The Association Between Weekly Activity and Trouble Sleeping in Middle-Aged Adults

Jonathan Groth, Quantitative Analysis Center, Wesleyan University

Introduction

- Inconsistent or lacking physical activity leads to negative health outcomes including both poor sleep quality and increased risk of sleep disorders (Alnawwar, 2023).
- While the association has been well established in the literature, less is known about the ways in how BMI may play a role in the emergence of sleep disorders when controlling for highly active individuals.
- Most research that has focused on how BMI and Physical Activity interact when looking at sleep outcomes leaves results open to whether or not findings are applicable to large and diverse populations (Alnawwar, 2023).
- Acknowledging that BMI is not a tell-all indicator of health, looking at individuals who have healthy lifestyles will help determine what factors play the most significant roles in sleep.

Methods

Sample

- The National Longitudinal Study of Adolescent Health, or Add Health, is an ongoing longitudinal study of a nationally-representative sample of more than 20,000 adolescents in grades 7-12 in the United States in 1994-95 who have been followed through adolescence and their transition to adulthood with five in-home interviews in 1995, 1996, 2001-02, 2008-09, and most recently in 2016-18 when they were aged 33-45 years old, which included responses from 4,196 of the original participants.

Measures

- Physical activity was measured through four questions that asked how many times per week participants biked/skateboarded/danced/hiked/hunted/did yard work, participated in gymnastics/weightlifting/strength training, participated in sports, and walked for exercise. Responses were recorded from 0 (0 times per week) to 7 (7 times per week), then summed together across all four questions to create an activity score from 0-28. Individuals who participated in physical activities 4 or more times per week were indicated as "highly active".
- Whether or not participants struggled with sleep or not was calculated by summing up binary responses to questions asking if participants snored, stopped breathing, had sleep apnea, needed 2+ pillows, or had trouble breathing during sleep. Struggling to sleep was categorized with a score of 1 or higher.
- BMI was calculated from participants' self-reported height and weight, then categorized using standard BMI classifications: underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obese (≥30.0). Demographic variables included age, gender, race, and income.

Research Questions

- What is the association between BMI and sleep outcomes in middle-aged individuals who are highly active?
- Does the protective effects of physical activity in regards to trouble sleeping outweigh the negative influence of high BMI on sleep?

Results

Univariate

- 70.3% of highly active individuals reported sleep symptoms that indicated troubles with sleeping
- 75.4% of not highly active individuals reported sleep symptoms that indicated troubles with sleeping

Bivariate

- When examining the association between BMI and trouble sleeping , an Analysis of Variance revealed that individuals who reported trouble sleeping had significantly higher BMI (Mean difference = 4.93, 95% CI [4.15, 5.71]) compared to those who did not report trouble sleeping. The overall model was statistically significant, $F(1, 1864) = 153.50$, $p < .0001$, indicating a meaningful difference in BMI between the two groups.
- Post hoc comparisons using Tukey's HSD confirmed that individuals who reported trouble sleeping had significantly higher BMI compared to individuals who did not report trouble sleeping (mean difference = 4.93, $p < .001$).

Multivariate

- BMI (O.R. 1.10, CI 1.07–1.13) is significantly associated with the likelihood of reporting trouble sleeping after controlling for income and the BMI × income interaction term. Each one-unit increase in BMI is associated with an expected 10% increase in the odds of reporting trouble sleeping, holding all other variables fixed.
- Income (O.R. 0.85, CI 0.57–1.27) is not significantly associated with the likelihood of reporting trouble sleeping after controlling for BMI and the interaction between BMI and income. The estimated odds ratio suggests lower odds of trouble sleeping with higher income, but the confidence interval crosses 1 and the effect is not statistically significant (p = 0.425), holding all other variables fixed.

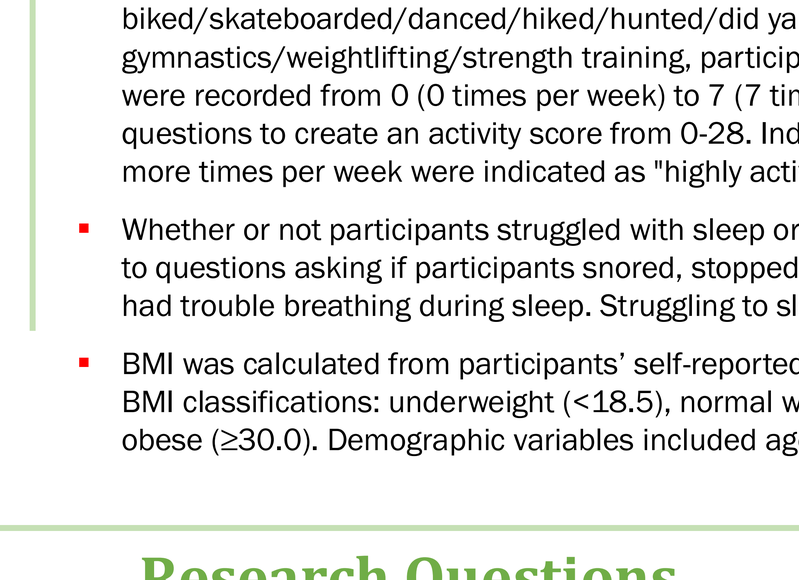

Figure 1. Mean of BMI by Trouble Sleeping in Highly Active Individuals

Multivariate (cont.)

- The BMI × income interaction term (O.R. 1.00, CI 0.99–1.02) is not significantly associated with the likelihood of reporting trouble sleeping. This indicates that the effect of BMI on trouble sleeping does not meaningfully differ across levels of income in this model, holding all other variables fixed.

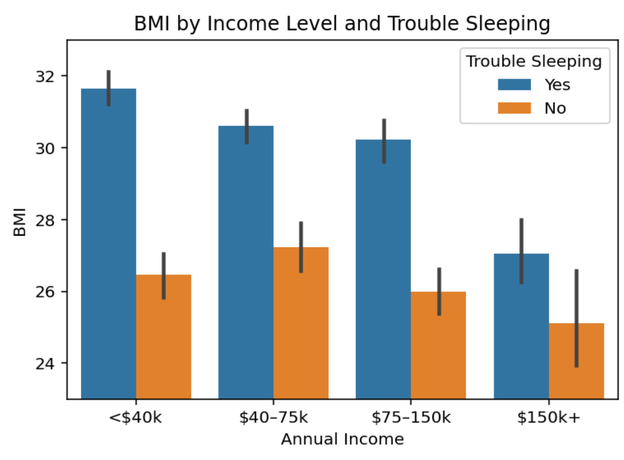

Figure 2: Average BMI by Annual Income for Middle-Aged Adults Who Do and Don't Struggle to Sleep

- Because the interaction between BMI and income was not statistically significant, this suggests that income does not meaningfully moderate the relationship between BMI and trouble sleeping—in other words, the association between BMI and sleep problems appears similar across income levels.

Discussion

- BMI showed a consistent and significant association with trouble sleeping, even after controlling for relevant covariates, suggesting that higher body mass may contribute to sleep difficulties regardless of other lifestyle factors.
- The effect size was meaningful, with each one-unit increase in BMI linked to roughly a 10% increase in the odds of reporting sleep problems, underscoring the practical importance of this relationship.
- Income itself was not a significant predictor of trouble sleeping; although higher income showed a small trend toward reduced sleep issues, the confidence interval included 1, indicating no reliable or substantial effect.
- Future research should explore additional social, behavioral, and physiological factors—such as stress exposure, mental health status, and metabolic functioning—to clarify the mechanisms linking BMI to sleep problems and to identify potential intervention targets.

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