Sleep mediates the association between exercise and cognitive complaints across adulthood

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BACKGROUND

Estimated 13.8 million Alzheimer's patients in America by 2050[1], and currently no effective treatments.

Sleep and physical activity independently influence AD risk and cognition, and their interactions are complex.

This study sought to examine whether self-reported sleep and exercise impact cognitive complaints, whether exercise effects are mediated by sleep, and the effect of age on these relationships.

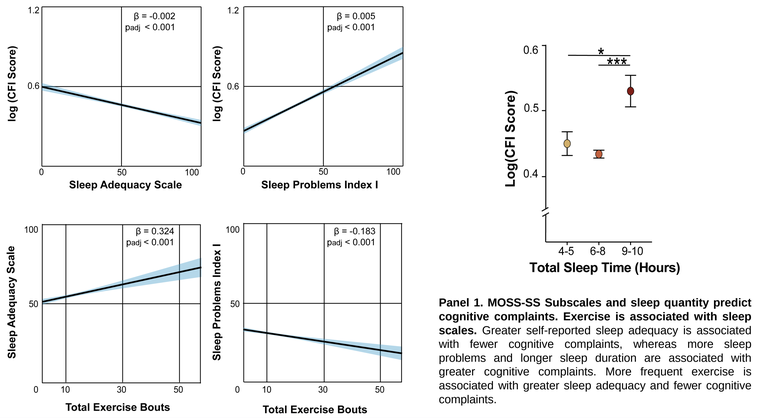
STUDY SUBJECTS AND METHODS

2456 Adults from the University of California Irvine Consent-to-Contact (C2C) Registry

Sample Characteristics	Mean (SD)
Sex No. (%F)	1579 (64.3)
Age, mean (SD)	55.99 (16.28)
Years of Education	16.30 (2.58)
BMI	26.45 (5.76)
CFI Score, median (IQR)	2 (0.5-4)
Total Sleep Time (Hours)	6.83 (1.15)
Exercise Frequency (Bouts/wk)	11.05 (7.77)
Snoring, No.(% More Frequent)	1668 (67.9)
Medical Comorbidities (N)	
Liver Disease, No. (%)	17 (0.006)
Diabetes, No. (%)	28 (0.001)
Hypertension, No. (%)	199 (0.081)
Hypercholesterolemia, No. (%)	159 (0.065)
Kidney/Renal Disease, No. (%)	7 (0.002)
Major Depressive Disorder, No. (%)	305 (12.4)
Sleep Apnea, No. (%)	77 (0.031)
Antidepressants, No. (%)	351 (14.3)
Cancer Diagnosis, No. (%)	603 (24.6)

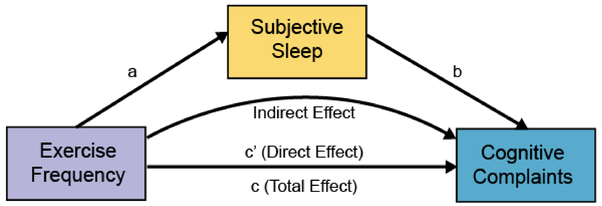
Multiple regression models, one-way ANCOVAs, and ordinary least squares path analysis were conducted to investigate relationships among the Cognitive Function Instrument[2] (CFI), Medical Outcome Study Sleep Scale[3] (MOS-SS) Subscales, and exercise frequency[4]. All models adjusted for education, sex, age, BMI, and other medical comorbidities.

EXERCISE IS ASSOCIATED WITH SLEEP
SLEEP IS ASSOCIATED WITH COGNITIVE COMPLAINTS



Panel 1. MOSS-SS Subscales and sleep quantity predict cognitive complaints. Exercise is associated with sleep scales. Greater self-reported sleep adequacy is associated with fewer cognitive complaints, whereas more sleep problems and longer sleep duration are associated with greater cognitive complaints. More frequent exercise is associated with greater sleep adequacy and fewer cognitive complaints.

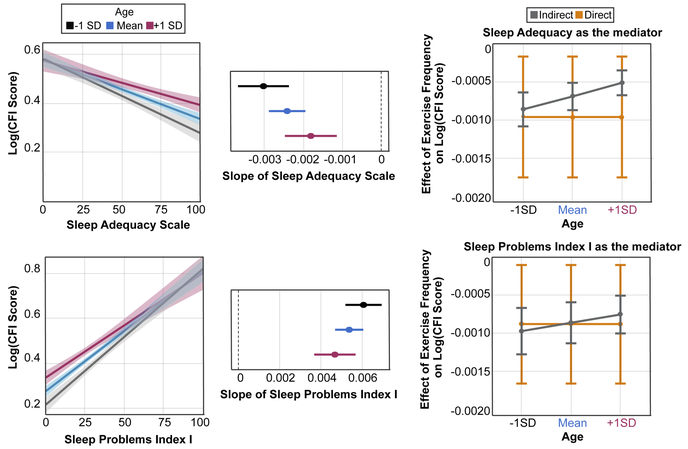
SLEEP MEDIATES THE ASSOCIATION BETWEEN EXERCISE AND COGNITIVE COMPLAINTS



Sleep Adequacy Scale (N=2440)	Coeff	SE	*p*
a	0.3241	0.0668	**<0.001**
b	-0.00244	0.00024	**<0.001**
c'	-0.00098	0.00796	0.219
c	-0.00177	0.000809	**0.028**
99% CIs	-0.00129	-0.00035	
Sleep Problems Index I (N=2405)	Coeff	SE	p
a	-0.18287	0.046007	**<0.001**
b	0.00547	0.000346	**<0.001**
c'	-0.00079	0.000781	0.309
c	-0.00179	0.000818	**0.028**
99% CIs	-0.0017	-0.0003	

Panel 2. MOS-SS Sleep Scales significantly mediate the relationship between exercise frequency and cognitive complaints. Model coefficients and results for moderated-mediation models. Abbreviations: Coeff—unstandardized regression coefficients; SE—standard error; Boot SE—Bootstrapped standard error based on 5000 bootstrap samples; CI—Confidence Interval

AGE MODERATES THE MEDIATING EFFECTS OF SLEEP



Panel 3. Age moderates the sleep-mediated effects of exercise frequency on cognitive complaints. Top Left and Middle: Interaction plot and simple slopes of the relationship between the Sleep Adequacy Scale and CFI score as a function of age. Bottom Left and Middle: Interaction plot and simple slopes of the relationship between Sleep Problems Index I and CFI score as a function of age. Top Right: The direct and the moderated indirect effects of exercise frequency on CFI score through sleep adequacy. Bottom Right: The direct and the moderated indirect effects of exercise frequency on CFI score through Sleep Problems Index I. Error bars: ±1 Bootstrapped SE based on 5000 bootstrap samples

TAKE-HOME MESSAGES

The effects of exercise frequency on cognitive complaints appear to be mediated by the effects of exercise frequency on sleep, and sleep's influence on cognitive complaints.

The sleep-mediated effects of frequent exercise on cognitive complaints are modestly stronger earlier in adulthood, suggesting that sleep problems may be particularly detrimental for cognition earlier in adulthood.

Sleep health may be a crucial consideration for exercise-based therapies aimed at preventing cognitive decline and AD.

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