



Original Article

Sleep duration associated with cardiovascular conditions among adult Nevadans



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ABSTRACT

Background: Associations between sleep duration and cardiovascular conditions have been inconsistent. Both short and long sleep duration are associated with increased risk for diabetes, hypertension, obesity, high cholesterol, depression, and overall metabolic dysfunction; all of which are cardiovascular disease risk factors. This study aimed to determine if deficient or excessive sleep duration is associated with cardiovascular conditions.

Methods: Data were obtained from the 2013 Behavioral Risk Factor Surveillance System for the state of Nevada. A total of 5101 participants completed the survey and answered questions as to whether they had ever had a cardiovascular condition ie, myocardial infarction, coronary heart disease or angina, and stroke. Multiple logistic regression was implemented during analyses and yielded four models including demographics, co-morbidity, behavior, and final significant variables.

Results: Six significant predictor variables were identified in the final model. Sleep duration was statistically significant ($p < 0.0001$). Individuals having deficient sleep, eg, 1–4 h a night, were 2.4 times more likely to have a cardiovascular condition versus those sleeping 7–9 h per night (OR = 2.412, CI = 1.139, 5.107). As for individuals who sleep excessively, eg, 10–18 h a night, they were nearly 7.2 times more likely to have a cardiovascular condition, compared to individuals who receive a normal night's sleep (OR = 7.170, CI = 3.284, 15.654).

Conclusions: Both deficient and excessive sleep duration were significantly associated with a cardiovascular condition, even after adjustment for covariates. The findings from this study can be used as additional evidence to encourage further research on improving sleep by developing future treatment therapies, and recommendations, that may help lower the risk of cardiovascular disease conditions.

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1. Introduction

Cardiovascular disease (CVD) is the leading cause of mortality in the United States accounting for one out of every three deaths [1]. Cardiovascular disease encompasses numerous vascular conditions including myocardial infarction, coronary heart disease or angina, and stroke. Approximately 84 million American adults have one or more cardiovascular disease conditions with an estimated 42.2 million of these individuals aged 60 years or older [1]. Furthermore, incidence of cardiovascular disease conditions is increasing with estimates suggesting that 43.9% of the population of the United States is expected to have some form of cardiovascular disease by

the year 2030. Consequently, both direct and indirect costs will increase substantially by 2030 [1]. Direct costs from 2012 to 2030 are expected to rise to \$918 billion with the majority attributed to hospital costs; while, indirect costs will rise to \$290 billion. Based on economic cost alone, primary prevention is critical for cardiovascular conditions [2,3].

To prevent cardiovascular disease conditions, research must be done to identify modifiable risk factors that may precede these diseases. Known risk factors include: age, low birth weight, race/ethnicity, genetic factors/family history, obesity, gender, high blood pressure, diabetes, high cholesterol, unhealthy diet, physical inactivity, tobacco use, alcohol abuse, and depression [4–6]. However, less is known about sleep duration, and its relation to cardiovascular diseases and its conditions, not its risk factors [7].

Current sleep studies including both quality and duration of sleep have shown inconsistent associations and uncertain causality between sleep and cardiovascular conditions. Studies specifically

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for the state of Nevada are sparse, and are only included in conjunction with other states e.g. multi-state, population-based studies. These multi-state, population-based studies have shown short and long sleep duration as being associated with known cardiovascular risk factors such as diabetes, hypertension, obesity, high cholesterol, depression, and overall metabolic dysfunction [5,8–11]. Studies have assessed associations between sleep duration versus sleep insufficiency and cardio-metabolic outcomes; general sleep disturbance and cardiovascular diseases; daytime sleepiness as a risk factor for CVD; and sleep duration, quality, and CVD mortality among the elderly [12–15]. Short and long sleep durations have both been cited as potential risk factors for cardiovascular diseases; however, there is still uncertainty about the association and causality. One study examining short sleep duration and cardiovascular disease found that those who slept less than 6 h were not at risk for cardiovascular disease after adjustment, but were at risk for type II diabetes [16]. Another study found that sleep duration was an independent risk factor for cardiovascular disease, and mortality for women only [17]. A cohort study in Sweden found short sleep duration was associated with myocardial infarction but not stroke [18]. However, a cohort in the United States found an association between short sleep duration and stroke, but not heart disease [19]. Aggarwal et al. (2013) found that short sleep durations were associated with stroke, myocardial infarction, and congestive heart failure, whereas long sleep durations were associated with coronary artery disease and angina. Altman et al. (2012) also found that deficient and excessive sleep were both associated with myocardial infarction and stroke. Some epidemiological studies have observed strong associations with obstructive sleep disorders (OSD) and cardiovascular diseases indicating obstructive sleep apnea (OSA), and sleep disordered breathing (SDB), may be strong risk factors [20–23].

With more than one third of the United States population reporting less than 7 h of sleep per night on average, the potential association between sleep deficiency and CVD is concerning [24]. According to the National Sleep Foundation, the average adult needs between 7 and 9 h of sleep per day, yet in 2008, 28% adults in the United States reported having deficient sleep [25]. It is estimated that 50–70 million adults in the U.S. have some form of a chronic sleep disorder, such as chronic insomnia, sleep talking or walking, sleep apnea, narcolepsy, and restless leg syndrome [25]. Almost one third of adults have reported getting insufficient sleep the previous 14 days or more in the past 30 days. Potential risk from inadequate sleep duration includes increased BMI, depression, substance abuse, and type II diabetes [26]. However, further research is needed to understand the association between sleep duration, either deficient or excessive, and CVD.

The primary objective of this study was to investigate the association between deficient and excessive sleep duration and myocardial infarction, coronary heart disease or angina, and stroke (ie, cardiovascular disease conditions) in adult Nevadans. The second objective of this study was to identify which demographic, co-morbid, and behavioral variables are associated with the combined cardiovascular condition variable.

2. Materials and methods

2.1. Study design and sample

This cross sectional, population-based study utilizes the 2013 Nevada Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is an annual, random-digit dialed telephone survey which was conducted as a collaboration between the Centers for Disease Control and Prevention (CDC) and each state with the purpose of collecting health-related data in the United States. These data

include risk behaviors, chronic health conditions, use of preventive services, and demographics. A standardized core questionnaire, along with optional modules, and state-added questions are administered. The population included in the BRFSS are adults aged 18 years or older who are not institutionalized. As of 2011, the survey utilizes landlines and cellular phones. The BRFSS goal is to capture at least 4000 interviews annually per state. The sample size for Nevada in 2013 was 5101.

2.2. Variables

To obtain the dependent variable for a cardiovascular disease (CVD) condition, three dichotomous variables were combined. This variable included: heart attack, coronary heart disease or angina, and stroke. Participants were asked if a doctor, nurse, or other health professional had ever told them they have had a heart attack, coronary heart disease or angina, and stroke. If the participant said yes to having any of these three conditions, they were considered to have CVD. The independent variables (IV) used in this analysis were divided into three individual blocks for the purpose of running a multiple regression model. These three blocks included a demographic, a co-morbid, and a behavioral block. Subsequently, a final model was run with the significant variables resulting from the previous three models in order to reduce collinearity and confounding bias.

The independent variables (IV) in the demographic model include: sex, race/ethnicity, age, marital status, education, and health insurance coverage. The variable 'sex' was dichotomous and other demographic variables were categorical as shown in Table 1.

The independent variables (IV) in the co-morbid model include: hypertension, high cholesterol, diabetes, depression, and BMI. Participants were asked if a doctor, nurse, or other health professional had ever told them they had hypertension, high cholesterol, diabetes, or depression. These variables were dichotomized as yes

Table 1
Descriptive statistics for the state of Nevada, BRFSS 2013 (N = 5102).

| Variable | Unweighted (n) | Weighted % |
|-------------------------------|----------------|------------|
| Gender | | |
| Male | 2195 | 50.2% |
| Female | 2907 | 49.8% |
| Age | | |
| 18–34 years old | 895 | 30.4% |
| 35–44 years old | 631 | 17.6% |
| 45–64 years old | 1915 | 33.9% |
| 65 years and older | 1607 | 18.1% |
| Race | | |
| White | 3744 | 56.1% |
| Black | 187 | 7.7% |
| Other race | 259 | 9.9% |
| Multi-racial | 218 | 1.9% |
| Hispanic | 611 | 24.4% |
| Marital | | |
| Married | 2480 | 50.4% |
| Divorced | 912 | 13.4% |
| Widowed | 618 | 6.6% |
| Separated | 129 | 2.8% |
| Never married | 930 | 26.8% |
| Education | | |
| Did not graduate High School | 356 | 17.1% |
| Graduated High School | 1375 | 29.5% |
| Attended College/Tech School | 1728 | 33.6% |
| Graduated College/Tech School | 1626 | 19.9% |
| Insurance | | |
| Yes Insurance | 4727 | 94.7% |
| No Insurance | 327 | 5.3% |

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