll outgrow it.'"

The opinion of the paediatrician is typical. According to surveys by the [National Sleep Foundation](#), 90% of American parents think their child is getting enough sleep.

The kids themselves say otherwise: 60% of [children](#) in high school report extreme daytime sleepiness. A quarter admit that their grades have dropped because of it. Depending on which study you look at, anywhere from a fifth to a third are falling asleep in class at least once a week.

The figures more than back them up. Half of all adolescents get less than seven hours of sleep on weeknights. By secondary school, according to studies by [Dr Frederick Danner, of the University of Kentucky](#), they average only slightly more than 6.5 hours of sleep a night. We all remember being tired at school, but not to the same extent as today's pupils.

It is an overlooked fact that children get an hour less sleep every night than they did 30 years ago. While modern parents obsess about their babies' sleep, this concern falls off the priority list after pre-school. Even pre-schoolers get 30 minutes less a night than they used to.

There are as many causes for this lost hour of sleep as there are types of [family](#). Overscheduling of activities, homework, lax bedtimes, television sets and mobile phones in the bedroom all contribute. So does guilt; home from work after dark, parents want time with the children and are reluctant to order them to bed. All these reasons converge on the fact that until now, we could ignore the lost hour because we didn't know the true cost to children.

However, sleep scientists have been able to isolate and measure the impact of this single lost hour. Because children's brains are a work in progress until the age of 21, and because much of that work is done while a child is asleep, this lost hour appears to have an exponential impact on children that it simply doesn't have on adults.

The surprise is not merely that sleep matters – but how much it matters, demonstrably, not just to academic performance and emotional stability, but to phenomena assumed to be entirely unrelated, such as the international obesity epidemic and the rise of attention deficit hyperactivity disorder (ADHD).

Some scientists theorise that sleep problems during formative years can cause permanent changes in the brain structure – damage that a child can't sleep off. It's even possible that many of the hallmark characteristics of adolescence – moodiness, depression, and even binge-eating – are symptoms of chronic sleep deprivation. [Dr Avi Sadeh, of Tel Aviv University](#), is a clinical psychologist. A couple of years ago, he sent 77 nine and 11-year-olds home with randomly drawn instructions to either go to bed earlier or stay up later, for three nights. Sadeh's team found that the first group managed to get 30 minutes more true sleep a night. The latter group got 31 minutes less of true sleep.

After the third night's sleep, a researcher went to the school in the morning to give the children a test of neurobiological functioning. The effect was sizeable. The performance gap caused by an hour's difference in sleep was bigger than the gap between a normal nine-year-old and a normal 11-year-old. Which is another way of saying that a slightly sleepy 11-year-old will perform in class like a nine-year-old. "A loss of one hour of sleep

is equivalent to [the loss of] two years of cognitive maturation and development," Sadeh explains.

Sadeh's findings are consistent with a number of other researchers' work – all of which points to the large academic consequences of small sleep differences. Dr Monique LeBourgeois, of Brown University, in Rhode Island, studies how sleep affects under-fives. Virtually all young children are -allowed to stay up later at weekends. They don't get less sleep, and they are not sleep -deprived – they merely shift their sleep to later at night on -Fridays and Saturdays. However, she has -discovered that the sleep-shift factor alone affects performance. Every hour of weekend shift costs a child seven points on the test.

Dr Paul Suratt, of the University of -Virginia, studied the impact of sleep problems on vocabulary test scores taken by elementary school -students. He also found a seven-point -reduction in scores, a significant -reduction. "Sleep disorders can -impair children's IQ as much as lead -exposure," says Suratt.

If these findings are accurate, then it should add up over the long term: we should expect to see a correlation -between sleep and school grades. Indeed, every study done shows this connection.

These correlations really peak in high school, because that's when there's a steep drop-off in kids' sleep. Dr Kyla Wahlstrom, of the [University of Minnesota](#), surveyed the sleeping habits and grades of more than 7,000 high-school pupils. Teenagers who got As averaged about 15 more minutes sleep than the B students, who in turn averaged 15 more minutes than the C students, and so on. Every 15 minutes counts.

With the benefit of magnetic -resonance imaging scans, researchers are starting to understand exactly how sleep loss impairs a child's brain. Tired children can't remember what they have just learned, for instance, because neurons lose their plasticity, becoming incapable of forming the new synaptic connections necessary to encode a memory.

A different mechanism causes -children to be inattentive in class. Sleep loss debilitates the body's -ability to extract glucose from the -bloodstream. Without this glucose, one part of the brain suffers more than the rest – the prefrontal cortex, which is responsible for "executive -function". Among these executive functions is the -orchestration of thoughts to meet goals, prediction of outcomes and -perceiving consequences of actions. Tired people have difficulty with -impulse control, and their abstract goals such as studying take a back seat to more entertaining diversions.

A tired brain gets stuck on a wrong answer and can't come up with a more creative solution, repeatedly -returning to the same answer it already knows is incorrect.

Both those mechanisms weaken a child's capacity to learn during the day. But even more important is what the brain is up to when a child is asleep at night. Dr Matthew Walker, of [University of California, -Berkeley](#) explains that during sleep, the brain shifts what it has learned that day to more efficient -storage regions of the brain. Each stage of sleep plays its own unique role in capturing memories. For example, studying a foreign language requires learning vocabulary, auditory memory of new sounds and motor skills to -correctly enunciate the new word. The vocabulary is synthesised by the

hippocampus early in the night during "slow-wave sleep", a deep slumber without dreams. The motor skills of enunciation are processed -during stage two non-REM sleep, and the -auditory memories are encoded across all stages. Memories that are emotionally laden get processed -during REM sleep. In other words, the more you have learned during the day, the more you need to sleep at night.

To reconsolidate these memories, certain genes appear to be activated. One of these genes is essential for synaptic plasticity, the strengthening of neural connections. The brain does synthesise some memories during the day, but they are enhanced and -concretised during the night – new inferences and associations are drawn, leading to insights the next day.

Kids' sleep is qualitatively different to grown-ups' sleep because children spend more than 40% of their time asleep in the slow-wave stage (which is 10 times the proportion of adults). This is why a good night's sleep is so important for long-term learning of -vocabulary words, times tables, historical dates and all other factual minutiae.

Perhaps most fascinatingly, the emotional context of a memory -affects where it gets processed. Negative stimuli get processed by the amygdala; positive or neutral memories are -processed by the hippocampus. Sleep deprivation hits the hippocampus harder than the amygdala. The result is that sleep-deprived people fail to recall pleasant memories, yet recall gloomy memories just fine.

"We have an incendiary -situation -today," says Walker, "where the -intensity of learning that kids are -going through is so much greater, yet the amount of sleep they get to process that learning is so much less."

While all kids are affected by sleep loss, for teenagers, sleep is a special challenge.

Mary Carskadon, of Brown -University, has demonstrated that during puberty, the circadian system – the biological clock – does a "phase shift" that keeps adolescents up later. In prepubescents and adults, when it gets dark outside the brain produces -melatonin, which makes us sleepy. But adolescent brains don't release -melatonin for another 90 minutes. So even if teenagers are in bed at 10pm, they lie awake, staring at the ceiling.

Awakened at dawn by alarm clocks, teenage brains are still -releasing -melatonin. This makes it more likely that they will fall back asleep – either first thing at school or, more -dangerously, during the drive to school. Which is one of the reasons why young adults are responsible for more than half of the [100,000 "fall asleep" crashes annually in the US](#).

Persuaded by this research, some school districts around the US decided to delay the time that school starts in the morning.

Edina, Minnesota, an affluent -suburb of Minneapolis, changed its high-school starting times from 7.25am to 8.30am. The results were startling, and it affected the brightest kids most. Getting another hour of sleep boosted maths Sat test scores of Edina's best and brightest by 56 points, and their -verbal Sat score a whopping 156 points. The students also reported higher -levels of motivation and lower levels of -depression. In short, an hour more of sleep improved the students' -quality of life.

While the evidence is compelling, few districts have followed this lead. Conversely, 85% of America's public high [schools](#) start before 8.15am, and 35% start at or before 7.30am.

Obstacles against later start times are numerous and Dr Mark -Mahowald has heard all those arguments. As -director of the Minnesota Regional Sleep Disorders Centre, he has been at the centre of many school start-time debates. But of all the arguments he has heard, no one is saying that children learn more at 7.15am than they do at 8.30am. "If schools are for education, we should promote learning -instead of -interfering with it," he says.

"We thought that the evidence was staggering," Carole Young-Kleinfeld recalls. Kleinfeld is a mother in Wilton, Connecticut who used to have a sullen teenager of her own. Whenever she visited local high schools, she regularly saw students sleeping in class. So she and others formed a committee to learn about the issue. Eventually, they convinced the district to move the high school's starting time to 8.20am.

For Kleinfeld, the change was "a godsend". Her son, Zach, had once been a perfectly happy boy, but when he moved up to high school he became the prototypical disengaged, unenthralled-by-everything teen. He was so negative, so withdrawn that "I really thought we'd lost him", she says.

After his school started later, Kleinfeld couldn't believe it: "We got our kid back." Zack would bound downstairs in the morning with a smile and his Sat scores went up too. Several scholars have noted that many hallmark traits of modern -adolescence – moodiness, impulsiveness, disengagement – are also symptoms of chronic sleep deprivation. Might our culture-wide perception of what it means to be a teenager be -unwittingly skewed by the fact that they don't get enough sleep?

Let's next consider the hidden role sleep has played in the obesity -epidemic. It's often noted that in the last three decades, childhood obesity has tripled. Half of all kids are at least "at risk of being overweight". For a long time, there's been one -culprit to blame for our failed efforts: -television. Rather than running around the neighbourhood, today's kids sit in front of the television an average of 3.3 hours a day. The connection to obesity seemed so obvious and was so often repeated, that few people thought it even needed to be supported scientifically.

[Dr Elizabeth Vandewater, of the -University of Texas at Austin](#), got fed up with hearing fellow scholars blame it all on television with only weak data to support the claim. "It's treated as -gospel without any evidence," she complains. "It's just bad science." Vandewater did her own analysis and found that obese kids watch no more television than kids who aren't obese. All the thin kids watch -massive amounts of television too. There was no statistical correlation between -obesity and media use.

Vandewater examined the children's time diaries and realised why the earlier research was wrong. Kids don't trade television time for physical activity. "Children trade functionally equivalent things. If the television's off, they don't go and play sports," she says, "they do some other sedentary behaviour."

In fact, while obesity has increased rapidly since the 1970s, kids watch only seven minutes more of TV a day. While they do average 30 minutes of video games and

internet surfing on top of TV viewing, the leap in obesity began in 1980, well before home video games and web browsers. This -obviously doesn't mean it's good for the waistline to watch TV.

But it does mean that something other than television is making kids even heavier.

Five years ago, already aware of an association between sleep apnoea and diabetes, [Dr Eve Van Cauter](#) -discovered a "neuroendocrine cascade" that links sleep to obesity. Sleep loss increases the hormone ghrelin, which signals hunger, and decreases its metabolic -opposite, leptin, which suppresses appetite. Sleep loss also elevates the stress hormone cortisol. Cortisol is lipogenic, meaning that it stimulates your body to make fat. Human growth hormone is also disrupted. Normally secreted as a single big pulse at the beginning of sleep, growth hormone is essential for the breakdown of fat.

It seems counter-intuitive to hear that a key to staying thin is to spend more time -doing the most sedentary inactivity possible. Yet this is exactly what -scientists are finding. All the studies point in the same direction: on average, children who sleep less are fatter than children who sleep more.

Van Cauter has gone on to discover that the stage of slow-wave sleep is especially critical to proper insulin -sensitivity and glucose tolerance. When she lets subjects sleep, but -interrupts them with gentle door knocks just loud enough to keep them from passing into the slow-wave stage (without actually waking the subjects), their hormone levels respond in a way that's akin to a weight gain of 20 to 30lb.

As -previously noted, children spend over 40% of their asleep time in this slow-wave stage, while adults are in this stage only about 4% of the night. This could explain why the -relationship -between poor sleep and obesity is much stronger in children than in adults.

Despite how convincing all this evidence is, somehow it still feels like a huge leap of faith to consider giving back an hour of our children's lives to slumber. Statistical correlations are fine evidence for scientists, but for -parents, we want more – we want control.

Long before children become -overscheduled high schoolers -gunning for college, parents – guardians of their children's slumber – start -making trade-offs between their sleep and other needs.

This is especially true in the last hour of our child's day. During this time, children should be in bed, but there are so many priorities lobbying for -attention. As a result, sleep is treated much like the national debt – what's another half-hour on the bill? We're surviving; kids can too.

Sleep is a biological imperative, but humans alone try to resist its pull. Instead, we see sleep not as a -physical need but a statement of character. It's considered a sign of weakness to -admit to feeling tired – and it's a sign of strength to refuse to succumb to -slumber. Sleep is for wusses.

But perhaps we are blind to the toll it is taking on us. Dr David Dinges, of the University of Pennsylvania, did an experiment shortening adults' sleep to six hours a night. After

two weeks, they reported that they were doing OK. Yet on a battery of tests, they proved to be just as impaired as someone who has stayed awake for 24 hours straight. Dinges did the experiment to -demonstrate how sleep loss is -cumulative and how our judgment can be fooled by sleep deprivation.

Nevertheless, it's tempting to think, I would suffer, but not that bad. I would be the exception. We've coped on too little sleep for years, and -managed to get by. We have some -familiarity with this.

But when it comes to a child's -developing brain, are we willing to keep taking the same brazen dare?

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