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# THE ROLE OF NAPS AND DAYTIME SLEEPINESS IN STROKE RISK: A REVIEW OF THE LITERATURE FROM A PUBLIC HEALTH AND SLEEP-MONITORING TECHNOLOGY PERSPECTIVE

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**ABSTRACT**

The aim of this review is to summarize the literature on daytime naps and their duration in relation to stroke risk, with particular emphasis on physiological mechanisms, demographic factors, and lifestyle. Analysis has shown that short naps of up to 30 minutes improve cognitive functions, blood pressure regulation, and stress hormone levels, and thus may have not only a neutral but also a beneficial effect on the human body. In contrast, long naps lasting 60–90 minutes or repeated multiple times during the day appear to significantly increase the risk of stroke, especially in older individuals with comorbidities such as diabetes, obesity, or hypertension. The mechanisms linking naps to stroke risk include changes in the autonomic nervous system, blood pressure, inflammatory status, and blood–brain barrier integrity. The authors emphasize that both nighttime sleep and daytime naps can be monitored for duration and quality using modern, widely available devices, such as wrist-worn trackers or mattress-embedded sensors, allowing objective assessment of sleep patterns and early identification of stroke risk factors. Further research is needed to develop systems for early detection of abnormal sleep and nap patterns, which could serve as a basis for implementing personalized stroke prevention strategies.

**KEYWORDS**

Stroke, Nap, Sleep Monitoring Technologies, Daytime Sleepiness

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## I. Introduction

Stroke is one of the most serious public health problems in the world and remains among the leading causes of death and long-term disability. Due to ageing populations and the increasing prevalence of risk factors such as high blood pressure, diabetes, and obesity, its incidence continues to be high. The consequences of stroke affect not only individual health, but also generate enormous social and economic costs.

A growing body of research indicates that sleep and the quality of daytime rest—including naps and episodes of microsleep—may play an important role in cardiovascular function. Sleep disturbances, excessive daytime sleepiness, and abnormal sleep patterns appear to be strong predictors of stroke.

The aim of this review is to provide a synthetic overview of the current state of knowledge on the role of naps and daytime sleepiness in the context of stroke risk. This review seeks to identify potential mechanisms linking sleep with stroke risk, as well as opportunities for home-based sleep monitoring.

## II. Methodology

The literature review was conducted using two main databases: PubMed and Web of Science. The analysis included publications comprising clinical and observational studies as well as review articles. The following keywords were used to search for relevant papers: stroke, nap, daytime sleepiness, sleep disorders, and sleep monitoring technologies. Specific inclusion criteria were applied in the selection process: original articles and reviews addressing the relationship between sleep—including naps and microsleep—and stroke risk; publications available in English; and studies involving adult participants.

The following types of publications were excluded: studies concerning only children and adolescents, experimental animal studies, papers unsuitable for full content assessment (e.g., conference abstracts without full text), and publications not directly related to the topic of sleep and stroke.

### III. Results:

### Nap, Sleepiness and Stroke

Sleep is essential for the proper physical and psychological functioning of humans. In addition to prolonged nighttime sleep, daytime napping may also serve as an important form of physiological recovery. In the scientific literature, a nap is defined as sleep occurring during the daytime that is shorter than nighttime sleep. Naps can be classified according to their duration into short naps (less than 30 minutes), medium naps (30–90 minutes), and long naps (more than 90 minutes) [1].

Depending on their intentionality, naps may be planned, for example as a preventive measure aimed at reducing sleepiness, or spontaneous, occurring as a response to increasing fatigue [2]. In many cultures, napping is an integral part of the daily rhythm and is regarded as a time for physical recovery, with the siesta being a well-known example.

The sleep–wake rhythm is based on a two-process model of regulation, in which two processes interact: the homeostatic process (Process S) and the circadian process (Process C) [3] [4]. Process S is responsible for the gradual increase in sleep pressure with prolonged wakefulness, whereas Process C is regulated by the suprachiasmatic nuclei (SCN) of the hypothalamus in accordance with the light–dark cycle [5]. Proper synchronization of these two processes enables optimal functioning of the organism, including daytime activity and nighttime rest. However, in the era of modern technology, widespread exposure to artificial light and shift work increasingly disrupt this rhythm, negatively affecting psychophysical performance and promoting the development of civilization-related diseases [3].

Stroke affects an average of 2–3 individuals per 1,000 annually. It is currently the second leading cause of death and the primary cause of long-term disability among adults. Stroke risk factors are divided into non-modifiable and modifiable factors. Non-modifiable risk factors include age (with risk increasing with advancing age), male sex, previous vascular disorders, elevated fibrinogen levels, genetic factors (e.g., coagulation disorders), and Black race. Modifiable risk factors include uncontrolled arterial hypertension, diabetes mellitus, dyslipidemia, obesity, sleep-disordered breathing, cigarette smoking, excessive alcohol consumption, and insufficient physical activity. Despite increasing public awareness of lifestyle factors and their impact on stroke risk, there remains a need to seek new solutions in the field of prevention and health education [6].

### Physiological mechanisms of sleep and naps

Sleep plays a fundamental role in the regulation of the nervous and vascular systems. During sleep, changes occur in autonomic nervous system activity, leading to a reduction in heart rate, peripheral vascular resistance, and arterial blood pressure, as well as influencing blood viscosity and plasma fibrinolytic activity. Adequate sleep also regulates the synthesis and release of pro-inflammatory cytokines, contributing to a reduction in inflammation and oxidative stress, as well as hormones such as cortisol, melatonin, prolactin, and growth hormone. Sleep deprivation results in elevated cortisol levels, which in turn increase blood glucose concentrations and impair insulin action at the cellular level, thereby increasing susceptibility to the development of diabetes in the long term [3].

### Mechanisms through which naps may influence stroke risk

Reduction of blood pressure – short naps may contribute to lowering blood pressure and facilitate recovery following psychological stress. However, sudden awakening from deep sleep may lead to abrupt increases in blood pressure and heightened sympathetic nervous system activity, which may potentially promote the occurrence of ischemic stroke. Studies have shown that cardiovascular mortality was inversely proportional to the frequency of napping, particularly among men [7].

Impact on the blood–brain barrier – sleep disorders such as obstructive sleep apnea, which may be accompanied by an increased need for naps and sleep fragmentation, lead to hypoxia. This may disrupt the integrity of the blood–brain barrier, intensifying inflammatory and neurodegenerative processes [8].

Glucose metabolism – the effect of naps on glucose homeostasis is closely linked to the regulation of circadian rhythms and metabolism. A study published in 2013 demonstrated that habitual naps lasting longer than 30 minutes in older adults were associated with a higher risk of impaired fasting glucose and the development of diabetes mellitus [9]. Long naps may promote desynchronization of the biological clock and lead to metabolic disturbances.

It is essential to distinguish between a short, healthy nap lasting less than 30 minutes, which improves alertness and cognitive performance without disrupting natural sleep rhythms, and excessive daytime sleepiness, defined as pathological sleepiness (hypersomnia). The latter often represents a warning signal of more serious disorders, such as nocturnal sleep fragmentation, depression, or developing cardiometabolic diseases [10].

The influence of nighttime sleep quality on the need for naps is direct—among individuals who nap due to reduced nighttime sleep quality and frequent awakenings, napping may serve as a means of compensating for sleep deficits. However, excessively long naps may further impair nighttime sleep quality, leading to the development of a vicious cycle [2].

**Napping as a risk factor for stroke**

The clear impact of daytime naps on the risk of stroke remains a matter of debate. Potential factors taken into account when assessing their potential impact include frequency and duration of naps. According to Kaźmierski et al., naps lasting >60-90 min are associated with a significantly higher risk of stroke than naps lasting 1-30 min, which appear to have a neutral or even beneficial effect [11]. An analysis conducted by Jin et al. showed that every 10-minute increase in nap duration is associated with a 3% increase in the risk of stroke [12]. Research conducted by Yang et al. suggests that increased frequency of daytime naps (regardless of duration) may be associated with a higher risk of developing essential hypertension and stroke. The exact mechanism remains unclear, but it appears to be related to an increase in pro-inflammatory factors and prolonged exposure to evening blood pressure spikes after daytime napping [13]. It should also be remembered that excessive daytime sleepiness can also be a symptom of certain diseases, such as the common sleep apnea syndrome or the less frequently diagnosed narcolepsy. Sleep apnea syndrome, resulting from nocturnal obstruction of the upper respiratory tract and mainly affecting obese people, is strongly associated with hypertension, atrial fibrillation, heart failure, and type 2 diabetes, as well as with the risk of stroke. It is a significant risk factor for sudden death and cardiovascular complications [14].

**The potential protective effect of naps on the human body**

Research conducted by Sun et al. shows that long naps during the day (lasting at least 1 hour) are associated with an increased risk of obesity, metabolic disorders (dyslipidemia, diabetes), hypertension, cardiovascular disease, and overall mortality. On the other hand, short naps during the day (lasting <1 hour or 30 minutes during the day) not only do not increase cardiovascular risk, but also seem to have a beneficial effect on health [15]. Short naps during the day lasting between 45 and 60 minutes seem to accelerate cardiovascular regeneration by facilitating the normalization of MAP (mean arterial pressure) in response to stress stimuli [16]. In addition, there are reports in the literature on the beneficial effects of short naps during the day (lasting 20-30 minutes) on cognitive functions in the period from 30 to 120 minutes after the end of the nap[2]. It also turns out that the adverse effects of long naps on health remain independent of factors such as age, gender, or comorbidities[17]. Short naps during the day (so-called "power naps") can be beneficial in reducing the adverse effects of chronic sleep deprivation, which is common nowadays. By preventively reducing the impact of stress factors (decreasing cortisol concentration and catecholamine release), immune system dysfunction (faster normalization of neutrophil concentration, reduction of interleukin-6 and CRP concentration) and response to pain stimuli (reduction of pain sensation and increased pain tolerance), they contribute to faster regeneration of the body. In addition, they have a beneficial effect on alertness and memory, accelerate the regeneration of cognitive functions more effectively than, for example, caffeine or exposure to light, and improve mood and mental state [18]. In addition, daytime naps not only reduce the risk of poorer performance in athletes exposed to nighttime sleep deprivation, but also appear to have benefits in terms of physical performance and cognitive function. However, in the case of athletes, it seems that longer naps lasting > 35-90 minutes bring greater benefits [19].

**Influence of Age, Sex, Lifestyle, and Comorbidities on Daytime Napping and Stroke Risk**

There are epidemiologic data showing that the relationship between napping and the risk of cardiovascular events, including stroke, is affected by age and gender. The highest relationship between napping and cardiovascular events and death from cardiovascular events is found in individuals aged 65-74 years, in whom frequent and long napping was observed to be a significant independent risk factor for cardiovascular events and death from these events. Especially among individuals aged 65-74 years, there was a higher relationship between the risk of vascular events and gender differences in napping, which could be attributed to hormonal factors in women [20].

Lifestyle is an important modifier of association between napping and stroke risk. It has been found to be significantly linked to an increased risk of developing primary (essential) hypertension and ischaemic stroke with increased frequency of napping during daylight hours in those who are physically inactive, have poor dietary habits, and are shift workers. Frequent napping may be compensation for chronic sleeping problems and an unhealthy lifestyle that can lead to an increased risk of stroke indirectly by increasing the risk of vascular events [21].

In Southern European countries, where the temperature often reaches high values during the afternoon, the siesta, which represents an ingrained cultural habit to nap regularly throughout the day, is very common. In two large prospective cohort studies conducted within the Mediterranean area, prolonged daily napping (>30 minutes) was shown to be related to the significantly increased risk of AF, with respect to shorter daily napping (<30 minutes), whereas those referring both to prolonged daily napping and poor nighttime sleep (<6 hours or >8 hours) had an approximately threefold increased risk of AF, thus indicating the additive role of unhealthy sleep habits on AF risk within the Mediterranean region[22].

In the Mediterranean region, longer nap duration has been shown to be positively correlated with the incidence of hypertension and cardiovascular disease, particularly when accompanied by shorter nighttime sleep duration. Apparently, both the duration of the nap as well as its combination with overall sleep patterns could play a role regarding CMR (Cardio Metabolic Risk) [23].

Co-existing cases of diabetes, hypertension, and obesity affect the link between daytime napping and the risk of having a stroke. In people with type 2 diabetes, frequent daytime napping has been linked with a higher risk of having a stroke or any significant adverse cardiovascular event. This is after adjusting for potential confounding variables. Longer napping occasions have also been associated with a higher prevalence of obesity. This can act as an independent risk factor for having a stroke [24].

From meta-analysis studies, the risk of cardiovascular events is increased for people taking prolonged naps during the day, lasting 60 min or more. Additionally, in people with the characteristics of metabolic syndrome, such as abnormal blood pressure and abnormal glucose metabolism, the irregularity in sleep timing and the prolongation of napping further contribute to the increased occurrence of stroke [25].

These findings highlight that the presence of comorbidities may amplify the negative impact of daytime napping on cardiovascular health.

**Sleep Monitoring Technologies as Tools for Assessing Stroke Risk**

Sleep technology has increasingly been used in the study of strokes, particularly with respect to daytime sleepiness and the habit of daytime napping. This habit of daytime napping could potentially be the first sign of a person having a risk for having a stroke. With the use of wearable technology such as smart watches or activity trackers, one can monitor their activities on a constant basis. The use of the monitor on the wrist has been shown to efficiently take night and daytime napping measurements. This can be particularly difficult with the use of the self-reported questionnaire [26].

Actigraphy still represents the gold standard of objective sleep evaluation in a clinical setting. Extended actigraphy recordings can now objectively evaluate the frequency, duration, and timing of naps, providing information which can be related to cardiovascular events. Actigraphy studies have now successfully revealed the pattern of napping during the daytime in stroke patients, pointing towards excessive daytime somnolence, which increases the risk of recurrence of stroke events [27].

Devices allowing contactless and multisensor monitoring also present other opportunities for long-term monitoring without the need to adhere to device use. Sleep times and the times of day when naps are taken could be detected through the use of sensors embedded under the mattress or in bedding systems. The technologies are useful in understanding the sleep habits associated with taking naps among the elderly because this group is prone to cerebrovascular accidents and could be used to identify early signs of excessive sleeping during the day before the event of stroke [28].

## IV. Discussion

A review of the literature indicates that sleep, including daytime naps, plays a key role in the physiological regulation of the body, particularly in the functioning of the nervous system, circulation, and metabolism. Short naps, lasting less than 30 minutes, exert beneficial effects on cognitive performance, alertness, blood pressure control, and the body’s response to stress. In contrast, long naps—especially those exceeding 60–90 minutes—may be associated with an increased risk of cardiovascular events, including stroke, suggesting that the duration and frequency of naps are clinically relevant factors.

From a mechanistic perspective, short naps may have a protective influence by reducing oxidative stress and inflammation, regulating hormonal activity (cortisol and growth hormone), and stabilising the autonomic nervous system. Conversely, prolonged naps or excessive daytime sleepiness may contribute to the desynchronisation of circadian rhythms, transient increases in blood pressure after awakening, and metabolic disturbances, which in turn elevate the risk of ischaemic stroke. Long naps appear to be particularly unfavourable in older adults with diabetes, hypertension, or obesity, underscoring the importance of considering comorbidities in risk assessment.

Epidemiological data further suggest that the health impact of naps is modified by demographic characteristics and lifestyle factors. Among individuals aged 65–74 years, frequent and long naps constitute a significant independent risk factor for cardiovascular events. In women, hormonal determinants may additionally modulate this relationship, while in people with sedentary lifestyles or those engaged in shift work, napping may mask chronic sleep deprivation, indirectly promoting stroke risk. In regions where the siesta represents a common cultural practice, prolonged daytime naps combined with poor nocturnal sleep are linked to higher rates of atrial fibrillation and hypertension, highlighting the need to account for environmental and cultural context when evaluating the effects of naps on health.

The application of modern sleep monitoring technologies—such as actigraphy and sensors integrated into mattresses or wearable wristbands—enables objective assessment of the duration and quality of daytime sleep and facilitates the identification of excessive sleepiness, which may serve as an early marker of stroke risk. These tools hold potential for use in the prevention and surveillance of high-risk patients, allowing for timely intervention even before a vascular event occurs.

## V. Conclusions

In summary, short naps lasting less than 30 minutes have beneficial effects on cognitive function, regeneration, the cardiovascular system, and the regulation of stress hormones. They may partially compensate for insufficient or poor-quality nighttime sleep and support physiological health, and they do not appear to significantly influence stroke risk. In contrast, long naps lasting more than 60–90 minutes, particularly when taken frequently during the week or repeated several times throughout the day, are associated with a higher risk of stroke, cardiovascular disease, and hypertension. This effect is markedly more pronounced in older adults with chronic conditions such as diabetes, uncontrolled hypertension, or obesity. Excessive daytime sleepiness may constitute an independent cardiovascular risk factor and can also represent an early manifestation of disorders including obstructive sleep apnoea syndrome.

Future research should focus on a multifactorial assessment of the impact of daytime naps on stroke and cardiovascular risk, taking into account nap duration, time of day, frequency, relationship with meals, and interaction with nighttime sleep quality. Large prospective cohort studies involving diverse adult populations are needed to better determine the direction of these associations. At the same time, experimental and clinical investigations are recommended to explore the physiological mechanisms potentially linking naps with stroke, with particular attention to comorbidities that may modify this effect.

The use of modern sleep monitoring methods—such as actigraphy and widely available wearable sensors—should become an integral component of future studies, as these technologies allow more accurate assessment of sleep and napping patterns in everyday life. Such an approach could contribute to the development of targeted preventive strategies and to earlier identification of patients in the preclinical or early stages of disease.

**Conflicts of interest:** No conflicts of interest to declare.

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