

Sleep Duration and Cardiovascular Disease Risk



Epidemiologic and Experimental Evidence

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KEYWORDS

- Sleep duration • Cardiovascular disease • Sleep deprivation • Hypertension
- Coronary heart disease • Stroke

KEY POINTS

- Inadequate sleep has become increasingly pervasive, and its impact on health and quality of life remains to be fully understood.
- Both extremes of sleep duration have been associated with increased prevalence and incidence of cardiovascular diseases, including hypertension, coronary heart disease, and stroke.
- Aberrations in physiologic functions induced by abnormal sleep may explain this association, along with enhanced prevalence of established cardiovascular risk factors.

INTRODUCTION

According to outcome-based recommendations issued recently by the National Sleep Foundation, the appropriate sleep duration for adults lies between 7 and 9 hours per night.¹ Notably, only 48% of the US adult population reports a habitual sleep time falling within that range,² whereas 26% average 6 to 7 hours of sleep per night, and 20% sleep less than 6 hours per night.

The time allotted to sleep has gradually declined over the past decades, with similar trends observed in multiple Western countries.³ A growing proportion of individuals are curtailing their sleep in response to increasing demands and lifestyle changes, such as prolonged working hours, increased environmental lighting, and introduction of new communication technologies, which enable living “around the clock.”

Nevertheless, changes in sleep habits are not without consequences. Deviations from optimal sleep duration may pose a substantial threat to health, with the detrimental effects of abnormal sleep on physical and psychological well-being only beginning to be unraveled. In this review, available data on the relationship between abnormal sleep duration and risk of prevalent and incident cardiovascular disease, the leading cause of morbidity and mortality, are presented. The putative physiologic mechanisms underlying the observed associations and potential confounders are also discussed.

EPIDEMIOLOGIC EVIDENCE

Hypertension

Hypertension is widespread, affecting approximately one-third of the adult population in the

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United States, and is a prominent risk factor for other cardiovascular and cerebrovascular diseases.⁴ Epidemiologic evidence indicates that the relationship between customary sleep duration and risk of hypertension is better described as a curvilinear phenomenon, with both extremes of the sleep length distribution independently associated with enhanced likelihood of prevalent hypertension in the general population.⁵⁻⁷

A U-shaped relationship between self-reported sleep length and hypertension has been documented in a large (N = 71,455) national representative sample (National Health Interview Survey, NHIS),⁶ with both ends of the tail exhibiting larger age-standardized prevalences of hypertension (<6 hours/night: 32.4%; ≥10 hours/night: 32.5%) compared with the referent category (8 hours/night, 23.2%). Similarly, the lowest risk of hypertension in the Sleep Heart Health Study⁷ was observed in those subjects sleeping 7 to 7.9 hours per night, whereas a progressive increase was seen when moving away from this reference. The greater hazard conferred by both short and long sleep withstood multivariable adjustments for lifestyle, clinical, and sleep-related covariates (adjusted odds ratio [OR] = 1.66, 95% confidence interval [CI] = 1.35–2.04 for <6 hours/night; OR = 1.30, 1.04–1.62 for ≥9 hours/night). Large population studies have replicated this pattern.^{5,8}

Although both ends of sleep duration have been cross-sectionally related to hypertension, the prospective contribution of long sleep is less compelling. As concluded by a recent meta-analysis,⁹ current longitudinal data mainly support a role of short sleep as an independent marker of incident hypertension.

Indeed, it has been estimated that individuals sleeping less than 6 hours per night are 20% to 32% more likely to develop hypertension compared with those sleeping 7 to 8 hours.^{8,10} Gangwisch and colleagues¹⁰ studied the incidence of hypertension over an 8- to 10-year time span using the first National Health and Nutrition Examination Survey (NHANES I) dataset. In the pooled cohort comprising 4810 participants, fully adjusted probability of high blood pressure (BP) was more elevated in those sleeping 5 hours per night or less (adjusted hazard ratio [HR] = 1.32, 1.02–1.71) than in normal sleepers (7–8 hours/night). Nevertheless, age-stratified analysis revealed that those who were 32 to 59 years old and reported habitual sleep 5 hours or less were 60% more likely to develop hypertension than peers sleeping 7 to 8 hours. Conversely, sleep duration was unrelated to outcomes in the older age strata (60–86 years). Several cohort studies

have subsequently replicated these null findings in the geriatric population.^{8,11,12}

Women have been found to be more susceptible to the pressor effects of abnormal sleep. Estimates for both prevalent and incident hypertension derived from the Whitehall II study¹³ were higher in middle-aged women who were sleeping 5 hours per night or less compared with those sleeping 7 hours, but not in men. Sex-specific associations have been confirmed and are further detailed in a transversal examination of the Western New York Health Study,¹⁴ where a subanalysis of the female sample classified by menopausal status unveiled significantly higher odds only in premenopausal women.

Differential vulnerability to abnormal sleep length has also been reported across ethnicities. Event rates for hypertension were higher in Black subjects from the NHIS who were sleeping less than 6 hours per night or greater than 8 hours per night, compared with their White counterparts.¹⁵ These data are in line with findings from the Coronary Artery Risk Development in Young Adults (CARDIA) study,¹⁶ where objective sleep duration, as quantified from actigraphy, related to greater surges in BP in African Americans.

The moderating effect of demographic variables on the link between sleep duration and hypertension interestingly parallels the increased prevalence of this condition in women after 65 years old and in the African American population.⁴

When BP is treated as a continuous variable, again a U-shaped relationship with sleep hours can be described, although it is more robust for systolic values.^{12,17} Abnormal sleep duration is also associated with altered diurnal BP rhythmicity. Both excess sleep and curtailed sleep have been linked with attenuated nocturnal dipping in BP,^{17,18} which is a sensitive prognostic marker for cardiovascular disease.¹⁹

Coronary Heart Disease

Coronary heart disease (CHD), which comprises a spectrum of acute and chronic manifestations, remains the major cause of death worldwide,²⁰ with rising prevalence.⁴ Abnormal sleep duration has been identified as a risk factor for CHD on the basis of epidemiologic studies, which show a cross-sectional relationship consistent with a U-shaped curve.²¹⁻²⁴ Weighted prevalence of total CHD was higher in respondents of the Behavioral Risk Factor Surveillance System (BRFSS) survey reporting either 6 hours per night or less (11.1%, 95% CI: 10.1–12.1) or 10 hours per night or more (14.8%, 12.0–17.6) than in the reference group sleeping 7 to 9 hours (7.9%, 7.3–8.5).²² When the

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