

## Synopsis

# SLEEP: THE FOURTH PILLAR OF HEALTH

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# Sleep:

## The Fourth Pillar of Health

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There is no doubt as to the importance of good habits for health. There are three pillars classically seen as having an impact: a balanced diet, moderate physical activity and emotional wellbeing. There is, however, another factor that is often downplayed or excluded: sleep.

A lack of quality sleep has consequences that go much further than just being tired the next day. If it persists over time, it is associated with a higher risk of cardiovascular disease, diabetes, obesity and, even, cancer. It affects memory and attention span, and is responsible for a loss of productivity of roughly 2% of the Gross Domestic Product in some countries, like the United States. This is why several projects are starting to raise awareness of the importance of sleep, the need for timetable reform and, even, using new portable technology and big data to improve people's habits.

In order to discuss all of these aspects, world-renowned physicians and scientists, as well as technology and social stakeholders, met for the debate '[Sleep: the Fourth Pillar of Health](#)', organized by B-Debate (an initiative of Biocat and the "la Caixa" Foundation to promote scientific debate) in conjunction with the [Global Sleep Observatory](#), [Lleida Biomedical Research Institute](#) (IRBLleida) and [AdSalutem Institute](#).

## CONCLUSIONS

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- **Both too much and too little sleep are associated with many diseases and increased mortality rates.** The clearest ties are seen with cardiovascular and mental conditions, but sleep is also being associated with some types of cancer.
- Some age groups are particularly sensitive to a lack of sleep, although for different reasons, including **pregnant women, children and teenagers, and the elderly.**

- **A lack of sleep affects the productivity of people and countries.** Some studies put its impact at roughly 2% of the Gross Domestic Product and estimate that one additional hour of sleep boosts productivity 16%.
- **Studies using big data can help better understand sleep and promote good habits** by collecting data from the population and sending out personalized tips, for example.

## 1. THE EXTREME IMPORTANCE OF SLEEP FOR HUMANS

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“If sleep didn’t play such a key role, it would be the biggest mistake in our evolution,” said David Gozal, chairman of Child Health at the University of Missouri School of Medicine, at the B-Debate session. **“Why haven’t we lost the need to sleep? Because sleep is essential to take advantage of life.** It consolidates memories and emotions, regenerates our cells. If we don’t treat it as an essential element, we pay the price.”

And this price can come in different forms. A lack of sleep (or, sometimes, excess) increases the **risk of some diseases**, but it also affects **productivity**, slows **development in children and young people**, increases the risk of **accidents** and decreases, in general, the **quality of life** of those who suffer from this problem or don’t get the right care.

“I’m a doctor, but we didn’t spend one minute of medical school discussing the importance of sleep and the consequences of a lack of quality sleep,” confessed Ferran Barbé, head of Arnau de Vilanova University Hospital and the Lleida Biomedical Research Institute (IRBLleida). **“We have to make sleep part of our health standards, as we have exercise and healthy diet,”** he added. However, that is no simple task. “Changing habits on a social level is the hardest thing to do in public health. If it were easy, no one would be obese or smoke cigarettes.”

“Technical and industrial evolution is much faster than genetic evolution, and this leads to a conflict between what we want to do and what our bodies allow us to do,” explained Gozal. **“But when top executives and influencers say they only need four hours of sleep, they’re making a huge mistake. That such successful people can say something so ridiculous implies widespread ignorance regarding sleep.”**

## 2. SLEEP, DISEASE AND VULNERABLE GROUPS

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Many studies have observed an association between mortality risk and lack of sleep (sometimes considered to be fewer than 7 hours and others, fewer than 6) or excess sleep (generally more than 9 hours a day). As Sudan Redline, professor of medicine at Harvard Medical School, explained at the B-Debate session, a **significant part of this risk is due to the increase in cardiovascular diseases**. Sleep, especially in the non-REM phase, seems to have a cardioprotective function. Any alteration, in quantity or quality, has a negative effect on the mechanisms that regulate hunger and insulin metabolism, increasing the risk of obesity. This is why both too much and too little sleep seem to be firmly tied to the risk of diabetes, high blood pressure, stroke and coronary disease.

**The connection with cancer is still up for debate, but the evidence is starting to pile up.** Ramón Farré, professor of Physiology at the University of Barcelona, explained “The data is still scarce and recent, and studies in both human and animals have their limitations. Nevertheless, they meet several of the classical criteria of causality.”

These studies include observations of animals in which fragmented sleep increases the risk of developing tumors. And, above all, studies in humans that have found a relationship between sleep apnea (a disorder that causes the patient to stop breathing while sleeping, affecting the quality and depth of sleep) and a huge increase in the frequency of certain types of cancer in patients over 60.

In addition to the increase in diseases associated with sleep quality, **some ages and groups are particularly vulnerable to its effects**. Problems like insomnia and apnea, among others, are relatively frequent in **pregnant women**, for example. María Luz Alonso-Álvarez, head of the Sleep Unit at Hospital Universitario de Burgos, lamented the fact that there are still very few studies that analyze the consequences of this, even though some have pointed to increased risk of gestational diabetes and postpartum depression, as well as more complicated birth and the need for cesareans. Thus, she believes it is **necessary to establish what is healthy sleep for each trimester of pregnancy**. It is also worth **stressing how important it is for children to get enough quality sleep, depending on their age**: It is a key element in their cognitive development and can even predict their risk of being obese in the future, as noted Oscar Sans, medical director at AdSalutem Institute and head of the Sleep Unit at Hospital Sant Joan de Déu in Barcelona.

**Adolescence** is a particularly problematic age for sleep. The [National Sleep Foundation](#) recommends teens sleep more than adults, between 8 and 10 hours a day. But 45% of them don't even get 8 hours. Plus, there is a 'phase delay' that occurs at this age, shifting circadian rhythms later into the night, so it is harder to fall asleep.

According to Leila Kheirandish-Gozal, professor of Pediatrics and director of the Child Health Research Institute at the University of Missouri School of Medicine, this **affects memory and attention span, leading to poorer performance at school**. But also to metabolic issues, greater risk of depression and anxiety, and of taking drugs and drinking. This is why, in addition to educating and promoting healthy sleep habits, some are studying the option of starting the day later at high schools. One study estimated the possible benefits at **\$8.6 million** over two years in the United States alone (mainly due to the increased performance and decreased chance of accidents), although there are also cons that would have to be studied and addressed.

**Too much screen time** is another problem. US teens spend an estimated 6 to 7 hours in front of a screen. Kheirandish-Gozal recommends disconnecting from all screens at least one hour before going to bed, as the light can make it harder to fall asleep. But there is no solid evidence yet. Jamie Zeitzer, associate professor at Stanford University, pointed out that we don't yet know if this amount of light is relevant, and alluded to the role screens play in social interaction, which would be an inadvisable stimulant before bed.

Another group that is especially sensitive are the **elderly**. We tend to assume that, physiologically, they need less sleep. But, according to Sonia Ancoli-Israel, professor emeritus at the University of California, San Diego, **"It isn't clear that the need for sleep decreases, but the ability to do so does"**. Although there is some change in circadian rhythms, "Age doesn't have the biggest impact on this; it is everything else that goes along with it." Sleep issues in the elderly tend to have more to do with the diseases that normally come with age and make it hard for them to rest, as well as the various medications they are generally taking that can have an impact. This is not only highly relevant to their quality of life but can also make diagnosis more difficult. "Lack of sleep leads to memory and attention problems," explained Ancoli-Israel, "which can lead doctors to, mistakenly, suspect dementia."

### 3. SLEEP FROM A PUBLIC AND ECONOMIC PERSPECTIVE

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In addition to the more than relevant issues of health and quality of life, how much and how well we sleep seems to also have an impact on the economy and productivity. “The factors that determine or influence productivity are highly complex and difficult to lock down,” recognized David Gozal. “But **some studies say it increases up to 16% with just one additional hour of sleep.**” Others, on a countrywide scale, put the repercussions of insufficient sleep in the millions of dollars, which would mean **1.56% of the German GDP, 2.28% that of the United States or 2.92% that of Japan.**

Although there are individual variations, the maximum average productivity is reached with approximately **9 hours** of sleep each night. This figure is at the top of the range established by the National Sleep Foundation, which recommends between 7 and 9 hours. These figures, however, don’t correspond with **some controversial studies** that have attempted to determine how many hours we should sleep ‘according to evolution’.

Jerry Siegel, professor at the University of California, has spent years studying three groups of people who live like traditional human societies did: in a natural environment, without electricity. They are the Hadza in Tanzania, the San in South Africa and the Tsimane in Bolivia. According to Siegel, “**They all sleep between 6 and 7 hours a night on average (one more in winter) and just 15% of them take a nap.** They don’t go to bed when it gets dark; they wait at least three hours. And they wake up very regularly just before dawn, leading us to believe it isn’t light that regulates their sleep, but temperature.” Gozal, however, believes this data must be **taken with a grain of salt.** “We don’t know, for example, whether they take *micronaps* throughout the day that are not being recorded. And we don’t know if the conditions they live in are ideal either.”

In any case, living conditions today are an obstacle to quality sleep. One of the major issues is **shift work**, which affects between 18% and 25% of the Western population. “It is a serious problem,” explained Manolis Kogevinas, professor at the Barcelona Institute for Global Health. “The resulting changes to the circadian rhythms are associated with increased risk of obesity, cardiovascular disease and stroke, and probably with some types of cancer, especially those that are hormonal, like breast cancer.”

To fight the epidemic of insufficient sleep, we have to act on many fronts and on a large scale. One of these fronts is the timetable reform that has been hotly debated for years.

In 2013, a committee of experts was set up in Catalonia, which has gotten a commitment from the Parliament to implement this reform by 2025. The goals of this reform include **adjusting official time to solar time (including staying on winter time), moving forward the times when we work, eat and sleep, and raising awareness of their importance**. Ferran Barbé summed it up: “lunch at 1 pm, no leaving work after 6 pm, dinner at 8 and in bed by 10.” For Salvador Cardús, professor at the Autonomous University of Barcelona and member of the committee of experts for timetable reform, it is an issue that entails equality and wellbeing, but there is **a lot of resistance** that must be overcome: “Much of it comes from the power structure, but also some individual reticence from those who consider timetables set in stone, who say: *it’s always been this way, it’s due to the climate, our national character...*”

## 4. SLEEP AND BIG DATA

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**“To what extent do our genes determine how we sleep?”** This is the basic question in the studies presented by Simon Warby, professor at the University of Montréal. “Before, the most complicated thing was analyzing DNA, but now that’s the simplest part,” he ensured. Sleep patterns are highly stable in each individual, and studies with twins have shown that they are highly hereditary, as well.

**Big data** in genetics tends to be called genomics. Studies with huge amounts of data have drawn links between various genes and narcolepsy (making it compatible with the theory that its origin is autoimmune), restless leg syndrome and chronic insomnia. This “not only opens the door to new treatments, but also to the possibility of using inverse genetic approaches, studies that discover new functions of genes and the basic biology of sleep,” Warby summed up.

Studies with big data have also allowed scientists at the IRBLleida to analyze the whole population of Catalonia treated with continuous positive pressure for sleep apnea, which means looking at the data for more than 70,000 people. By analyzing their clinical history and comparing it to more than 180,000 control subjects (people without apnea), researchers observed, surprisingly, that men undergoing treatment had a lower mortality rate than men without apnea (although in women, the opposite seemed to be true). Although more studies need to be done, Sandra Bertran, a statistician at IRBLleida, defended the use of these approaches, which aren’t your run-of-the-mill clinical trials but, given the amount of data included, can be very powerful tools for testing a hypothesis.

Another way to use big data in sleep studies is **with portable devices (wearables)**. This is what the [cronobiology group](#) led by Maria dels Àngels Rol at the University of Múrcia is doing, with devices that measure temperature, activity and, even, exposure to different types of light (blue, yellow and red). Social media is also a good source of big data. For Mark Aloia, vice president for Behavior Change at Philips, this is a great opportunity to spread healthy messages. **“Facebook users already make up one third of the global population and many are concerned about their health,”** he said. “But that is easier said than done: most people who have portable device data are more concerned with monetizing it than with improving sleep patterns of the general population.”

To try to influence and improve this, **a new project in the city of Vitoria** has just kicked off with collaboration from IRBLleida. Taking into account that between 10% and 35% of the population sleeps fewer than six hours, and that this has a direct effect on mortality, they have developed “a mobile app and platform to collect sleep data from residents and send them information with personalized recommendations,” explained Carlos Egea, head of the Sleep Department at the Araba University Hospital. For Ferran Barbé, **“This is a star project. We have to create sleep-friendly cities and environments,”** he said.