

# **A Personalized Approach to Determining Optimum Sleep Time**

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Sleep duration has been an important health subject for years, now most sources suggest that the best sleep duration is 7.5 hours, and too little and too much sleep can increase death rates. Those studies might serve as good guidance to government in planning its resources, their conclusions, if they are used as health guidance, are wrong. Even the question is improper. It most probably will hurt whoever tries to follow.

For political purpose, governments need to treat people by categories in order to impose same rules and regulations. Such rules and regulations are arbitrary. However, when a single rule is used as health-care guidance, the validity of the population data would depend upon two assumptions: all human beings are same and sleep is the limiting and independent factor that affects health and death rate. None of those two assumptions can hold. First, among people in a population, there are young people, women and men, and old people. Within each category, people may be vegetarians, caffeine drinkers, alcohol users, or drug addicts. People have different jobs such as physical workers, sedative workers, and high stress workers. Their health conditions range from very healthy to very poor. All those factors affect death rates. So, the conclusion from such data cannot make a slightest sense.

The differences in those factors are far more than the difference we see from wheat grown in a farm. They are more different from the differences in TV brands, TV models, and different use conditions like broken, refurbished, and new units. When the population data is acquired from commingled subjects and is turned into some sort of "average", the conclusion is useless to every person. There is no such average person in reality.

The second fatal flaw in those studies is that sleep duration is not a limiting independent factor among a large number of other factors. It is not an important factor in many deaths. People might die from all kinds of causes that are influenced by sleep duration. Thus, true contributory factors to death rates cannot be attributed to sleep duration in a fixed way. Even though, researchers in every field must consider limiting factors and how a factor interacts with other factors, but this practice has often been ignored in medical research. When sleep duration is not a limiting factor, one cannot ignore other limiting factors and other interactive factors in assessing true effects of sleep duration. The conclusion is naturally flawed.

We must use the optimization method for complex life system to analyze how sleep duration affects health, daily function, and lifespan. It must be analyzed by looking at its interactions with a large number of other factors. First, we need to understand what is the function of sleep? It is generally agreed that sleep is a process for recovery of energy, clearing metabolic by-products, and repairing the body. One would expect that the more the better. However, excessive sleep would reduce the time for the body to do physical activities and exercise and thus result in fat accumulations. Thus, excessive sleep would result in obesity and slowly damage the vascular system. Thus, I can easily see that there is a optimum point for each person and this point must depend upon indi-

vidual person's overall activities, lifestyle, health condition, age, and development stage. Sometimes, a meaning change in any of those main parameters would require an adjustment to the sleep duration. For example, if your change in jobs may require you to do more complex mental work, you may need more sleep to gain full recovery from the fatigue each day.

The speeds of recovering and repairing the body are highly depend upon the vascular condition. The body provides nutrients to tissues in the whole body by convection and diffusion, and bring metabolic products from tissues including the brain, the heart and kidneys by the circulating blood. After you have worked for a whole day, you will feel tired because acids, toxic metabolic products are accumulated in tissues all the body including the brain, the heart, and the kidneys. All toxic substances are brought by circulating blood to the kidneys and were eliminated by the kidneys. If your body can eliminated them completely, you will feel full recovery. The efficiency for eliminating them would depend upon micro-vascular network system and may be limited by your kidney functions. So, some people with kidney diseases often feel tired because their kidneys would not remove toxic substance completely and timely.

The micro-vascular network conditions can vary by great extent. A good micro-vascular system is that the issue has high density (more capillary number per cross section area) and all capillaries have decent cross section reason (without fat coatings insides), and shorten paths. In contract, a bad micro vascular system is low capillary density, reduced cross-section areas and elongated paths. All those those features might appear minor in terms of numbers, their impacts on the body ability to clear toxic substances can be huge. This has a lot to do with fundamental law of diffusion. When the number of capillaries are fewer, the blood must diffuse a longer distance to reach those terminal cells in any tissues. Unfortunately, diffusion is very slow process. Thus, people with poor health could need longer time to clear toxic substances because the diffusion path is longer and capillaries are smaller.

This difference in the micro-vascular network explain why some people take little sleep but still feel very energetic while others might feel that they would not get enough sleep and always feel tired. For this reason, one needs not to worry about following a definite sleep duration. What is important is you must make sure that you will get enough sleep to make sure that you can get fully recovery. Getting ten hours sleep does not mean better than getting 6 hours sleep.

We should note that the sedative lifestyle is a very important factor that affects sleep duration. For people with sedative lifestyle, critical issues are low consumption of energy, monotonic activities, excessive accumulation of fats. Due to physical inaction, the body is conditioned to use more energy in glucose and with less activity of using fatty acids. This could favor fat accumulation insider the capillaries. If calories are not balanced, a long-term sedative lifestyle will slowly compromise the micro-vascular network. The subjective signs are people have poor energy, easily get fatigue from physical work, can feel short breath for doing minor physical activities. In this stage, all physical checks will be normal. However, it is very bad to health. It is easy to fix and reverse for a long time. Most people have decades of time to fix.

Sedative people do not have much metabolic waste in the whole body due to limited physical activities. They can gain recovery without much sleep. If they do extraordinary physical activities, they will not be able to recover for days. Therefore, the most

critical factor is not the sleep length for repairing the body, but the blood circulation condition in tissues around the body. Taking additional sleep will make the terminal blood circulation worse. Anything that can increase blood circulation and capillary number will have more beneficial effects. We assume that the population data may be applicable to U.S. residents because the population has a high number of overweight and inactive people. However, for people who are active in sports and physical activities, their critical issue is to get rid of metabolic products and repair wears and tears. Getting additional sleep is most probably beneficial to them.

Optimum sleep duration depends upon a large number of factors such as lifestyle, age, job nature, geographic location, weather condition, social activities, sleep quality, and personal health condition. In conducting analysis, one must consider how sleep duration affects the immune system, the digestive system, and energy balance in light of the individual person (but not the population). On one hand, sleep duration must be sufficiently long to have metabolic products fully cleared and have the body fully repaired. On the other hand, it should not be too long to promote more fat deposits to impair the micro-vascular system. Saved energy from one additional hour could be enough to cause a total destruction of health even though it exerts the effect slowly.

The optimum sleep duration is a dynamic parameter. We should never seek a magic constant that is good for everyone or good for all days in a year. For example, if a person has worked for a long day with massive toxic metabolic compounds in the body, he needs to get more sleep to gain a full recovery. If the person has cancer, a critical goal is to boost the immune system to protect vital organs. More sleep may help, provided that it would not result in further damages by energy imbalance. If a person who tends to eat more than he would need, an excessive sleep will be more damaging; people who can properly balance energy intake may take a longer sleep; people with highly complex mental activities (but without excessive energy intake) may take a longer sleep without worrying about obesity. More sleep may help the person reactivate the immune system, but must learn to prevent the body get overweight.

Optimum sleep duration can be viewed as a function of a large number of factors that interact with each other. Sometimes, a change in one single factor can change the optimum sleep duration. Assuming that a person who is very healthy, a change in his job that requires him to have a late dinner. This change would require him to reduce sleep duration or reduce total calories to avoid obesity. Young people whose bodies are still under development need more sleep. A person who is in recovery from a serious bodily injury needs more sleep because a longer repairing phase would help him repair the body fast. When a person gets fatigue from his job, he needs to increase sleep duration. Even change in season may require a person to adjust sleep duration. The adjustment may depend upon how a person responds to change in seasonal temperature. If a person sleep quality is poor due to noise interference or other health problems, a longer sleep duration window is beneficial. Even health condition can be a factor that requires a change of sleep duration.

It is indisputable that sleep duration is a function of a large number of lifestyle variables and genetic-specific variables. When most of the variables cannot be fixed, you should not follow sleep duration of others.

A holistic approach should be used to determine optimum sleep duration. The effects of sleep duration are realized by controlling the relative duration of the working phase and repairing phase, and total energy balance. In determining the optimum sleep duration, we cannot use population data that is based upon sedative lifestyle of majority

people. This data is simply not good for any person. The data is only good for an abstract average person with characteristics of obesity, high blood pressure, chronic diseases. This abstract person simply does not exist in the world. All health parameters derived from population data cannot be applied to any actual person. Effects of many variables from different systems cannot be added and averaged as guidance for optimizing a specific system.

Taking an afternoon nap can have great health benefits because it gives the body an additional chance to clear toxic metabolic substances at the time people get really tired. After the nap, you would gain immediate recovery from fatigue. However, if you take too much sleep, you might need less sleep at night. You must avoid depriving normal sleep. You should not take a long nap. A nap lasting 10 minute to 30 minutes may be the best.

Therefore, our guideline is that sleep duration should be as long as possible within a reasonable range from 7 to 10 hours, provided that it will not result in energy imbalance in a reasonable time window. Young people and people with diseases and bodily injuries require longer sleep duration for recovery. Sickness, extreme exhaustion, and fatigue may require longer sleep duration on certain days.