



A GOOD NIGHT'S SLEEP STRENGTHENS YOUR IMMUNITY!

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YOUNG REVIEWERS:



**BENJAMIN,
CHARLIE**

AGES: 11–13



LAURENT

AGE: 10



YA'EL

AGE: 11

Sleep is an important part of a healthy lifestyle. Getting good quality sleep regularly helps the immune system, the body's infection-fighting force, work at its best so that we can tackle the bacteria and viruses that try to make us sick. In addition, getting good quality sleep around the time of vaccination is important to ensure that the vaccination is as effective as possible at protecting us, even for a long time afterwards. At night, all the germs that we encounter during the day are shown to the cells of the immune system so that those cells can be activated to stop an invader, if necessary. Sleeping well contributes to both the ability of the immune system to defend us when we get infected with viruses or bacteria *and* the ability of vaccines to protect us from getting sick in the first place.

INTRODUCTION

Everyone gets sick occasionally, especially in the colder months of the year when many people around us are sniffing and sneezing. However, there are things we can do to help our bodies fight off the

germs that make us sick. We often hear people say, “Make sure you are eating healthy and taking your vitamins!” and “Do not forget to wear your hat and scarf!” but every so often we may also hear, “Make sure you get some good sleep!”

CAN SLEEP KEEP US HEALTHY?

Can sleep really stop us from getting sick? Research certainly seems to suggest that it can. Several studies found an association between the amount of sleep that people get and their risk of getting sick. In a 2009 study, healthy people were asked to tell researchers about their previous 14 days of sleep, before they were isolated in a controlled environment and given nasal drops that contained the common cold virus. The participants were then observed for the next 5 days for symptoms of sickness. The researchers found a strong association between the amount of sleep participants got before the virus was given and the risk of getting sick from the virus. Those with <7 h of sleep the night before getting the nasal drops were almost three times more likely to get sick than those who slept 8 h or more. Researchers also looked at the effect of **sleep efficiency**, which is a way to calculate how much time a person sleeps when they are in bed as opposed to being in bed but awake. They found that participants with lower sleep efficiency were more than five times more likely to develop a cold than those who had better sleep efficiency [1].

This finding was repeated in a similar study in which, instead of relying only on people’s own reports of their sleep behavior, the experimenters *monitored* the participants’ sleep for 7 days before the experiment. Sleep was monitored using **actigraphy**, which means the participants wear a special kind of watch which tracks when they are asleep and when they are awake. The researchers found that those participants who slept the least, with <6 h of sleep each night, were more likely to become ill from the virus compared to those who slept for more than 6 h. This was true regardless of age, gender, race, income level, smoking, and physical activity [2]. So, it seems that sleeping well helps the body’s **immune system** to work better, which means that we are less likely to get sick from **pathogens** such as bacteria, viruses, or fungi that enter our bodies.

Over the past 3 years, we have been dealing with the COVID-19 pandemic, caused by a new coronavirus called SARS-CoV-2. Many people have been infected with this virus, but the severity of the symptoms has varied across individuals, ranging from no symptoms at all to mild symptoms to severe symptoms. Although ongoing research is exploring the reasons behind this diverse response to SARS-CoV-2, sleep was found to be involved in the body’s ability to tackle the infection. People with poor sleep quality in the month before getting infected with SARS-CoV-2 were more likely to get severely ill and to stay in the hospital longer [3]. Moreover, among COVID-19 patients

SLEEP EFFICIENCY

The ratio of time spent in bed sleeping vs. overall time spent in bed. Someone with high sleep efficiency spends most time in bed asleep, which suggests better sleep quality.

ACTIGRAPHY

A method of measuring sleep and movement in humans by using a small device similar to a watch.

IMMUNE SYSTEM

A group of cells and chemicals that keep an organism healthy. Their job is to detect and fight off germs and viruses that can make the organism sick.

PATHOGENS

Microscopic organisms such as bacteria, viruses or fungi that can enter our bodies and make us sick.

who were already in the hospital, those who were poor sleepers were more likely to get worse and to be moved into the intensive care unit than those who were good sleepers [4].

SLEEP MAKES VACCINES WORK BETTER!

Besides helping us resist infections, sleep contributes to the immunity we build following vaccination, which is something many of us have been striving for recently. As the body's defense mechanism against pathogens, part of the immune system's job is to identify the specific pathogens that have invaded our bodies and to produce **antibodies** against them. Antibodies are proteins that can specifically fit or bind to the surface of an invading pathogen, like a key fits in a lock, killing or inactivating the pathogen. The white blood cells that work together to create antibodies are called **lymphocytes**. Lymphocytes circulate in the blood and bodily tissues until they get a signal that tells them to activate because an invader is present [5]. A similar response takes place when we get vaccinated, except that the "invader" in this case is the vaccine. Once the lymphocytes have seen the harmless form of the pathogen in the vaccine, they are "trained" and ready to fight the actual pathogen if it enters the body in the future.

So, how does sleep make vaccines work better? One of the first studies to demonstrate that sleep plays a role in immunity following vaccination was a study on the hepatitis A vaccine [6]. Hepatitis A is a virus that targets the liver and can make us sick, which is why we get vaccinated. The vaccines help the immune system prepare for a future infection by delivering into the body a weakened version of the virus to launch an immune response. In this study, half of the participants were allowed to sleep the night after vaccination, whereas the other half were kept awake all night. Researchers measured their antibody levels 4 weeks later, when these levels were expected to reach their maximum. Those who slept had twice the number of antibodies compared to those who did not sleep. Even a year following vaccination, those who slept the night following the hepatitis A vaccine had a greater number of antibodies compared to those who did not sleep [7]. A more recent study monitored sleep using sleep diaries, over a period of 13 days before and after vaccination with two different influenza vaccines that protect against the flu. That study found that sleep on the two nights before vaccination was an important contributor to antibody production, even 4 months after vaccination, although this was true for one type of flu vaccine but not the other [8]. There are still no published studies about how sleep affects immunity after receiving the SARS CoV-2 vaccines.

THE TYPE OF SLEEP MATTERS TOO!

The immune system is influenced by the time of day. For example, the number of lymphocytes circulating in the blood reaches a maximum in

ANTIBODIES

Blood proteins that fight pathogens by sticking to them like a key in a lock, protecting people from disease.

LYMPHOCYTES

White blood cells produced in bone marrow. There are different types of lymphocytes such as T cells and B cells. They are part of the immune system.

the evening or early night, and their numbers begin to drop throughout the night until they reach a minimum by the morning hours [5]. The number of circulating lymphocytes drops because they slowly move away from the circulation and into the lymph nodes, where they can encounter any pathogens that have entered the body the day before [7]. Sleeping at night is important because when we sleep, certain chemicals are released that help the immune response get started and fight pathogens if they are present [5].

SLOW-WAVE SLEEP

A type of deep sleep where brain activity slows down and body temperature drops. Young people's bodies grow during this time, as growth hormone is secreted.

CORTISOL

A hormone which is released in the body when we are threatened or stressed. In small amounts it is helpful but if there is too much it can be harmful.

Although there is still a lot to be discovered on sleep and immune system interactions, research suggests that a type of sleep called **slow-wave sleep** (SWS) is important in this process. During SWS, bodily functions and brain activity slow down compared to wakefulness. When people are in SWS, their bodies have very low levels of the stress hormone **cortisol**. When cortisol is around it suppresses the activity of the immune system, so when this hormone is at its lowest, the immune system can more easily create antibodies and fight infections [5–7]. It is important to note that people get more SWS during the early part of the night, as opposed to the later part of the night when people tend to sleep more lightly [7].

SLEEP IS KEY TO STAYING HEALTHY!

Getting good sleep every night is just as important as eating a balanced diet and exercising regularly. So, if you are a fan of being healthy, one of the best things you can do to help your resistance to illness is to make sure you get enough good quality sleep, regularly. The need for sleep changes with age, with younger people needing more sleep (Figure 1)

Figure 1

Sleep needs change across a person's lifetime. The younger a person is, the more hours (h) of sleep they need [Figure credit: [9]].



[9]. Even though it can sometimes be tricky to go to bed and wake up at the same time every day, especially as you get older and busier, having a regular sleep-and-wake routine is the best way to support your immune system and enjoy better health and all the other benefits that sleep can offer.

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SUBMITTED: 11 October 2022; **ACCEPTED:** 03 October 2023;

PUBLISHED ONLINE: 18 October 2023.

EDITOR: Bahtiyar Yilmaz, University of Bern, Switzerland

SCIENCE MENTORS: Michael A. Grandner and Klavdja Annabel Fignole

CITATION: Hadjimarkou MM and Abdullayev K (2023) A Good Night's Sleep Strengthens Your Immunity! *Front. Young Minds* 11:1067201. doi: 10.3389/frym.2023.1067201

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YOUNG REVIEWERS



BENJAMIN, CHARLIE, AGES: 11–13

We enjoyed reviewing this article: not only is sleep a necessity to live, also it can determine how well your brain can think, how well you can eat, and it helps you survive. It impacts almost everything in your daily life.



LAURENT, AGE: 10

My name is Laurent. I love spending time with friends from my neighborhood and with classmates. I love reading and writing, and I have won already prizes for poems' writing! I am French mother tongue and speak English. I play basketball and before I played Judo and Football. I love reading fiction-stories, manga's, "Enquêtes Policières" horror stories, myths and histories, and I like watching scientific documentaries. My favorite season is spring when play outdoor and ride bicycle.



YA'EL, AGE: 11

I like Minetest, computer programming, maths, science, running, playing with dolls, drawing, baking, reading, playing with lego, watching videos, arts and crafts, and thinking.

AUTHORS



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Maria is a lecturer at the School of Psychology at the University of Sussex. Her research interests lie in the area of sleep and its impact on physical and mental health. Maria is involved in several projects that promote neuroscience and the importance of sleep to the general public. Besides being a lecturer and author of several publications, Maria coordinates the Study Abroad program for psychology and is a member of the Academic Advisors team. *m.hadjimarkou@sussex.ac.uk



KAMILLA ABDULLAYEV

Kamilla recently completed her undergraduate degree in psychology at the University of Sussex, England, and now works there as a health psychology researcher. She is especially interested in the role of sleep in our everyday lives, particularly in helping maintain our physical and mental health. Kamilla is passionate about raising awareness of the importance of sleep for living longer and healthier lives, and she wants to help kids understand this as early as possible. In her spare time, she loves to watch sunsets on the beach, go on long walks in nature, and cook for her friends.