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May 21, 2021

Biostatistics 624

Final Abstract

**Title:** Behavioral Risk Factors of Excessive Daytime Sleepiness in NHANES 2017-2018

**Context:** Insufficient sleep duration and quality is associated with both morbidity and mortality from cardiometabolic disorders and affects neurobehavioral functioning.1,2 The 20th century has seen a downward trend in sleep duration and quality.3 Understanding factors associated with poor sleep could provide avenues for intervention and ultimately impact morbidity and mortality.

**Design:** Data were obtained from National Health and Nutritional Examination Survey (NHANES) 2017-2018, a cross-sectional complex survey.

**Setting:** Home interviews and exams were conducted on a nationally representative sample of adults and children in the United States.

**Participants:** A population-based sample was derived from a complex multistage, probability sampling design. 9,254 participants were interviewed, and 8,704 were examined. Only participants aged 18 and older were included in the analysis, resulting in a study sample size of 5,856.

**Exposures:** Since this is a risk factor study, all exposures were considered equally with no primary exposure of interest. Potential risk factors were derived from evidence in the literature.3–6 BMI and caffeine intake were measured in the examination stage. Alcohol use, excessive daytime sleepiness, current smoking, depression score, race and ethnicity, age, and participation in moderate to vigorous exercise were all collected at the interview stage. All risk factors except for income-to-poverty ratio, were transformed into categorical variables based on literature-informed criteria and conventions.

**Main outcome Measure:** Excessive daytime sleepiness was chosen as the outcome of interest. This outcome was selected over self-reported hours of sleep because it is an indicator of sleep quality, rather than sleep duration.7,8 In addition, the missingness rate was lower for this outcome than it was for sleep duration measures. The question asked to participants was “In the past month, how often did {you/survey participant} feel excessively or overly sleepy during the day?” Following the convention of Lal et al., participants responded as “Often” or “Almost always” were categorized as “Yes,” and other responses were categorized as “No.7 This study was exploratory in nature and meant to be hypothesis-generating and replicate prior associations between behavioral risk factors and sleep quality.

**Results:** Of all individuals screened, the response rate of the interviewed sample was 51.9% and the response rate of the examined sample was 48.8%. Belonging to older age groups (40-59 years & 60+ years) conferred a decreased risk (PR = 0.79, CI: 0.66-0.96 & PR = 0.79, CI: 0.67-0.92, respectively) of excessive daytime sleepiness when compared to a referent group of 18-39 years, contrary to what is expected based on the literature.3 This may indicate that age-differential lifestyle factors confound the relationship between age and sleep quality. There was also an association in the opposite direction of to what is expected for race categories.3 When compared to white individuals, Hispanic, Asian, and Black individuals have a decreased risk of excessive daytime sleepiness (PR = 0.73, CI: 0.60-0.89; PR = 0.57, CI: 0.41-0.81; & PR = 0.79, CI: 0.64-0.97, respectively).

Perhaps the most clinically actionable associations were mild and moderate to severe depression (PR = 1.90, CI: 1.56-2.33 & PR=1.27, CI: 1.06-1.53, respectively), caffeine intake (PR = 1.25, CI: 1.04-1.51), and obesity (PR = 1.46, CI: 1.19-1.80). The direction of the association of depression score with excessive daytime sleepiness varied by severity, which may be due to low sample sizes in severity categories. Some covariates previously presented as risk factors for poor sleep quality in the literature that were not replicated in this study were heavy alcohol use (PR = 1.06, CI: 0.90-1.25), current tobacco smoking (PR = 1.10, CI: 0.96-1.26), and participation in weekly moderate to vigorous physical activity (PR = 1.03, CI: 0.92-1.15).4,9,10

**Conclusion:** For many risk factors, there were conflicting results with previous studies. More research is needed to uncover the links between age, race, alcohol use, tobacco smoking and exercise on sleep quality. High daily caffeine consumption is a modifiable risk factor that could play a role in causing excessive sleepiness during the day. Based on these results and the results of previous research, it may be clinically advisable to address sleep hygiene in people with depression and obesity to prevent future morbidity and mortality.

**Citations**

1. Gangwisch JE, Heymsfield SB, Boden-Albala B, et al. Short Sleep Duration as a Risk Factor for Hypertension: Analyses of the First National Health and Nutrition Examination Survey. *Hypertension*. 2006;47(5):833-839. doi:10.1161/01.HYP.0000217362.34748.e0

2. Hall MH, Muldoon MF, Jennings JR, Buysse DJ, Flory JD, Manuck SB. Self-Reported Sleep Duration is Associated with the Metabolic Syndrome in Midlife Adults. *Sleep*. 2008;31(5):635-643. doi:10.1093/sleep/31.5.635

3. Bixler E. Sleep and society: An epidemiological perspective. *Sleep Med*. 2009;10:S3-S6. doi:10.1016/j.sleep.2009.07.005

4. Phillips BA. Cigarette Smoking and Sleep Disturbance. *Arch Intern Med*. 1995;155(7):734. doi:10.1001/archinte.1995.00430070088011

5. Temple JL, Bernard C, Lipshultz SE, Czachor JD, Westphal JA, Mestre MA. The Safety of Ingested Caffeine: A Comprehensive Review. *Front Psychiatry*. 2017;8:80. doi:10.3389/fpsyt.2017.00080

6. Schoenborn C, Adams P. Sleep duration as a correlate of smoking, alcohol use, leisure-time physical inactivity, and obesity among adults: United States, 2004–2006. Published online April 7, 2010. Accessed May 21, 2021. http://medbox.iiab.me/modules/en-cdc/www.cdc.gov/nchs/data/hestat/sleep04-06/sleep04-06.htm#socialMediaShareContainer

7. Lal C, Kumbhare S, Strange C. Prevalence of self-reported sleep problems amongst adults with obstructive airway disease in the NHANES cohort in the United States. *Sleep Breath*. 2020;24(3):985-993. doi:10.1007/s11325-019-01941-0

8. Xu F, Adams SK, Cohen SA, Earp JE, Greaney ML. Relationship between Physical Activity, Screen Time, and Sleep Quantity and Quality in US Adolescents Aged 16–19. *Int J Environ Res Public Health*. 2019;16(9):1524. doi:10.3390/ijerph16091524

9. Stein MD, Friedmann PD. Disturbed sleep and its relationship to alcohol use. *Subst Abuse*. 2005;26(1):1-13. doi:10.1300/j465v26n01\_01

10. Kredlow MA, Capozzoli MC, Hearon BA, Calkins AW, Otto MW. The effects of physical activity on sleep: a meta-analytic review. *J Behav Med*. 2015;38(3):427-449. doi:10.1007/s10865-015-9617-6