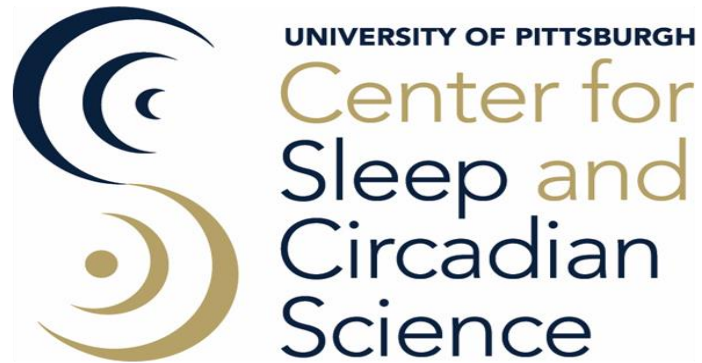


# Sleep as a Pillar of Healthy Aging



Martica Hall, PhD

Professor of Psychiatry, Psychology, and Clinical and Translational Science

University of Pittsburgh School of Medicine

hallmh@upmc.edu

*Distinguished Lectureship in Aging*

*University of South Florida School of Aging Studies*

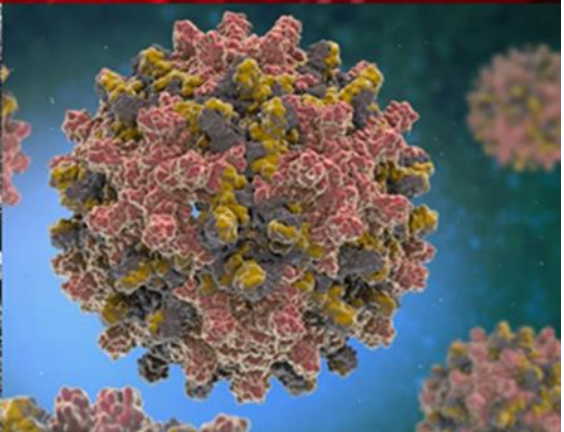
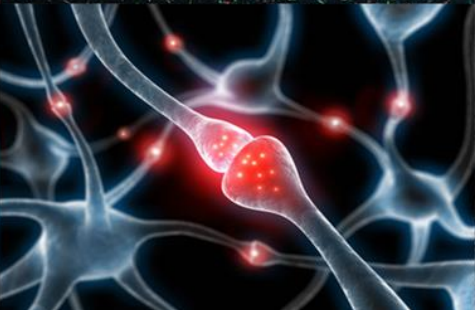
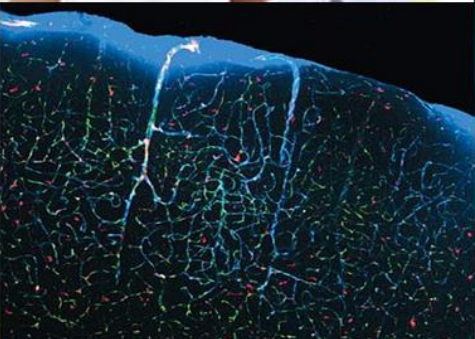
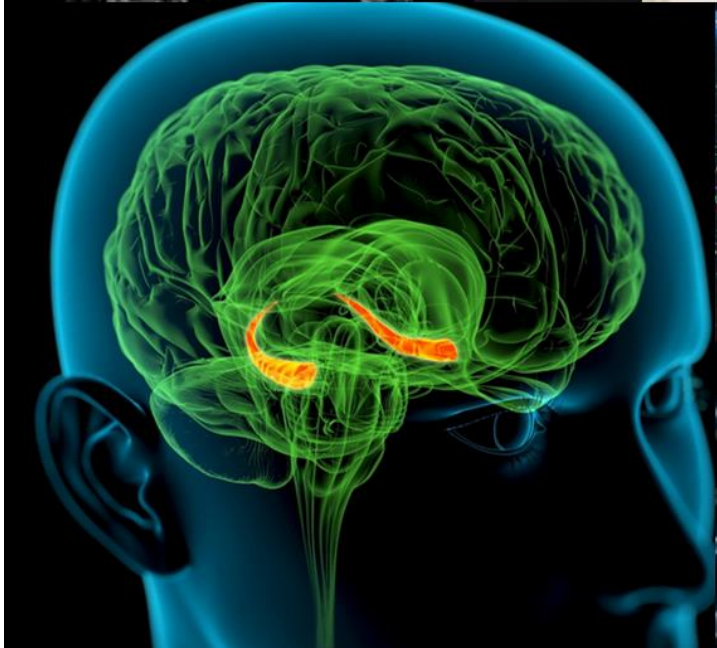
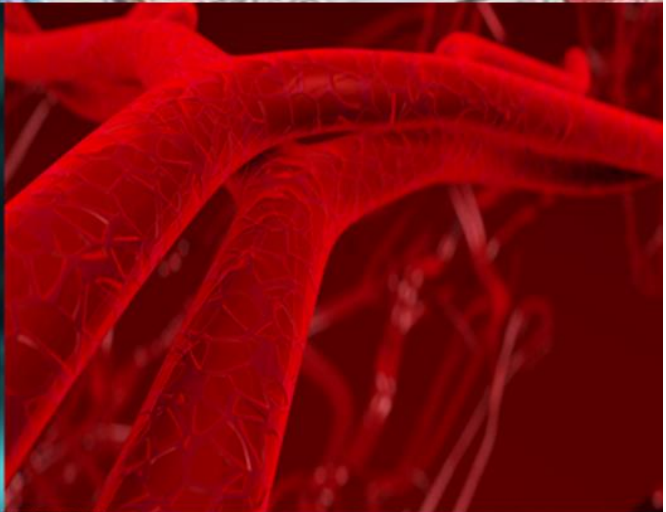
*February 1, 2019*



“If sleep doesn’t play an absolutely vital function, it is the biggest mistake evolution ever made.”

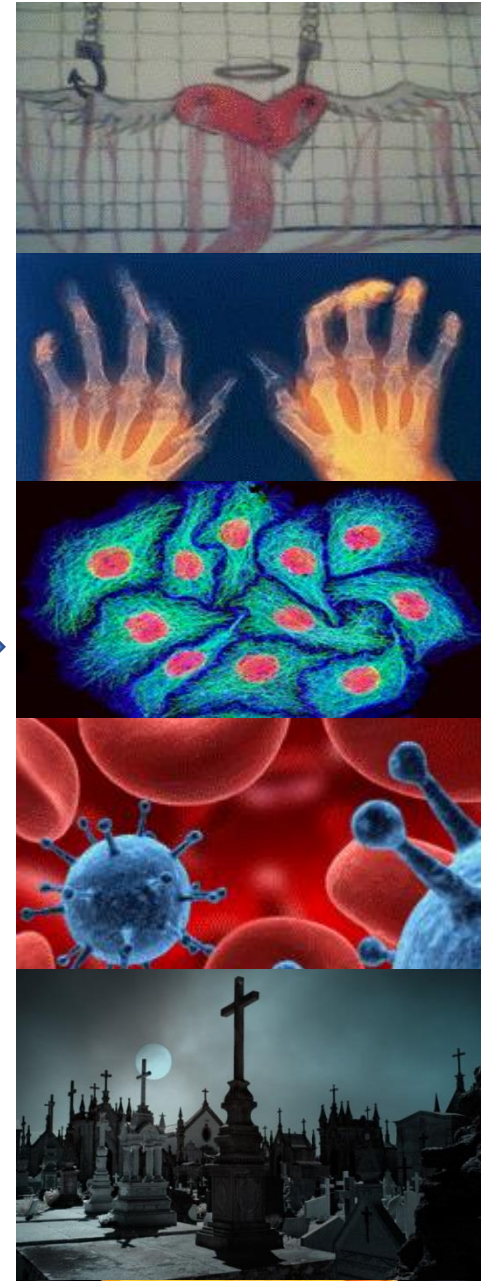
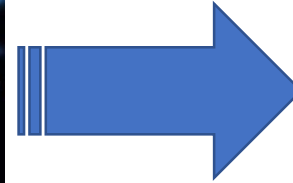
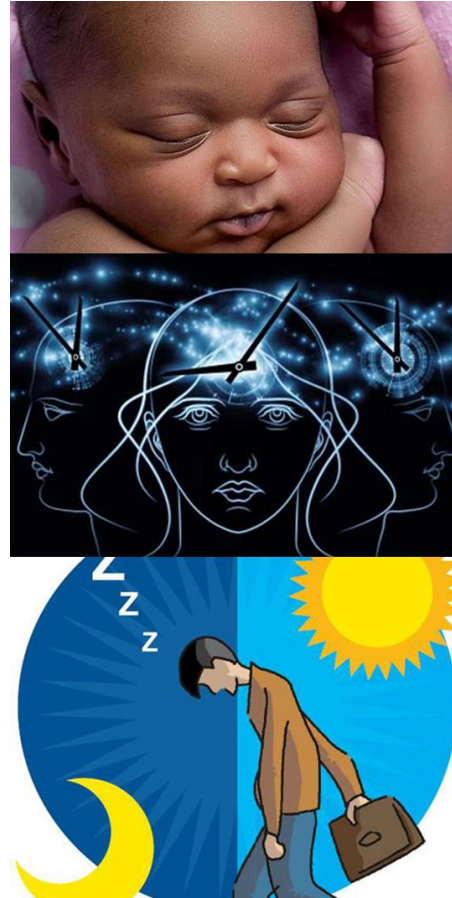
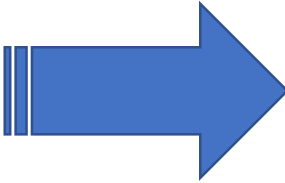
*Allan Rechtschaffen*





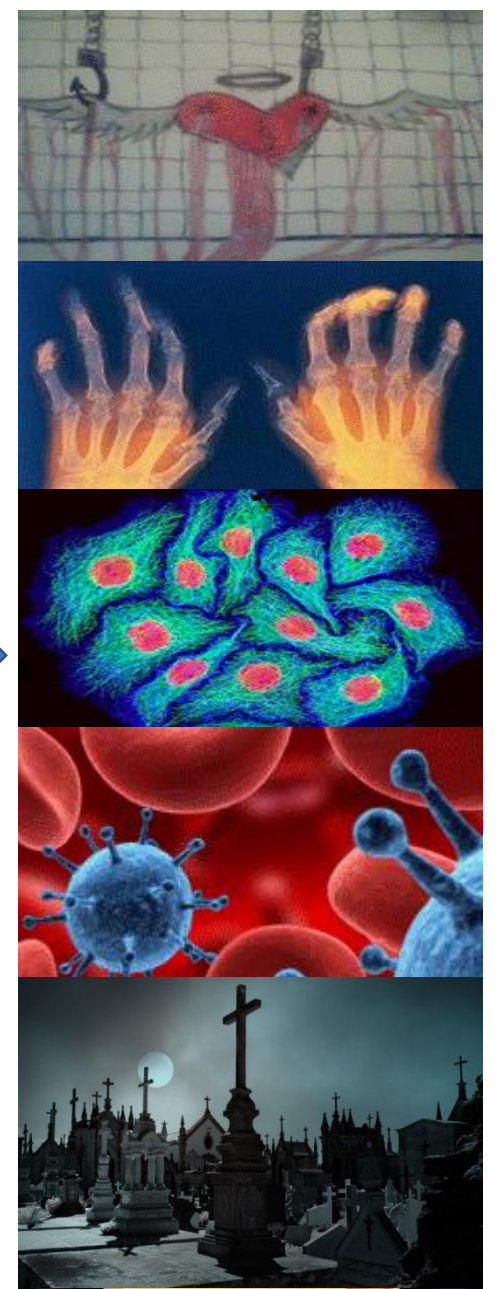
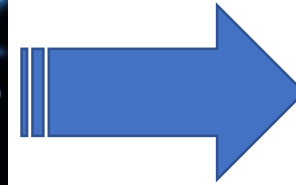
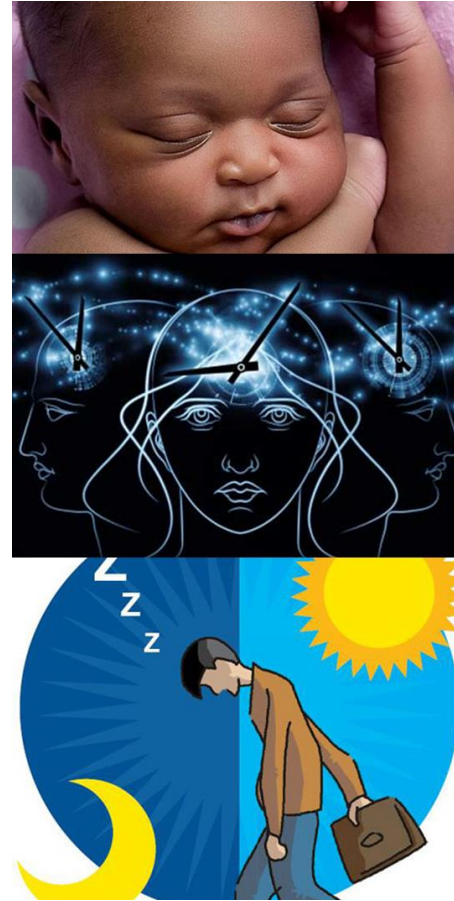
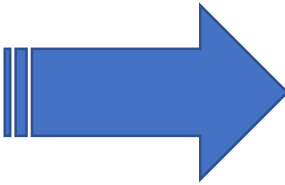


# MMoSH PITT Laboratory



**EFFECT MODIFIERS**

# MMoSH PITT Laboratory

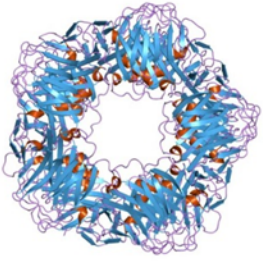


## TODAY

- Correlates/Consequences of Short Sleep
- Sleep Health
- Scarring of Shiftwork

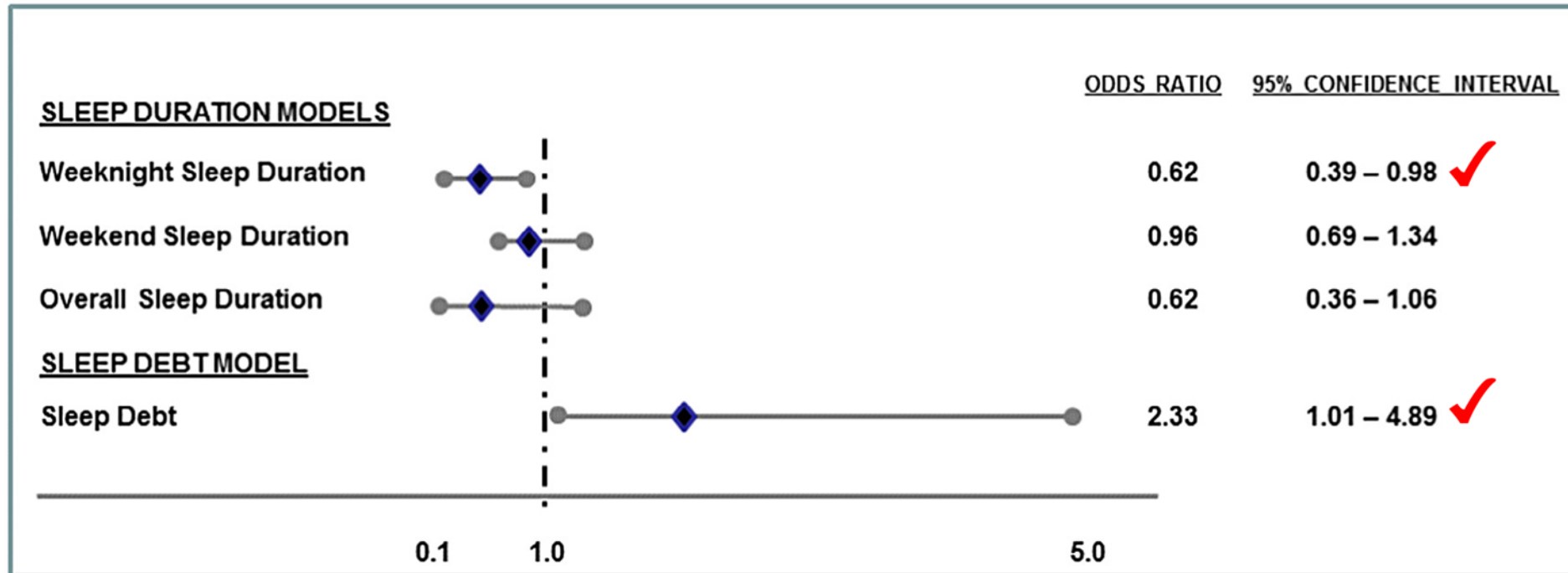
Transdiagnostic examples...



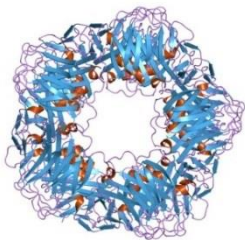


# Actigraphy-assessed sleep duration & C-reactive protein in adolescents

(n=244; 17.1  $\pm$  1.3 years; 52.5% female; 51.6% African American)

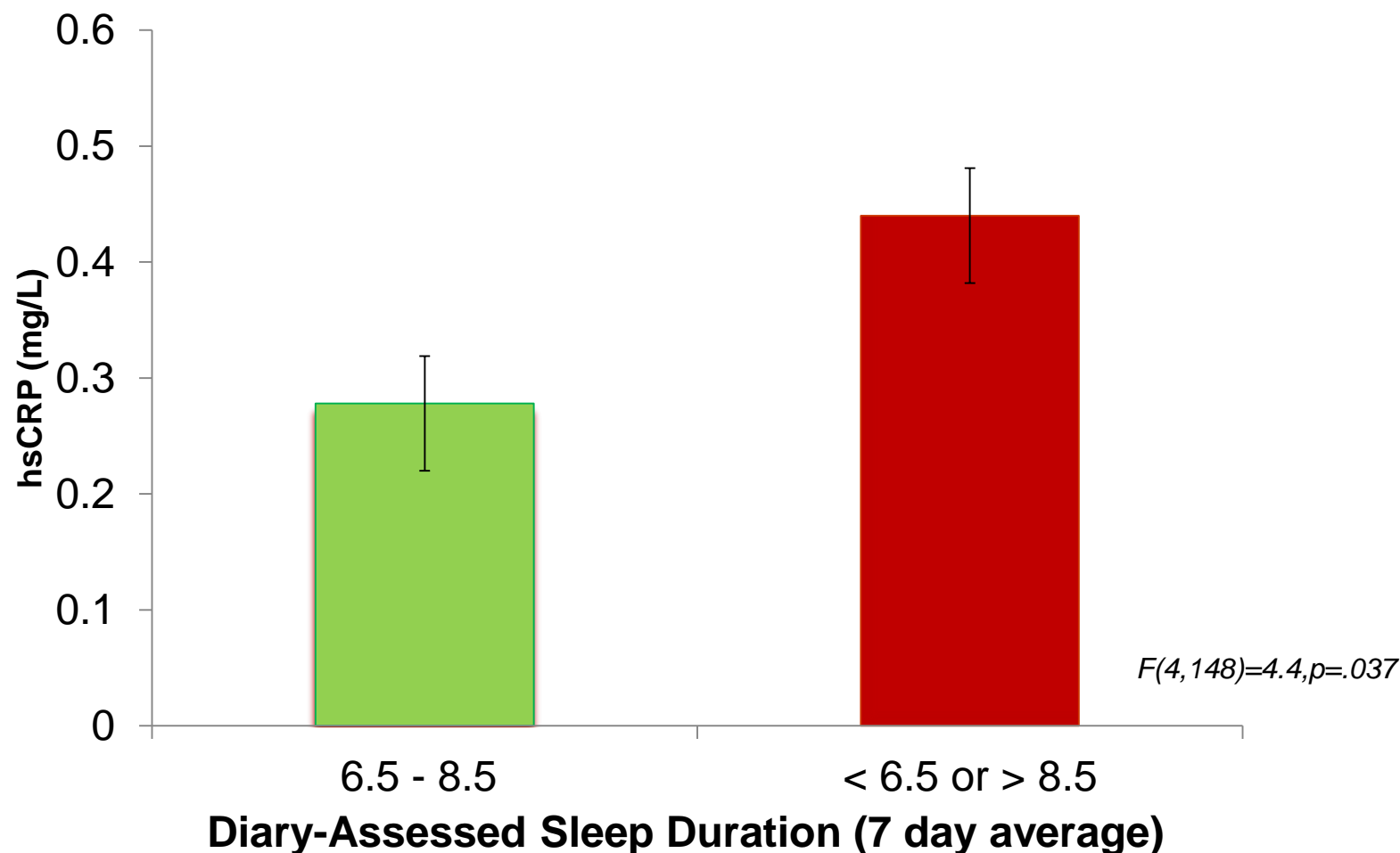


Models adjusted for sex, race, highest parental education and BMI



## Self-reported Sleep Duration & C-Reactive Protein in Older Adults

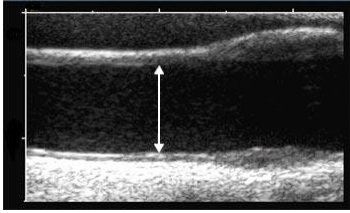
(n=153; 58.9  $\pm$  9.0 years; 67.2% female; 5.5% African American)



Covariates: sex, BMI, lifetime history of depression (SCID)

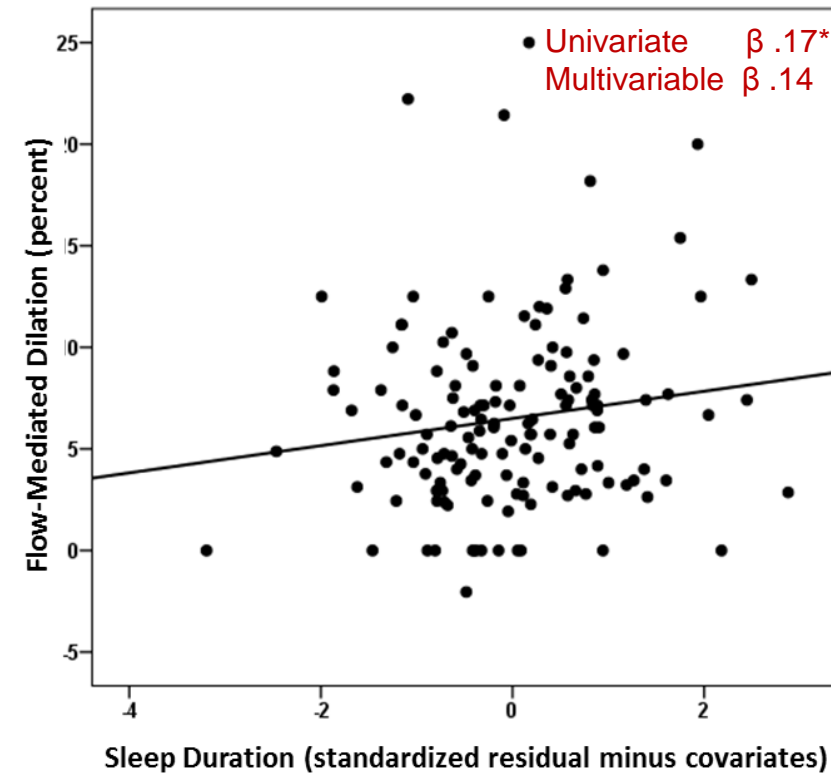
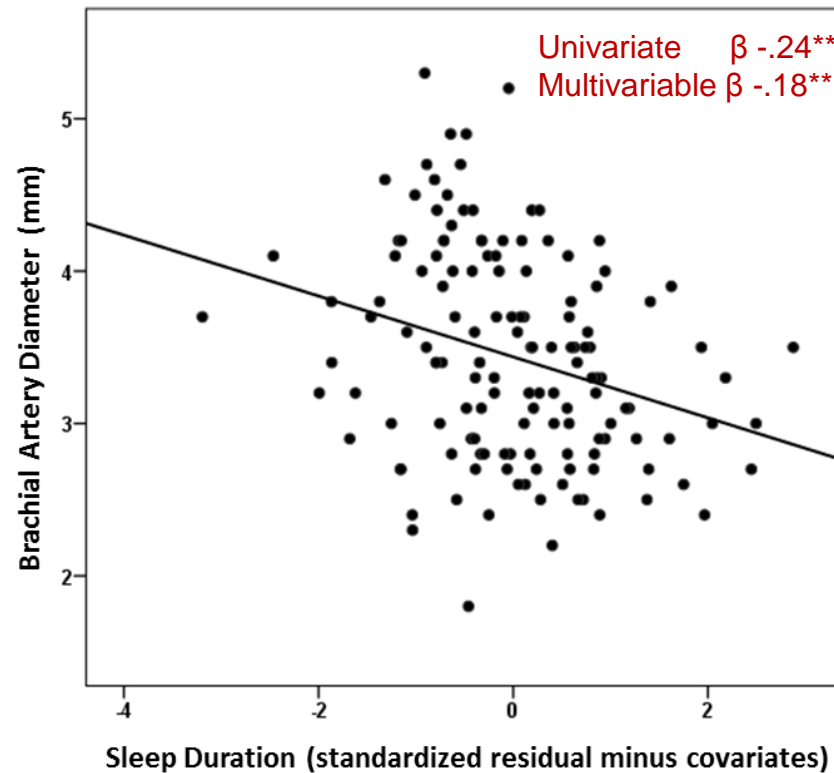
Hall et al., under preparation



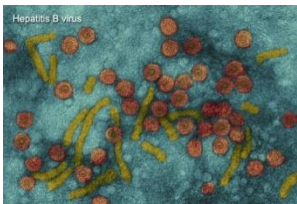


# PSG-Assessed Sleep Duration is Prospectively Associated with Endothelial Health

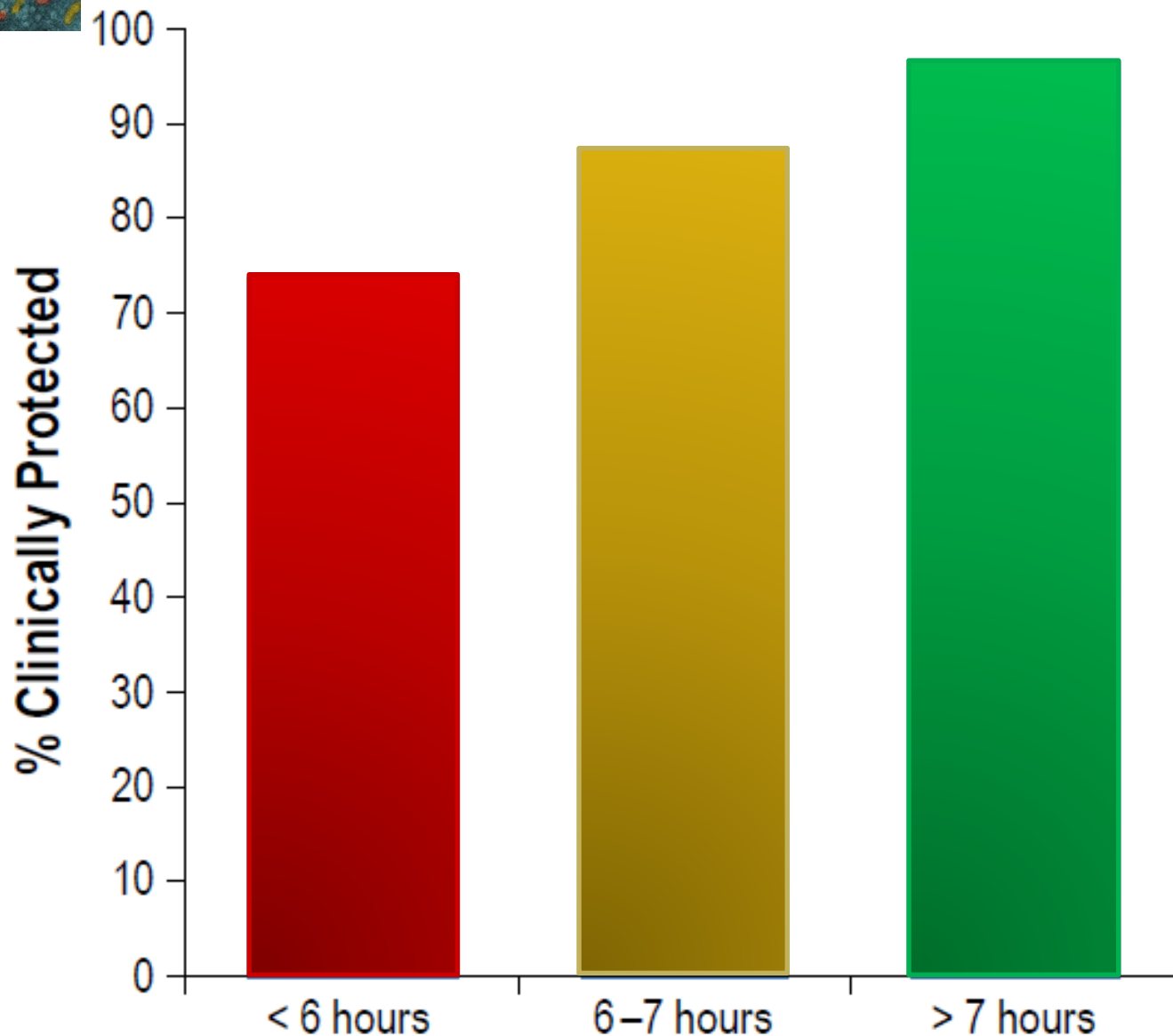
(n=141; 60.0  $\pm$  9.3 years at T2; 65.2% female; 94.3% European American; 12-30 years between T1 and T2)



Covariates: sex, age, minority racial status, smoking, BMI, diabetes, hypertension, lifetime MDD history



# Actigraphy-assessed sleep duration & antibody response to Hepatitis B vaccination (n=125; 40-60 years; 56% female; 91.2% European American)

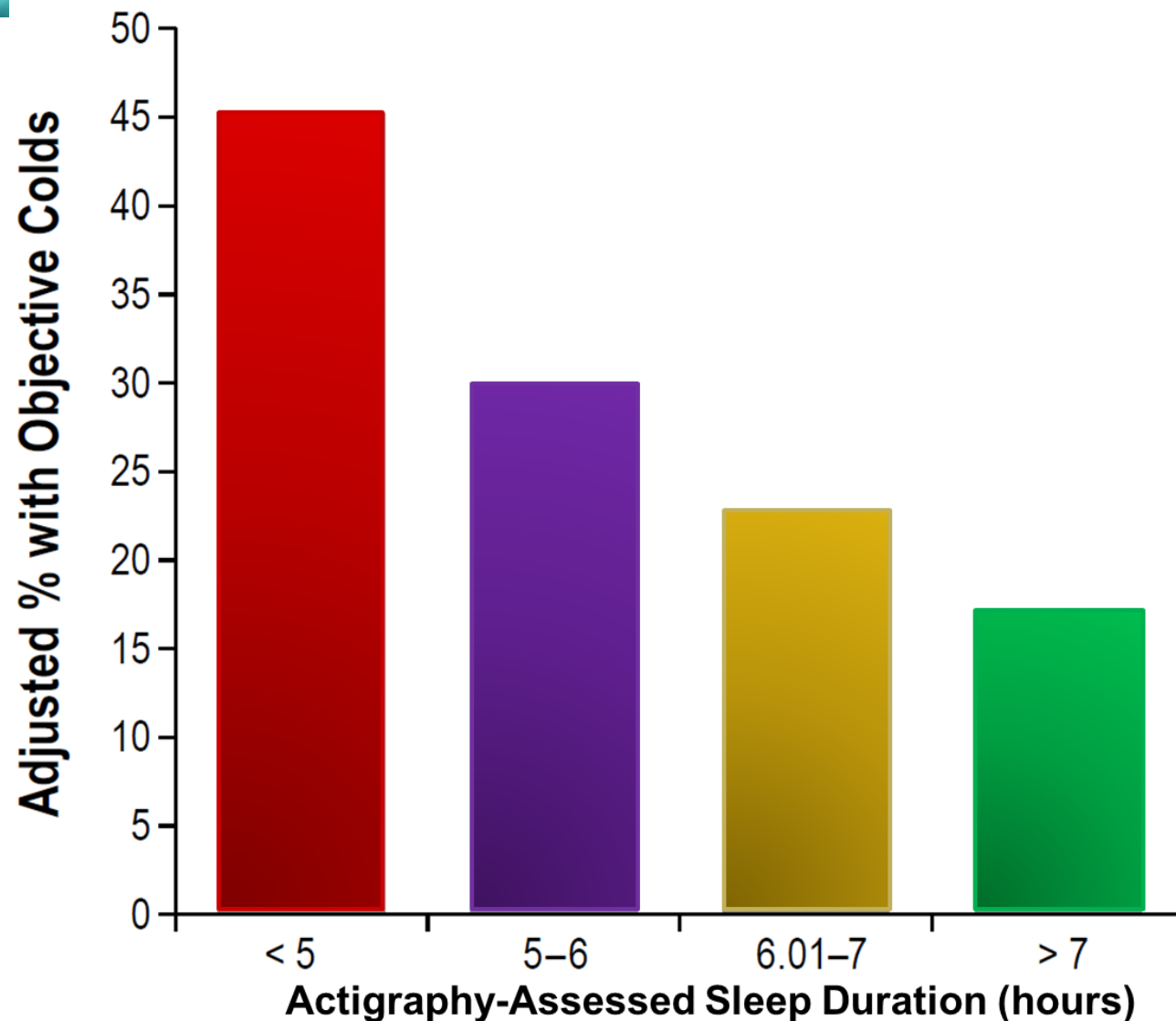


*Prather, Hall, et al., Sleep, 2012*



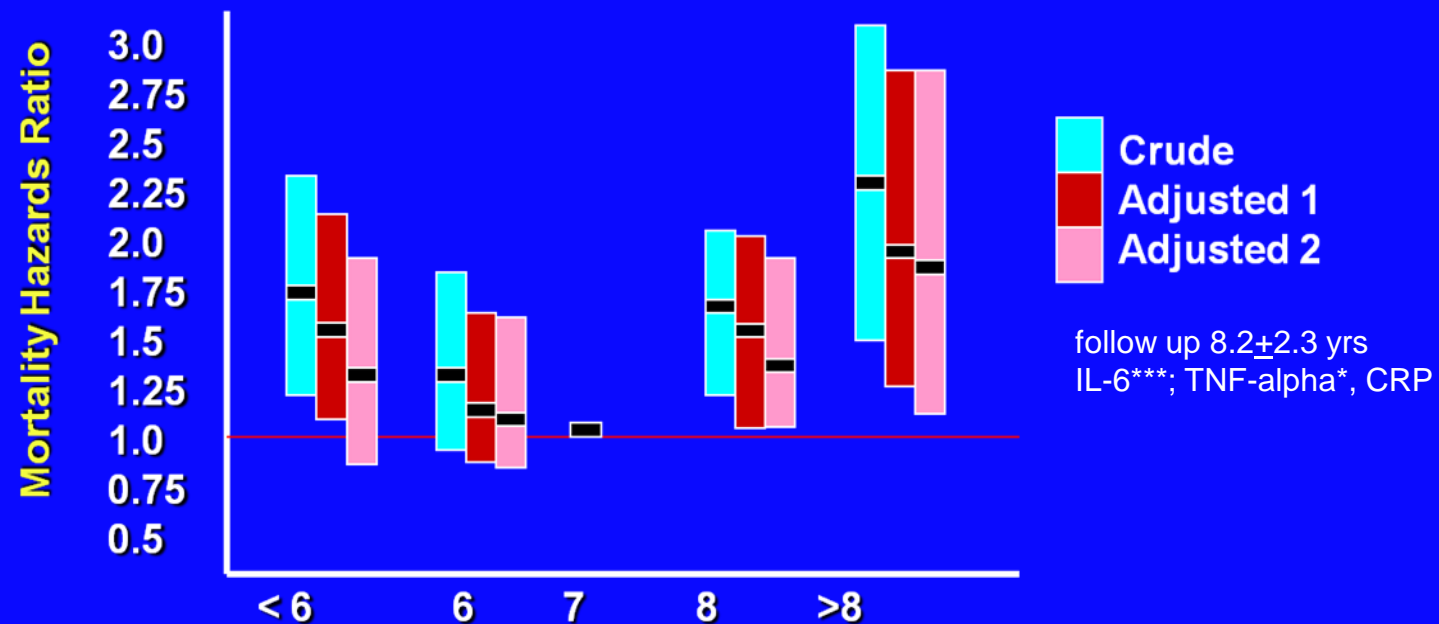


## Actigraphy-assessed sleep duration & susceptibility to the common cold (n=164; 18-55 years; 42.7% female; 68.3% European American)





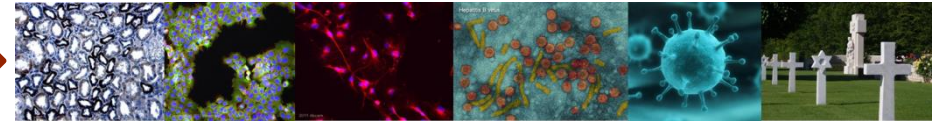
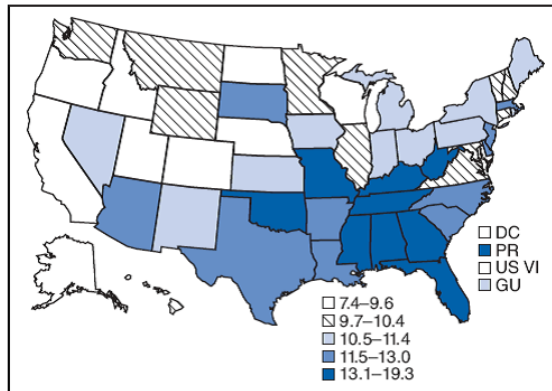
# Inflammation Attenuates the Association Between Sleep Duration and Mortality (n=3,075; 73.6 $\pm$ 2.9 years, 51.4% female, 41.4% African American)



Adjusted 1: age, sex race, BMI, smoking, site, diabetes, CVD, anti-inflammatory use; Adjusted 2 adds inflammation



# Insufficient Sleep and the 3 D's: The Pittsburgh Experience



Adolescents  
Older Adults  
Men & Women

Inflammation  
Vascular Health  
Vaccine Response  
Susceptibility to the Common Cold  
Mortality

# What about sleep duration is important?



Sheer Amount?  
Fragmentation?  
Architecture?  
Timing?  
Quality?  
Sleep Disorder?

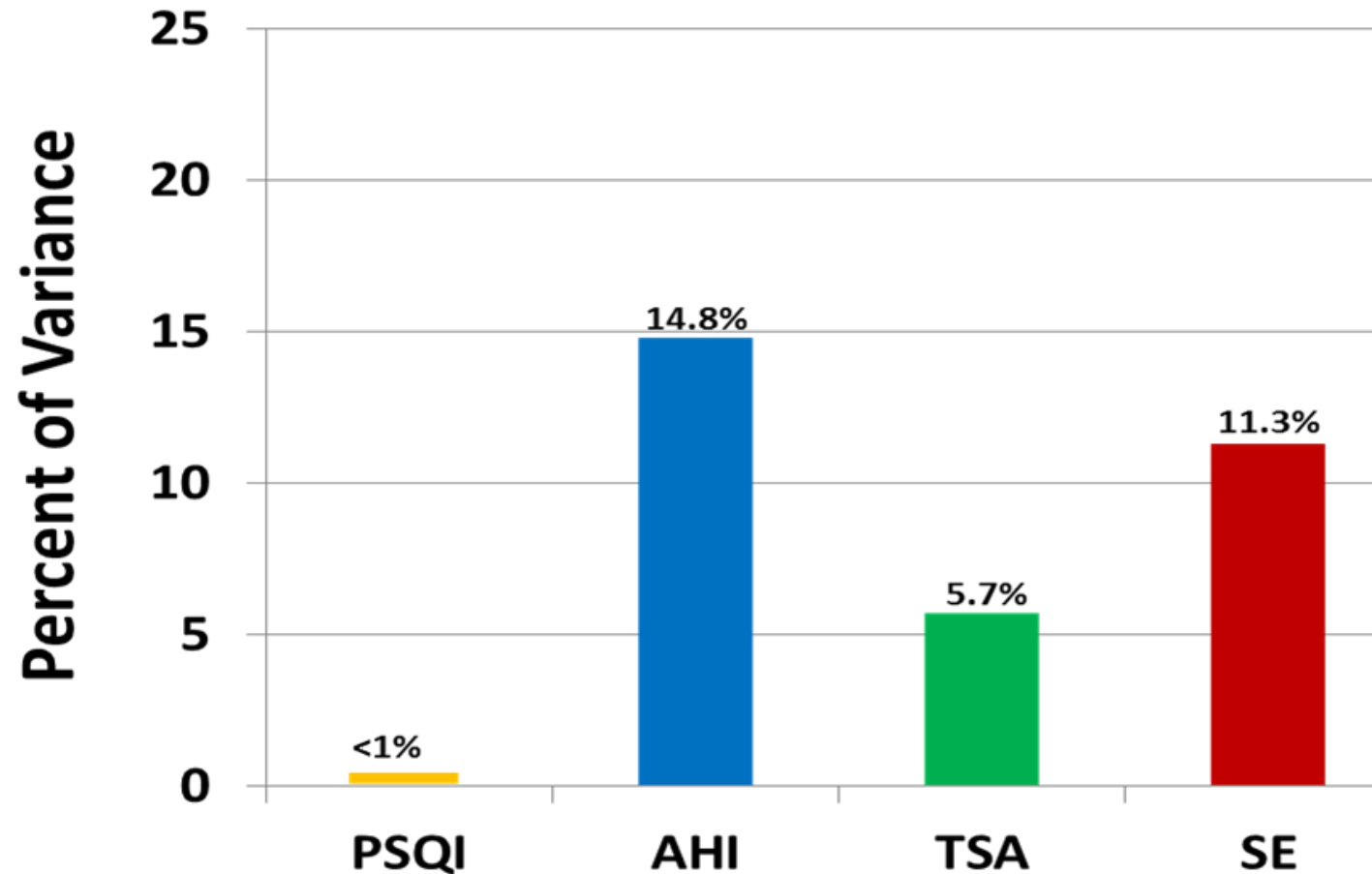
Some combination of the above?

*Examples: traditional, more sophisticated...*



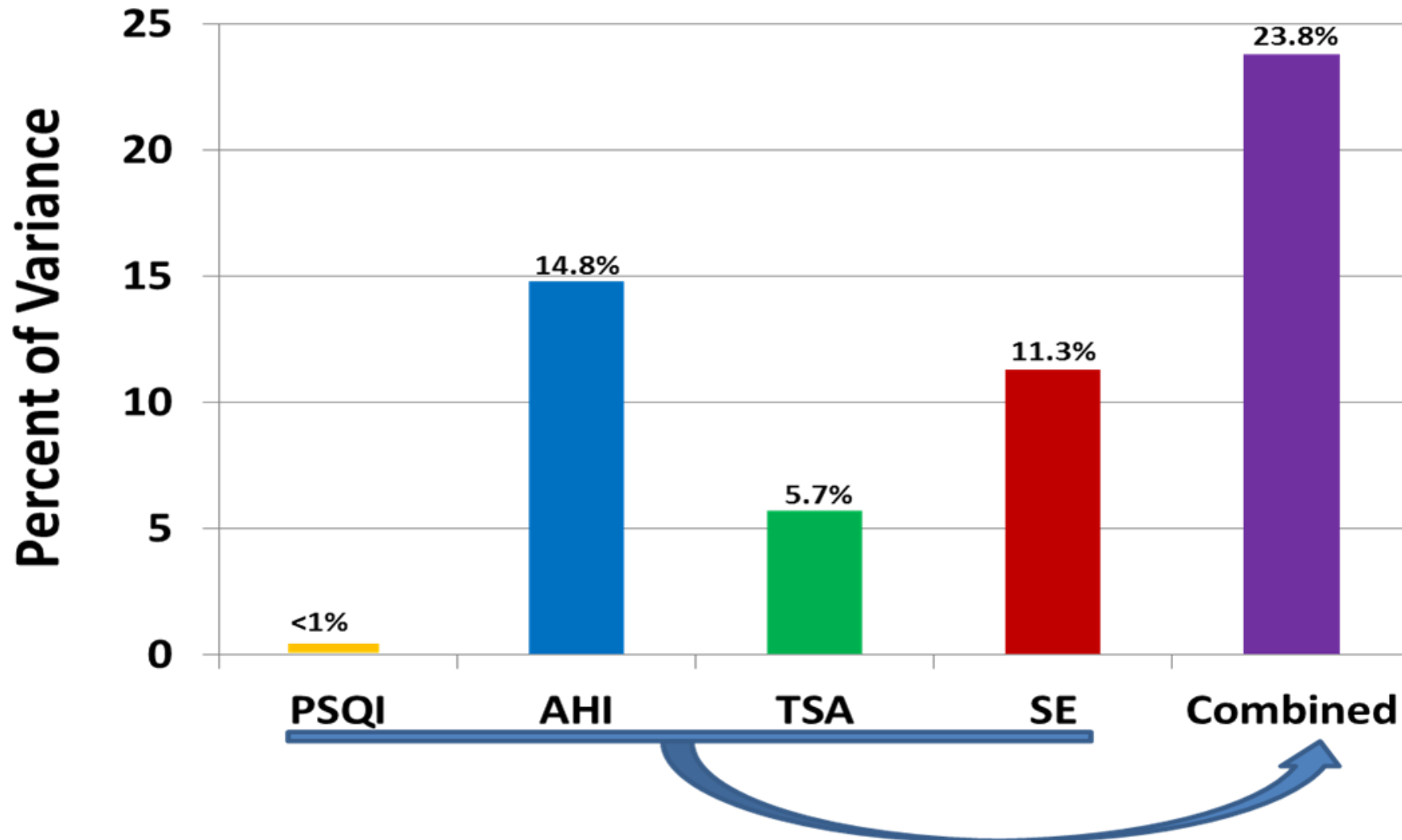
# Sleep Predicts Framingham Heart Age in Women

(N=84; Age=59.6±8.5; FMA=65.2±16.2)



# Sleep Predicts Framingham Heart Age in Women

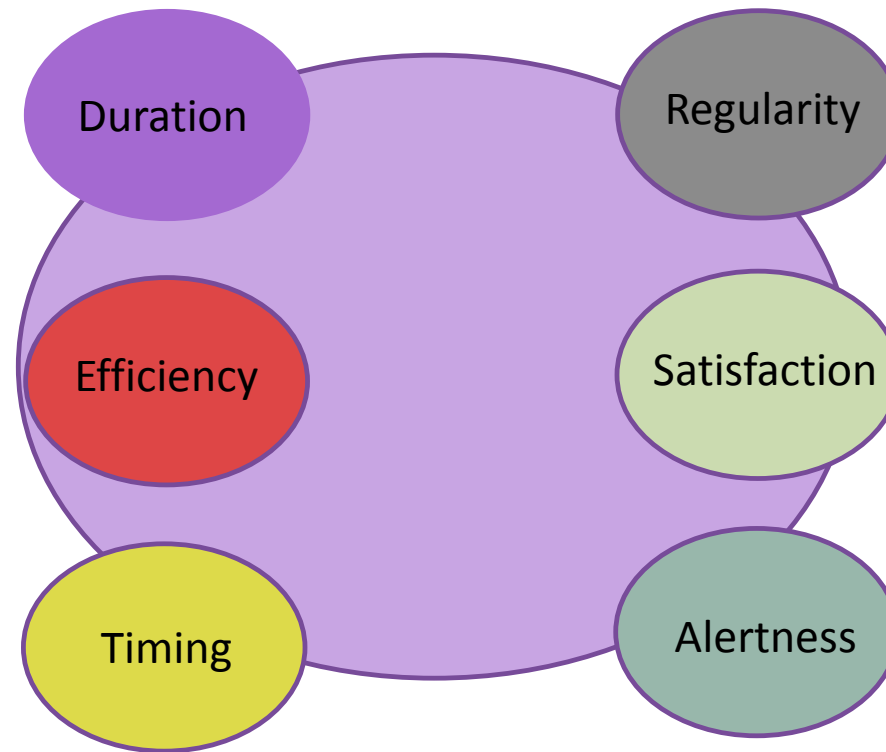
(N=84; Age=59.6 $\pm$ 8.5; FMA=65.2 $\pm$ 16.2)



*Bowman, Hall, et al., under preparation*

# Sleep Health: Can We Define It? Does It Matter?

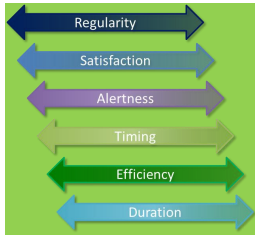
Sleep health is a multidimensional pattern of sleep-wakefulness, adapted to individual, social, and environmental demands, that promotes physical and mental well-being.



**RU SATED?**

Buyse, *SLEEP* 2014; 37(1):9-17

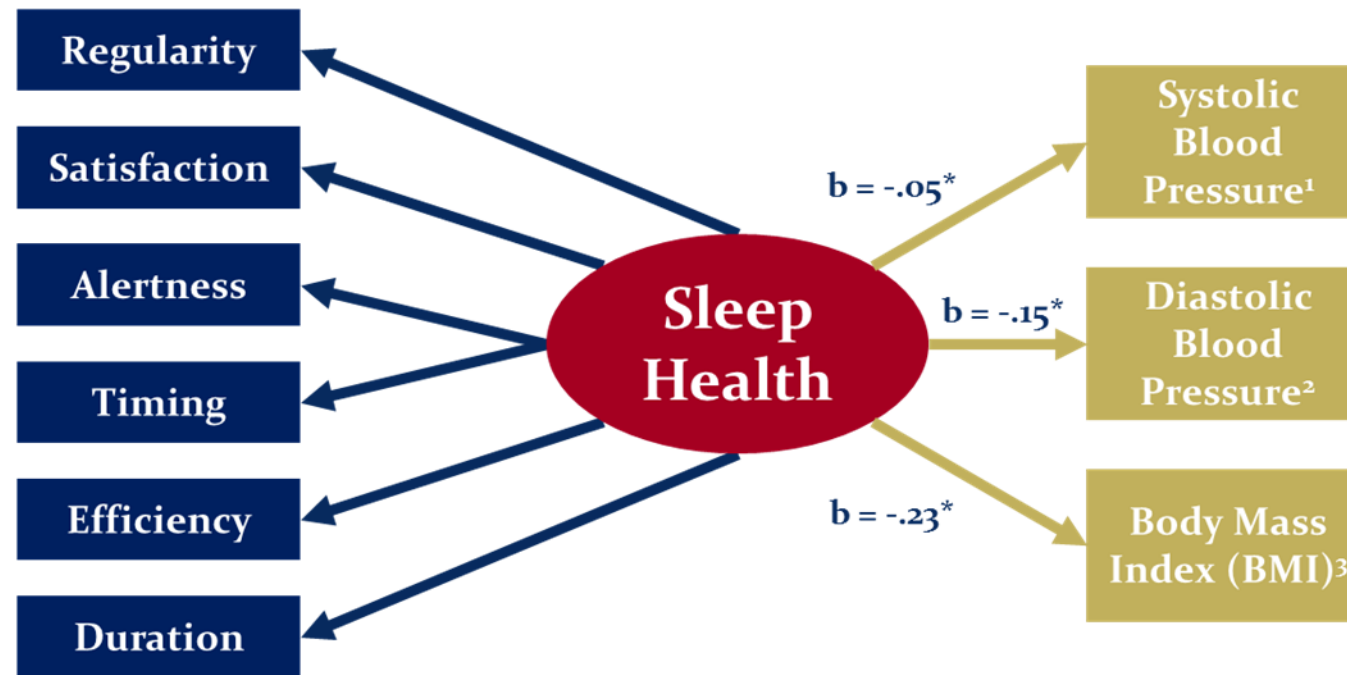




# What about sleep health?



# Sleep Health & Cardiometabolic Health



- N = 1,639 research participants (M = 52.2 yrs; range 18 - 93 years; 55% Female)
- Sleep diary (M = 7.7 days)
- All coefficients reported are unstandardized betas. \*  $p < .001$

<sup>1</sup>Measurement Model Fit: RMSEA = .110 [90% confidence interval (CI) .101 -- .119] ; CFI = .984; TLI = .962

<sup>2</sup>Measurement Model Fit: RMSEA = .088 [90% confidence interval (CI) .076 -- .100] ; CFI = .984; TLI = .962

<sup>3</sup>Measurement Model Fit: RMSEA = .152 [90% confidence interval (CI) .140 -- .164] ; CFI = .966; TLI = .922

Cribbet et al., under preparation



# Sleep Health in Midlife Women

## SWAN Sleep Study

368 Midlife Women

Age = 50.7 ( $\pm 2.0$ )

Race/Ethnicity

European American	n=171 (46.5%)
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African American	n=138(37.5%)
------------------	--------------

Chinese American	n=59 (16%)
------------------	------------

Educational Attainment

High School or less	n=62 (17.1%)
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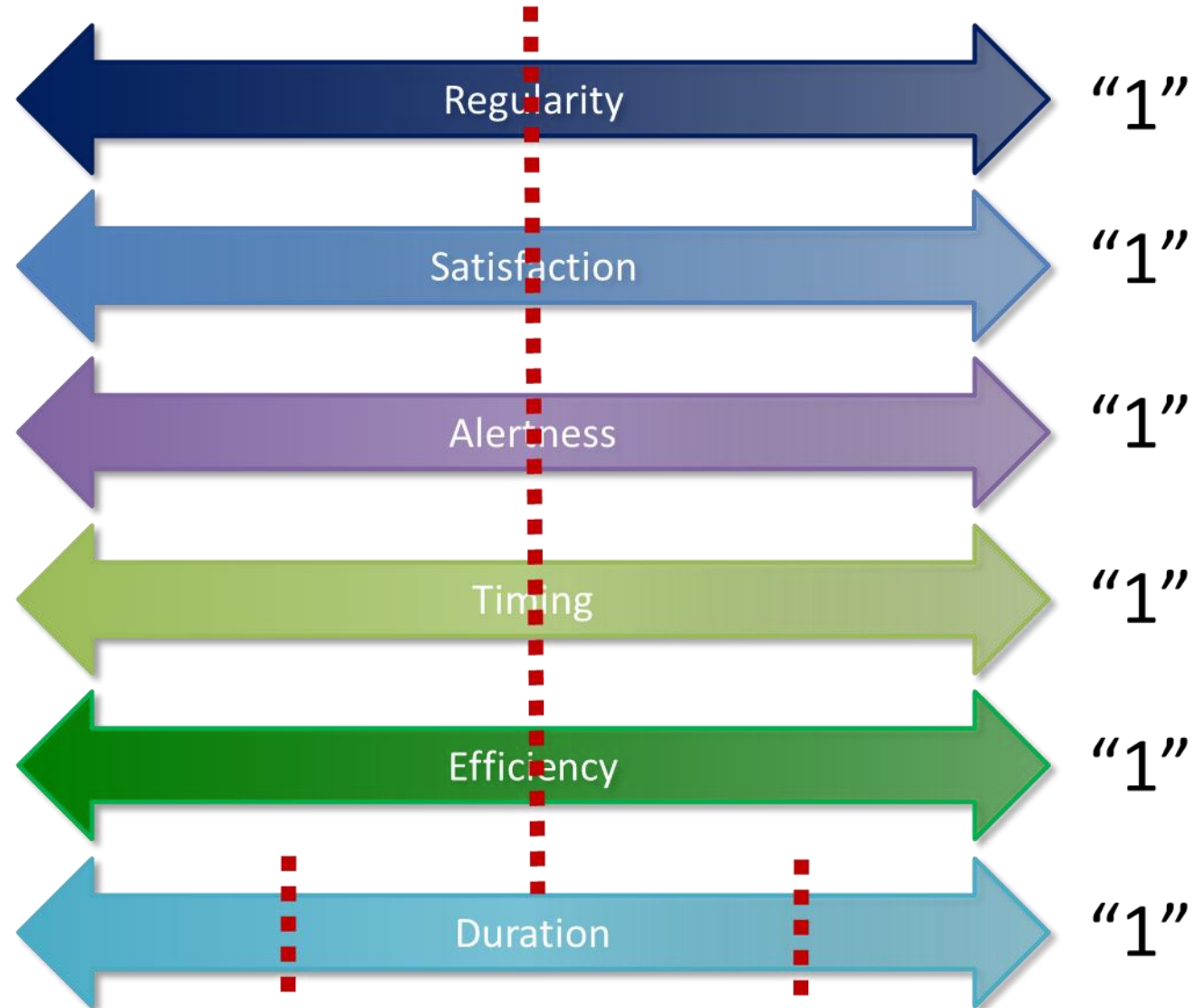
Some College	n=115 (31.8%)
--------------	---------------

College Degree or more	n=185 (51.5%)
------------------------	---------------



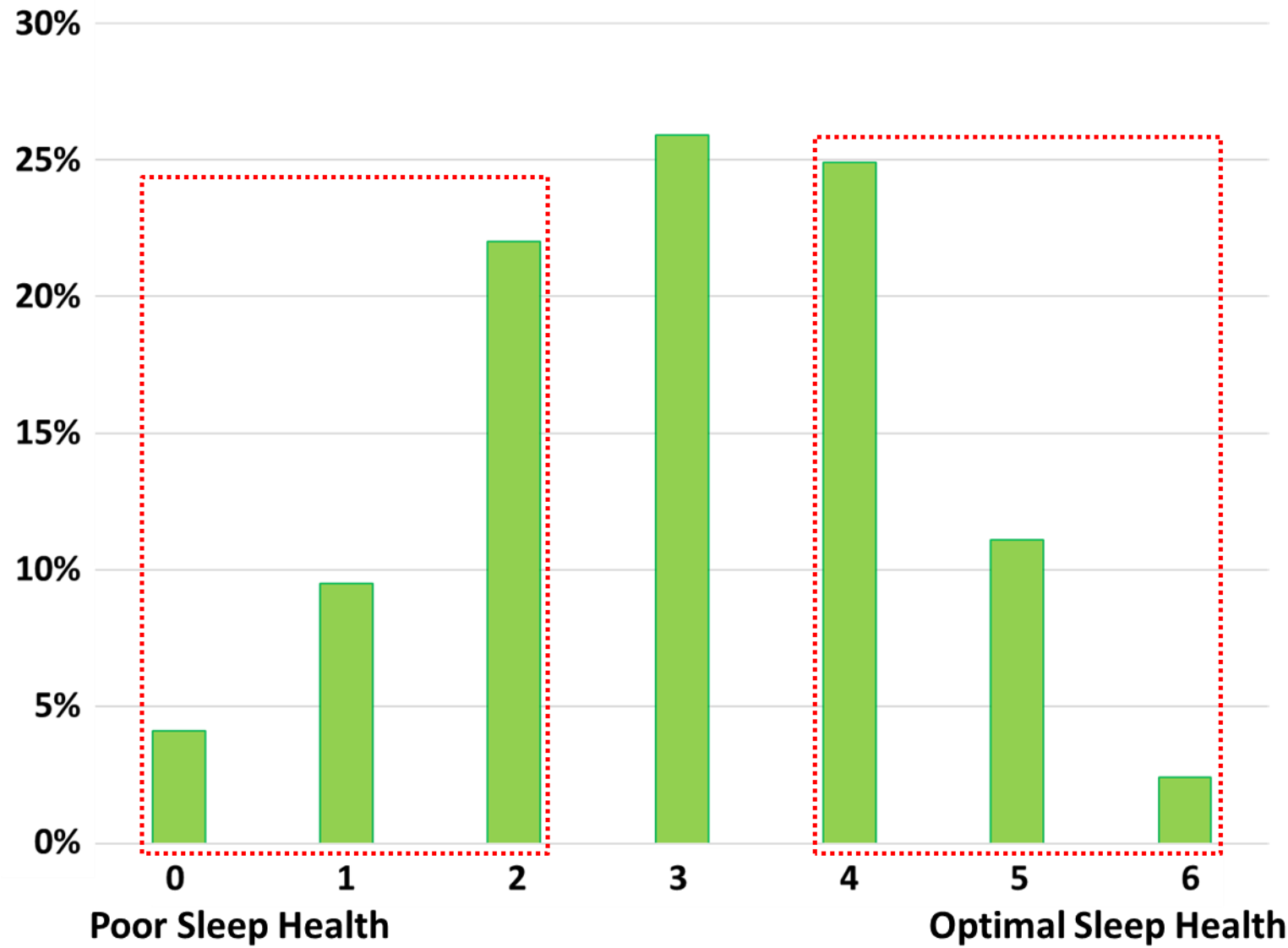


## Sleep Health: Summary Measure

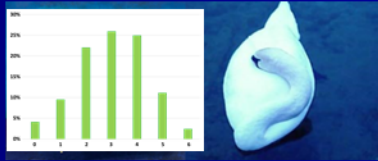




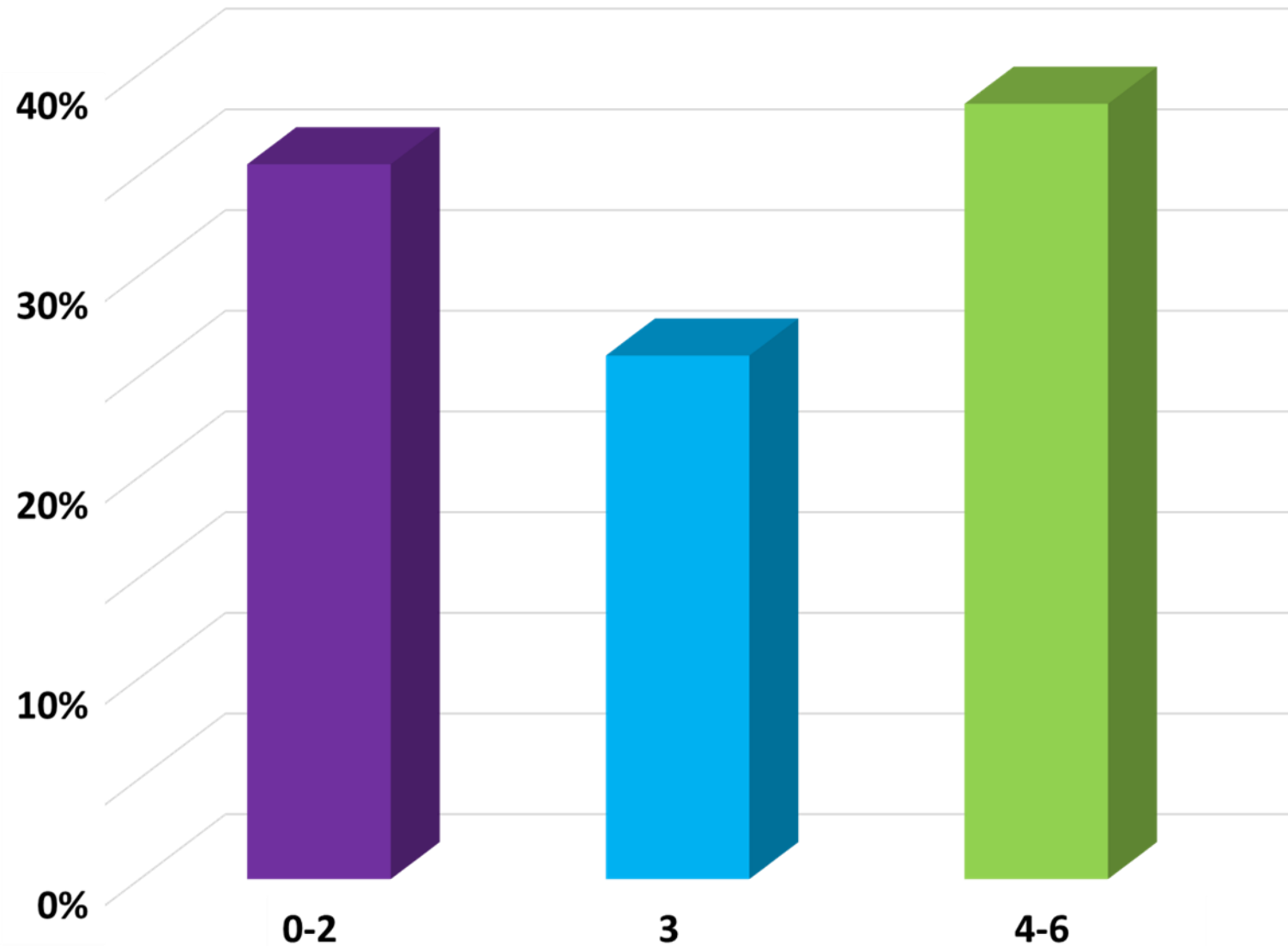
# Self-Reported Sleep Health: Sleep I



Categories...

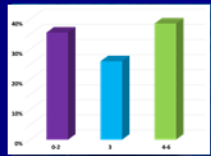


## Self-Reported Sleep Health Tertiles

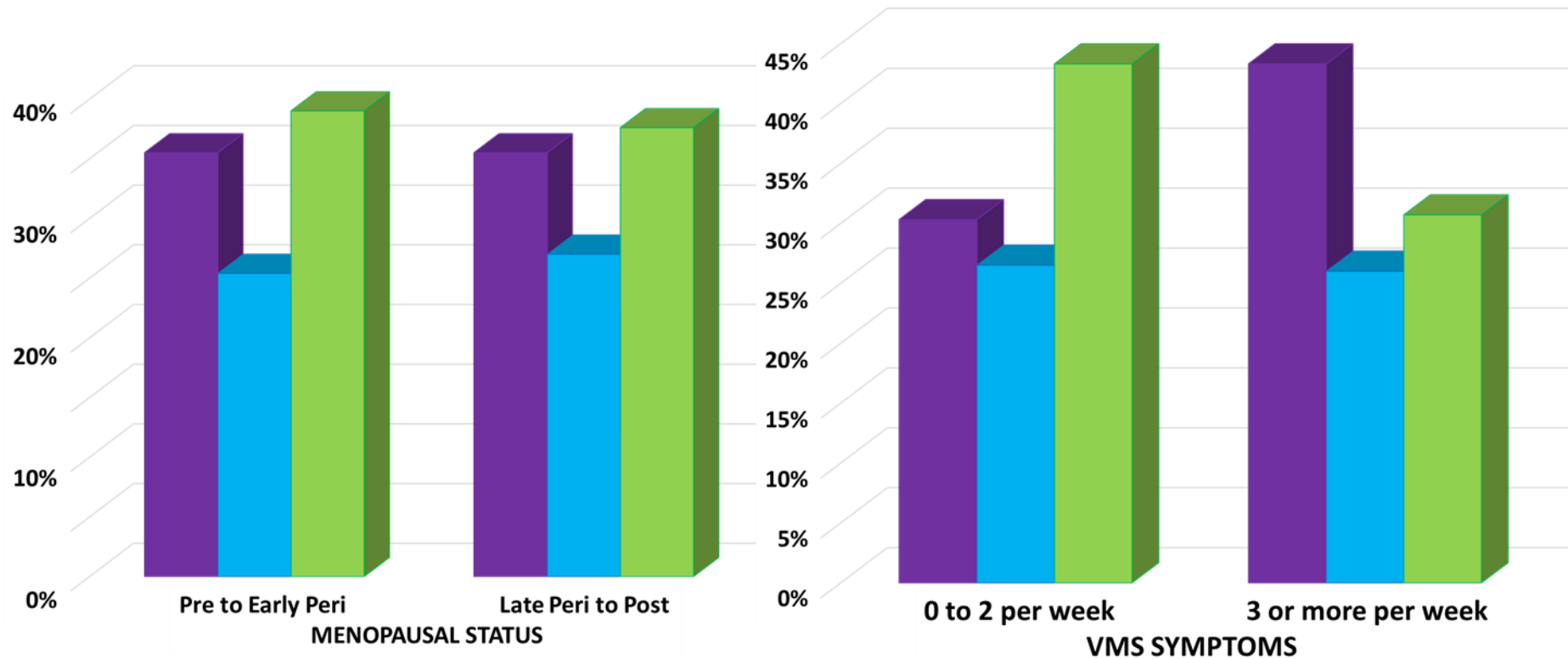


*Correlates...*





## S-R Sleep Health: Menopausal Characteristics

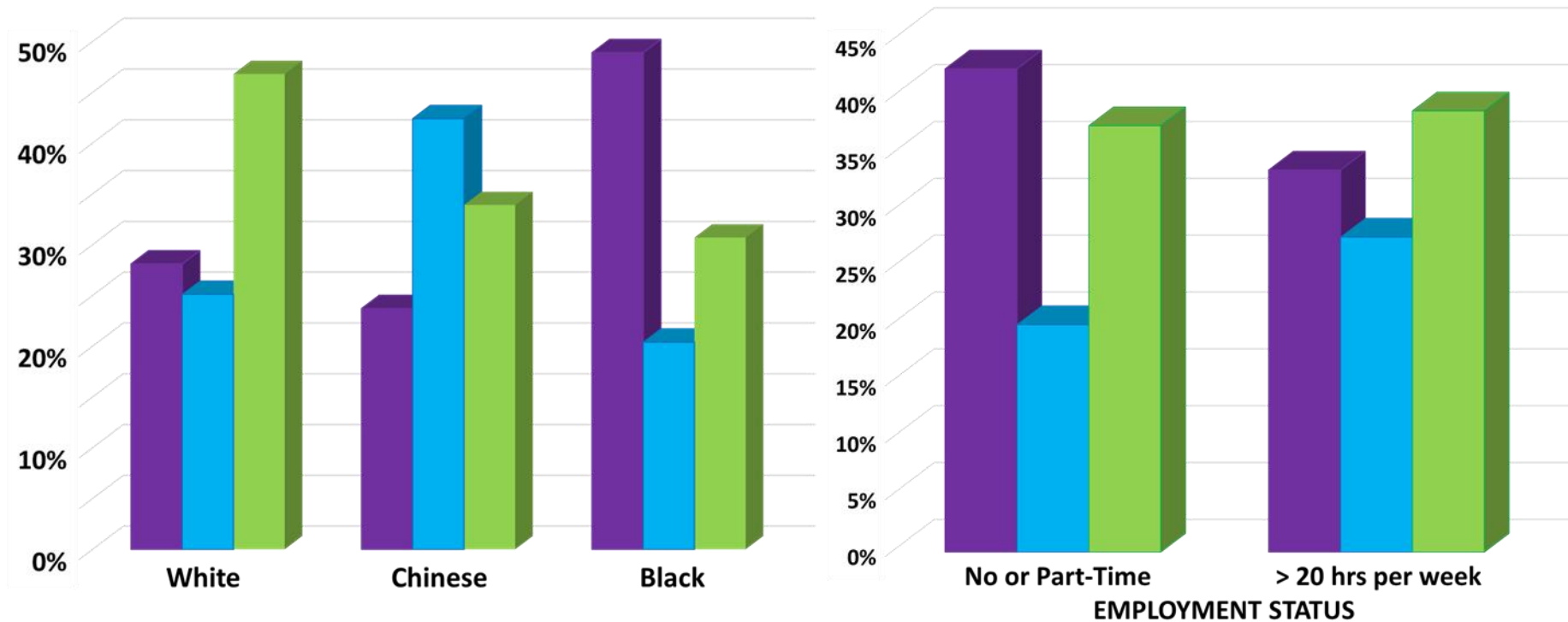


**No Difference**

**Chi<sup>2</sup> = 7.5\***



## S-R Sleep Health: Sociodemographics

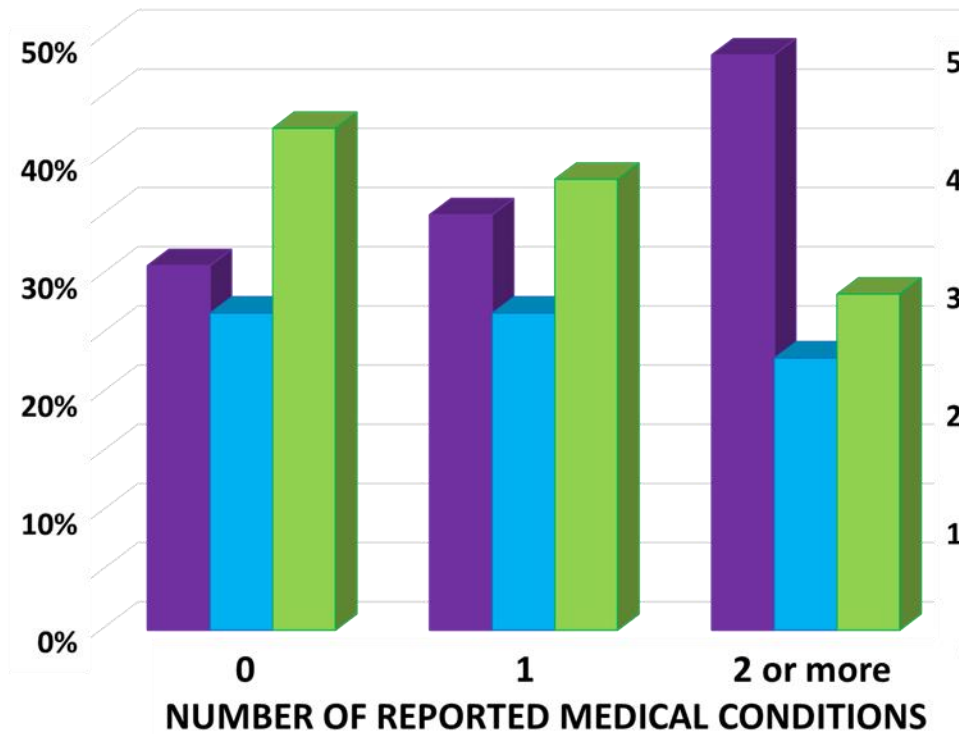


**Chi<sup>2</sup> = 25.2\*\*\***

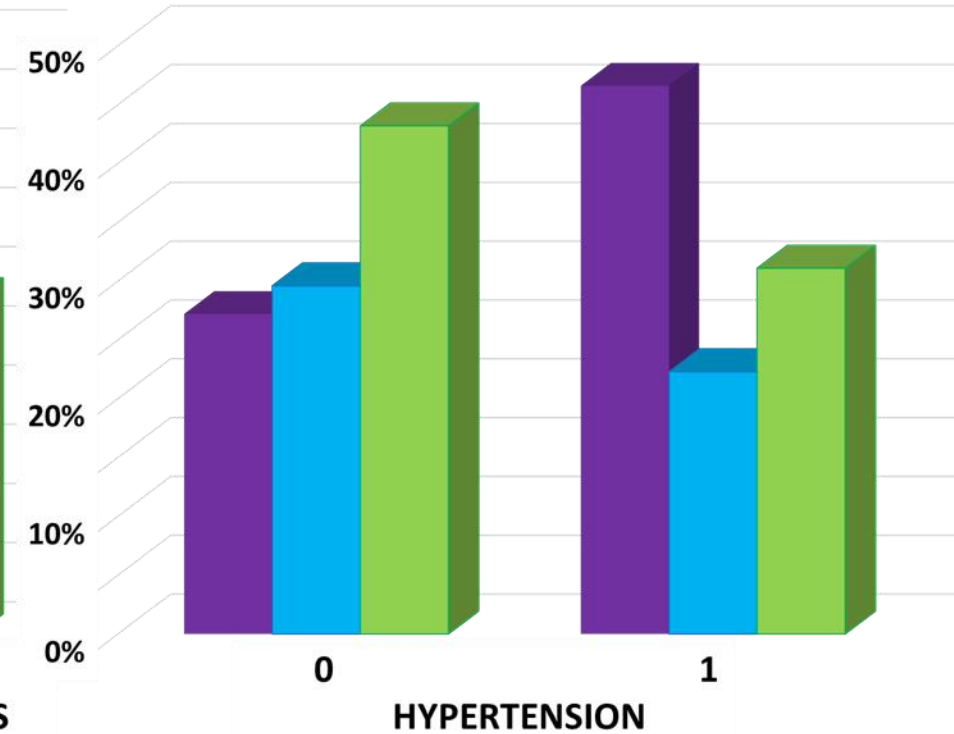
**No Difference**



## S-R Sleep Health: Physical Health

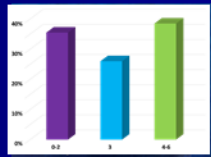


**Trend**

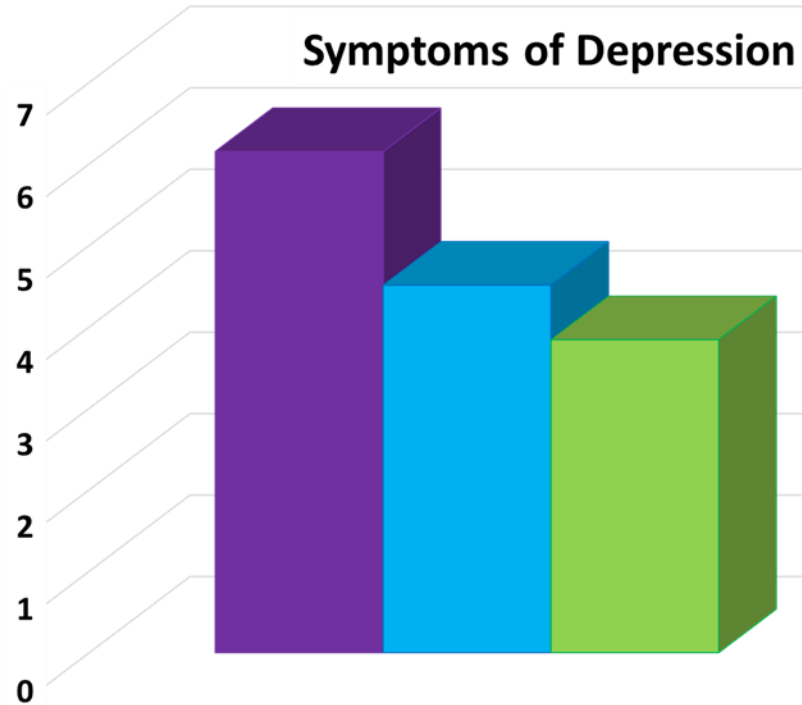


**Chi<sup>2</sup> = 14.3\*\***



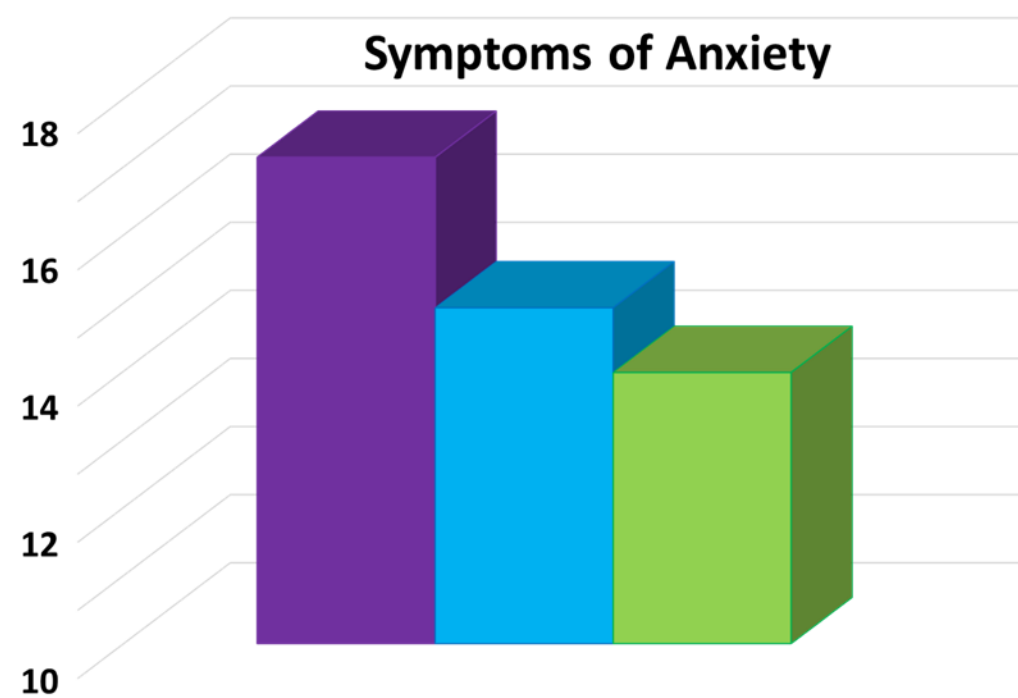


## S-R Sleep Health: Mental Health



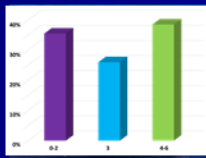
$F(2,361)=24.1***$

Purple > Blue Green

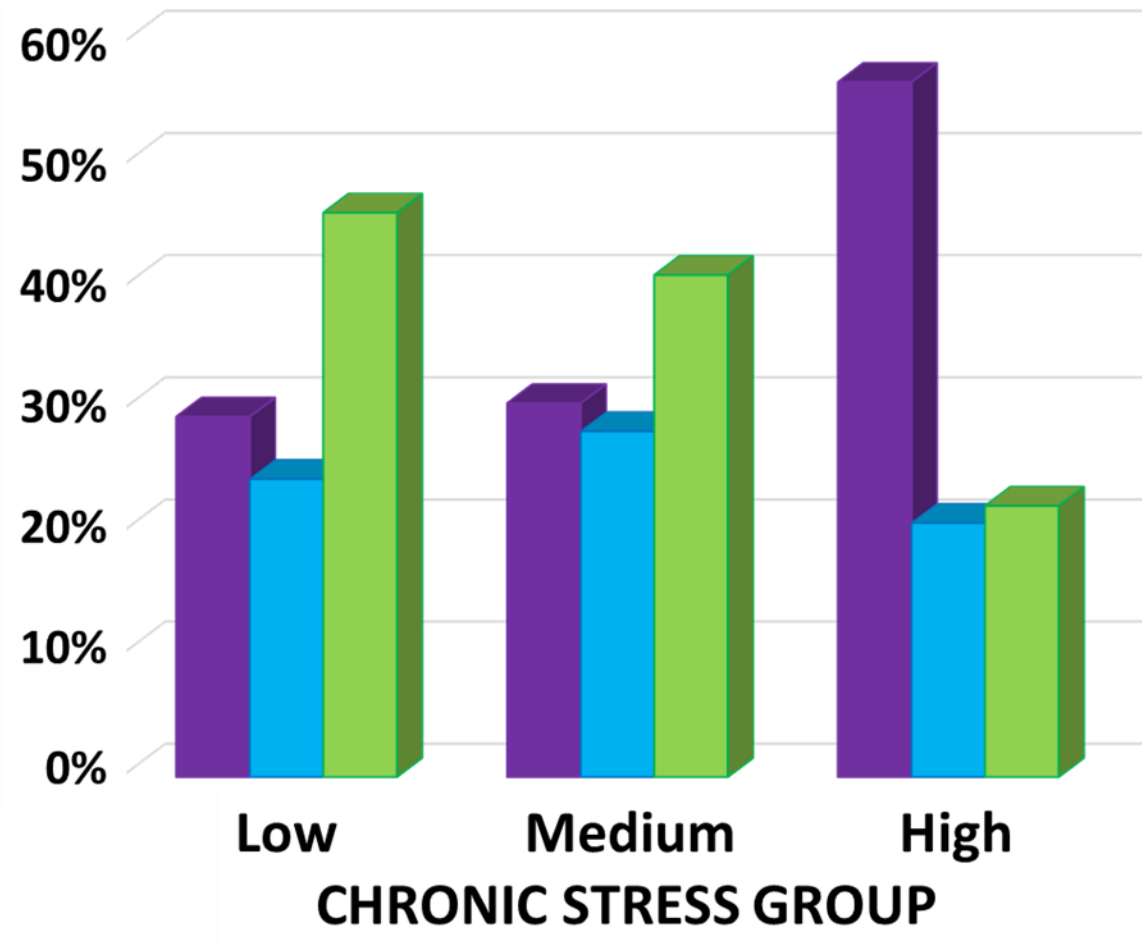


$F(2,361)=17.5***$

Purple > Blue Green



## S-R Sleep Health: Chronic Strain



$\text{Chi}^2 = 19.4^{***}$

# Mechanisms, Moderators & Consequences of Sleep Health: The Pittsburgh Experience



# Are there long term consequences to poor sleep health? The “scarring” of shift work

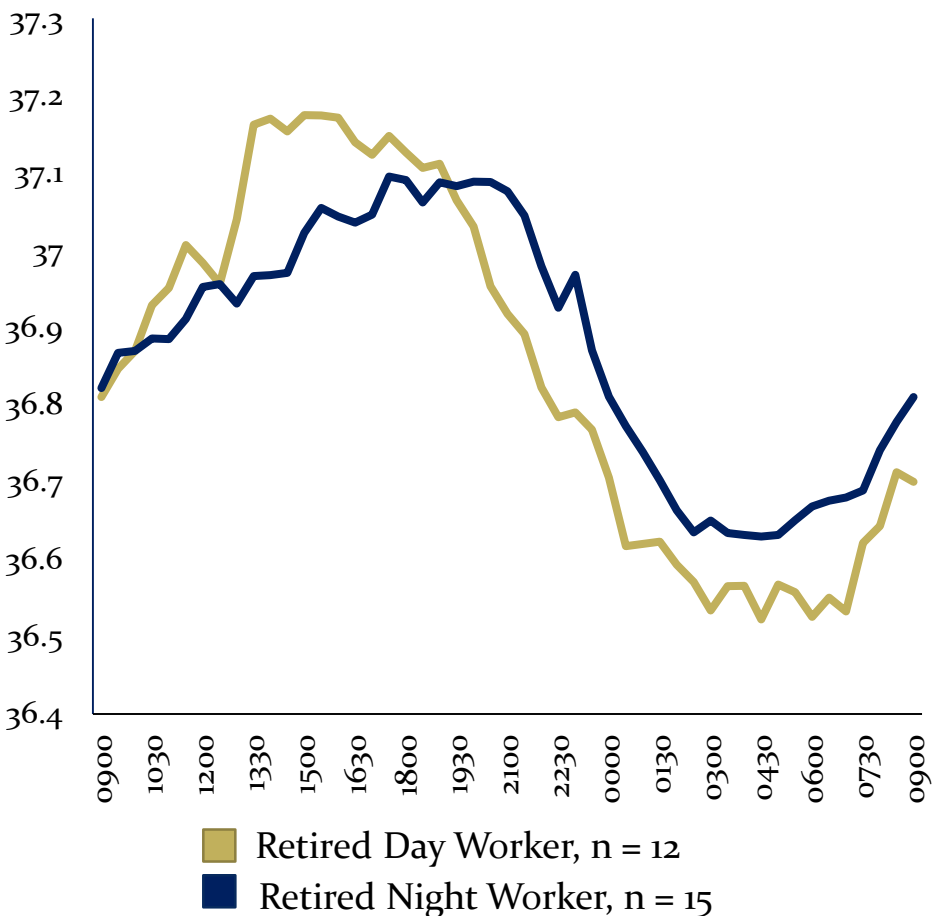


Sleep in Retirement Study  
AGo47139, Buysse & Hall, MPI

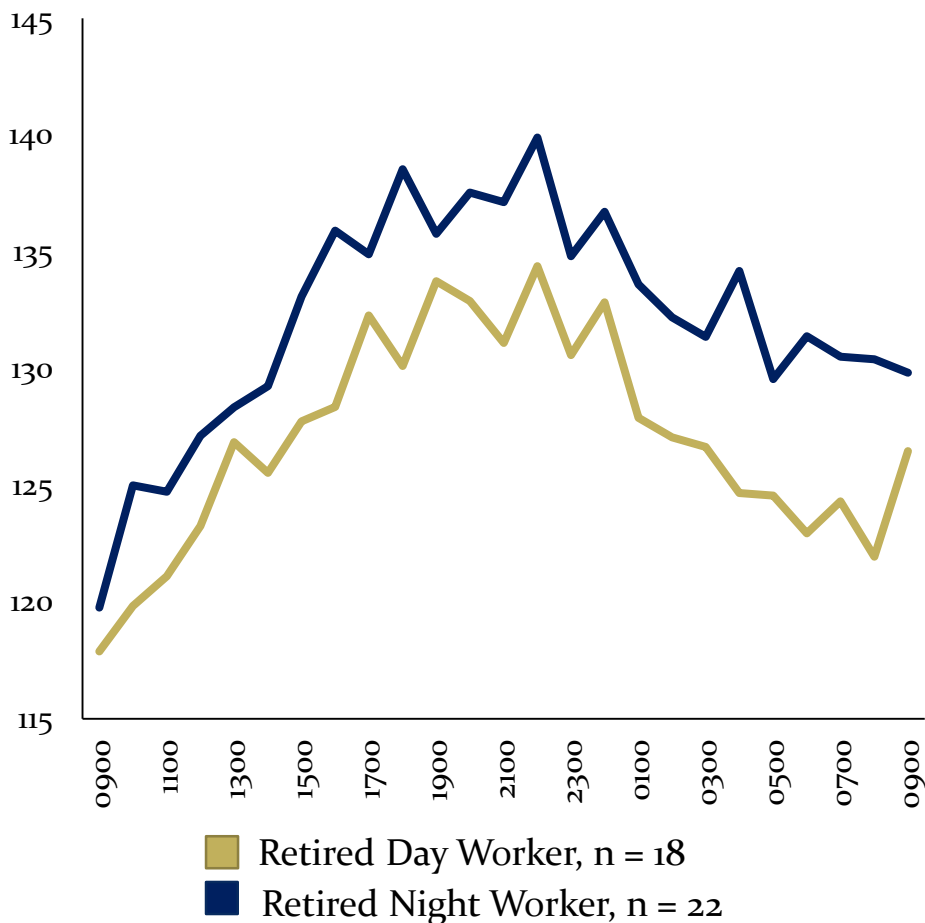


# Does prior night shift work affect sleep, rhythms, and cardiovascular function *in retirement*?

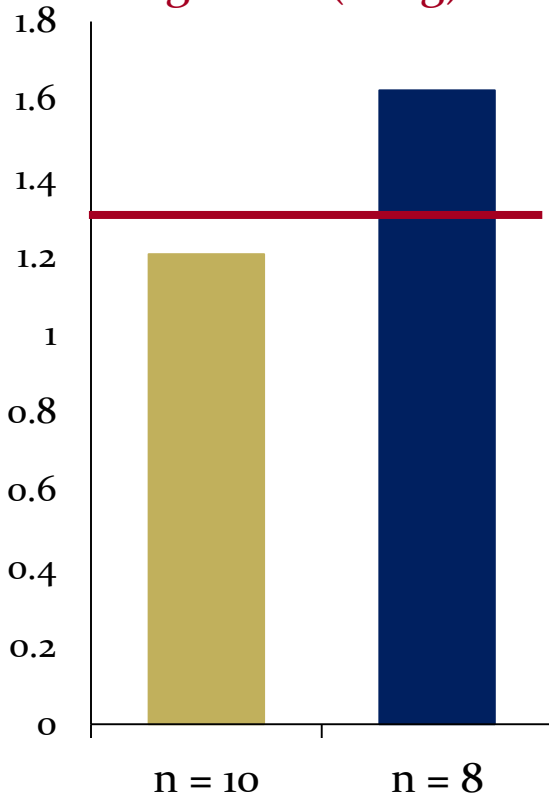
Core Body Temperature (°C)



Systolic Blood Pressure



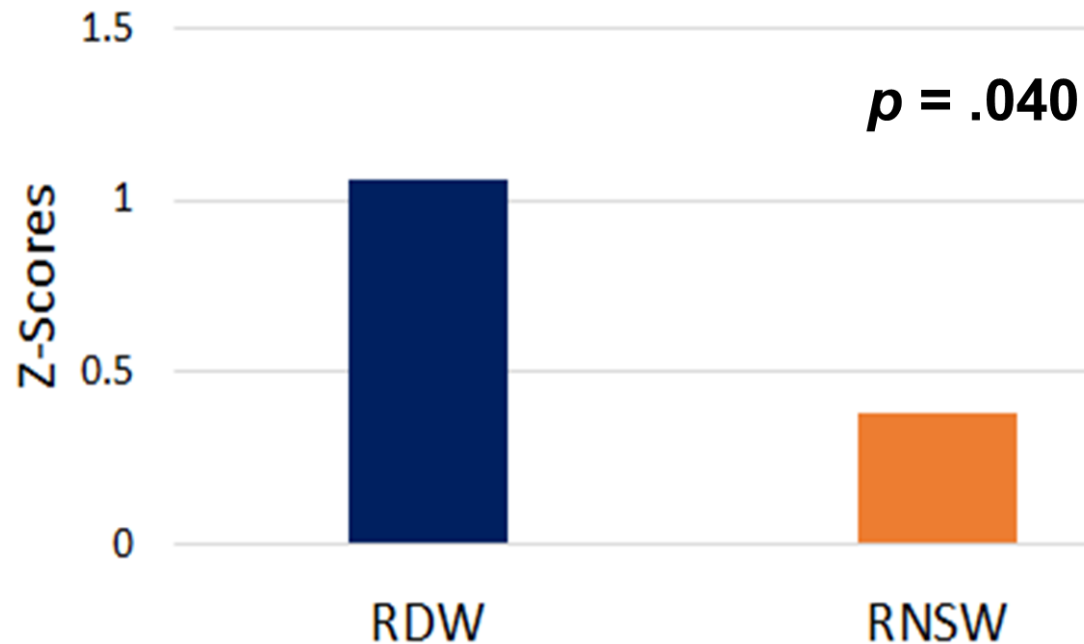
Impairments in Everyday Cognition (Ecog)



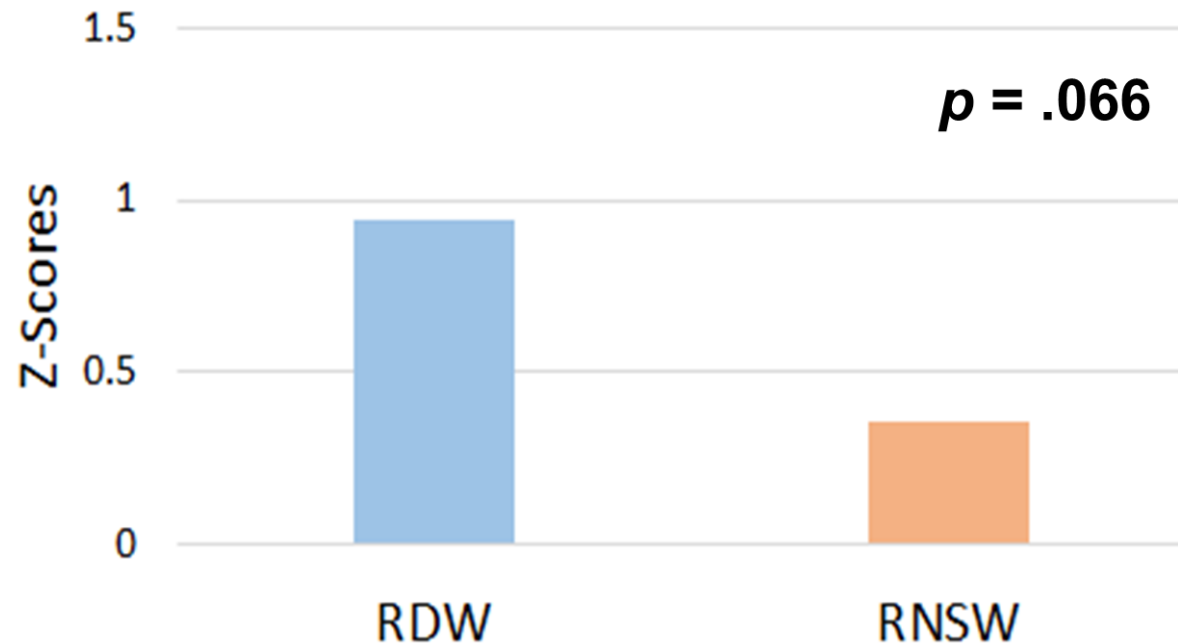
# Long-term Neurocognitive Effects of Repeated Sleep Disruption and Circadian Misalignment in Retired Night Shift Workers

## Episodic Memory

CVLT-II Short Delay Free Recall



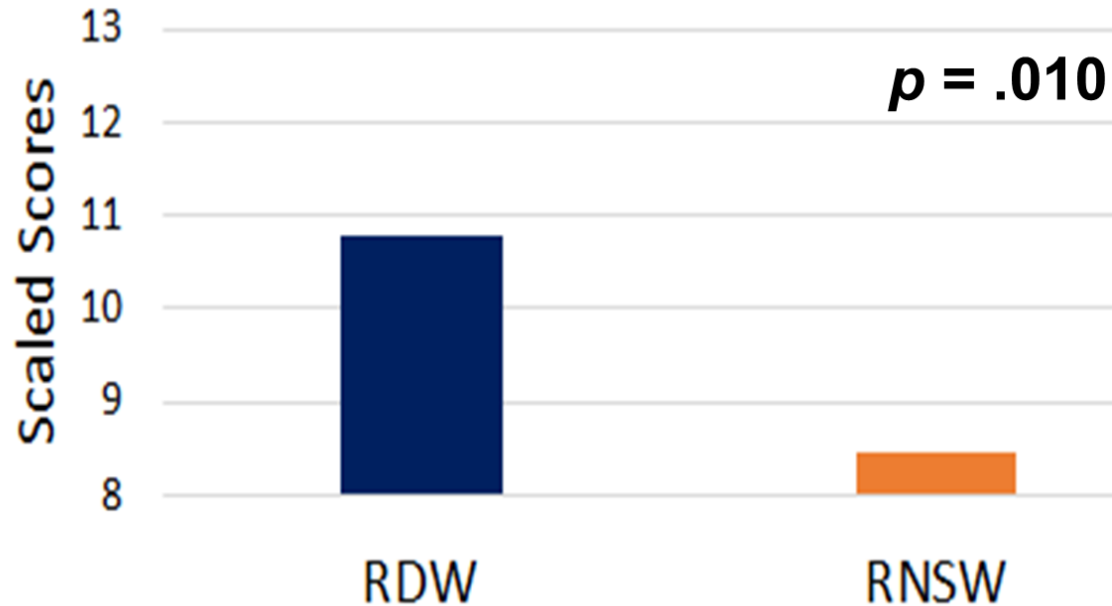
CVLT-II Long Delay Free Recall



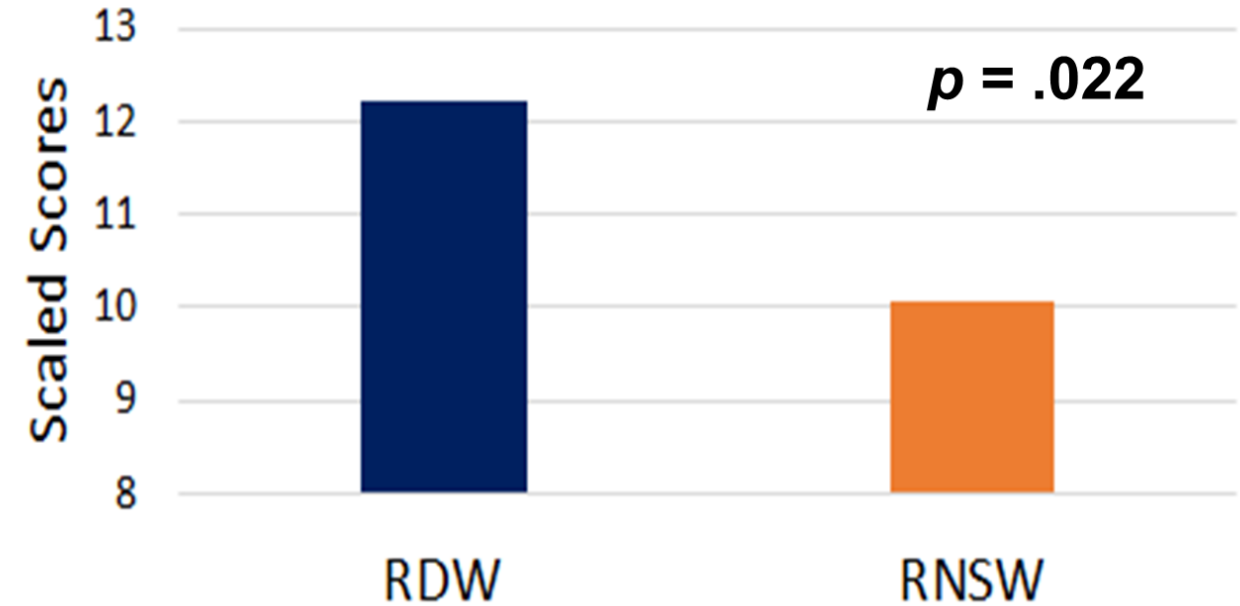
# Long-term Neurocognitive Effects of Repeated Sleep Disruption and Circadian Misalignment in Retired Night Shift Workers

## Executive Function

DKEFS Trail Making Test: Letter-Number Switching (Adjusted)



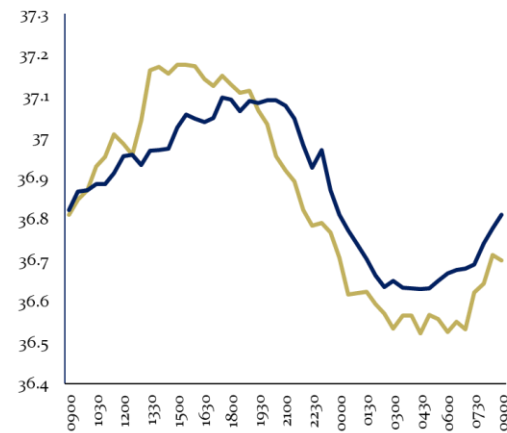
DKEFS Color Word Inhibition: Condition Three (Inhibition)



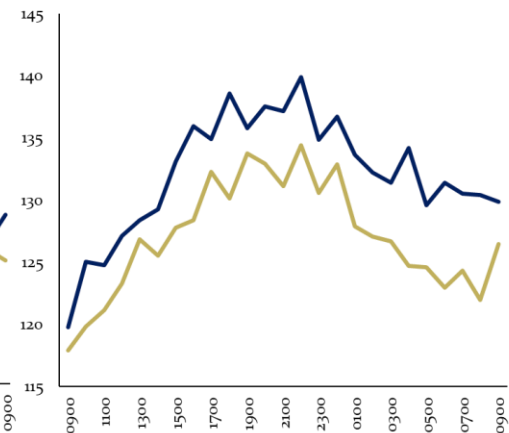
# The “scarring” of shift work



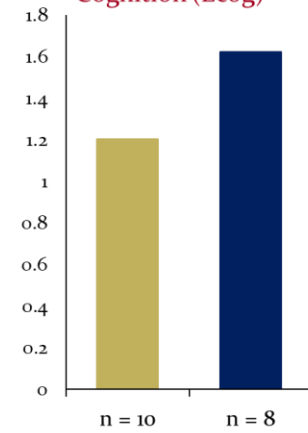
Core Body Temperature (°C)



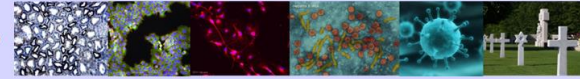
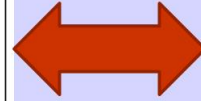
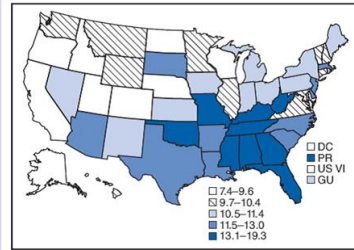
Systolic Blood Pressure



Impairments in Everyday Cognition (Ecog)



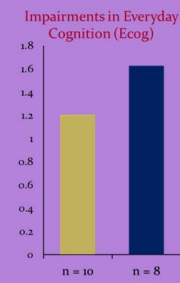
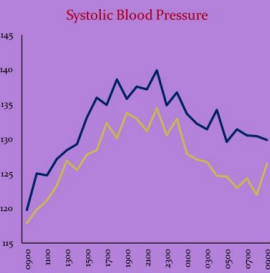
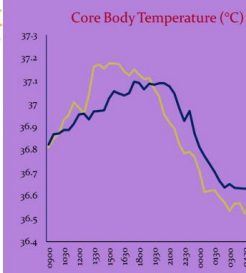
# Insufficient Sleep and the 3 D's



## Mechanisms, Moderators & Consequences of Sleep Health:



## The “scarring” of shift work





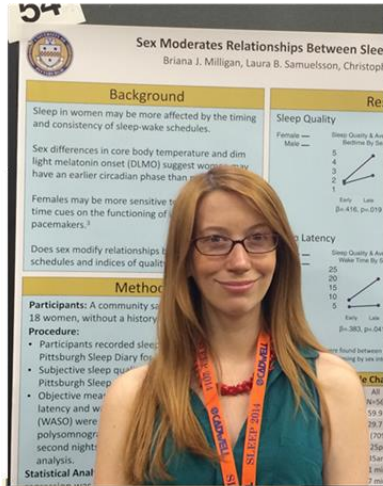
# Busy Trainees

Marissa Bowman

Kat Duggan

Laura Samuelsson

Bree Taylor



Ryan Brindle with undergraduates Kami Brown, Alicia Brindle, & Claire Ozolek

Stephen Smagula

“There is no ‘i’ in “Sleep Health.” *D. Buysse*

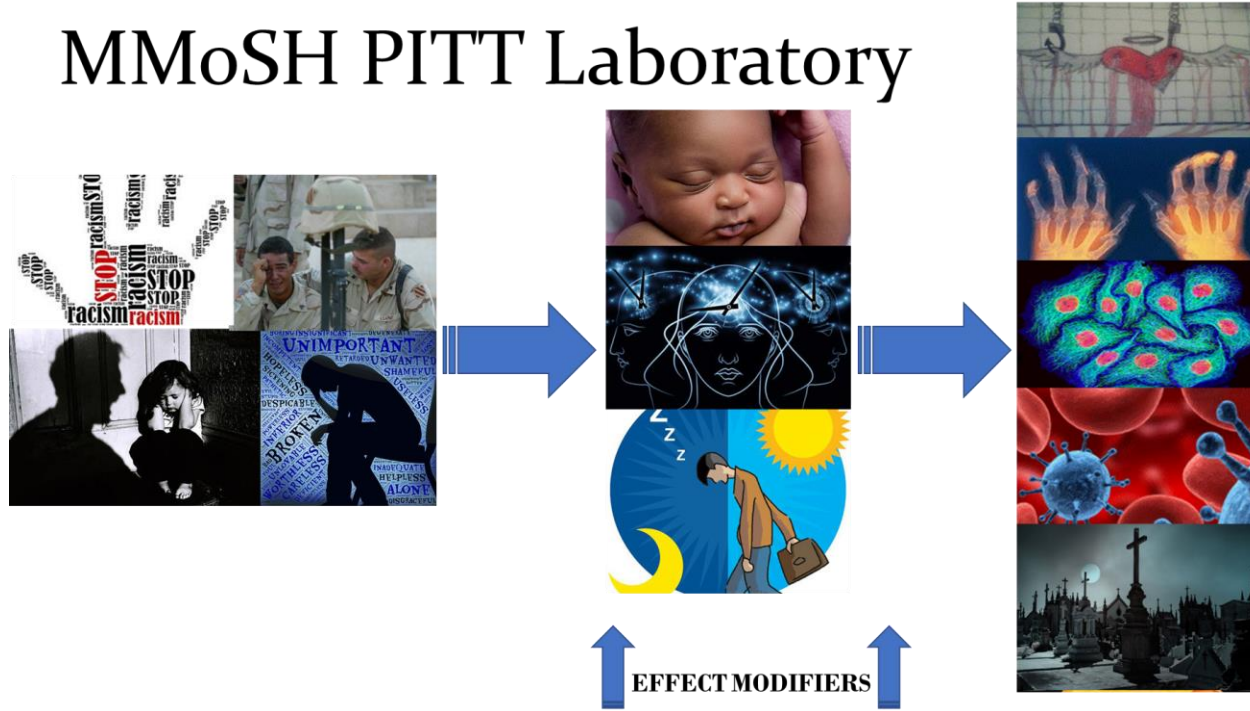
## MMoSH PITT Laboratory & Colleagues



...and grants from the National Institutes of Health, American Academy of Sleep Medicine



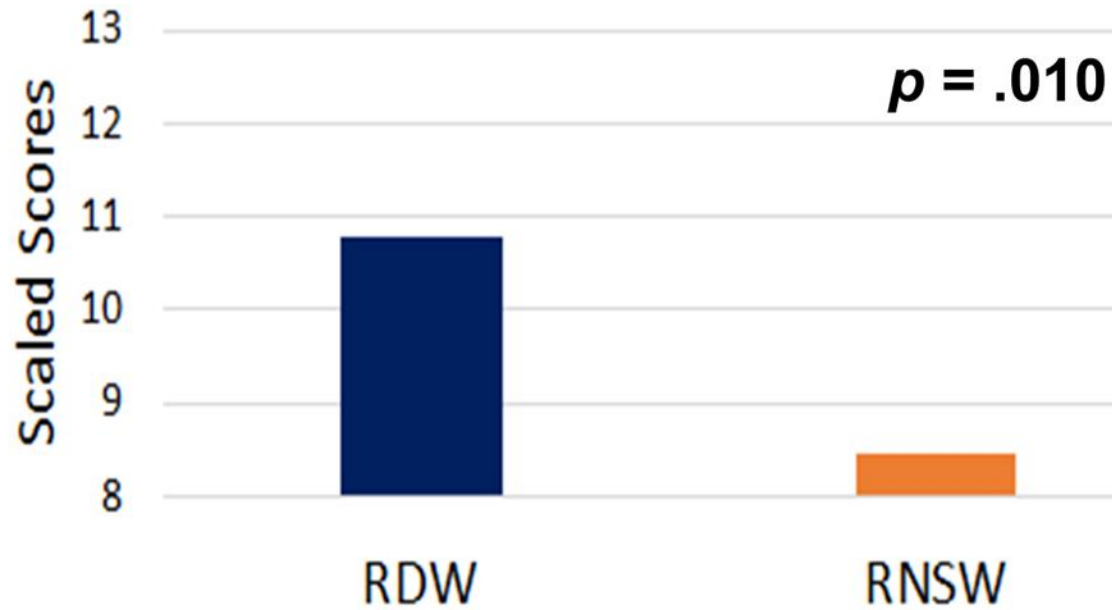
# MMoSH PITT Laboratory



## Questions?

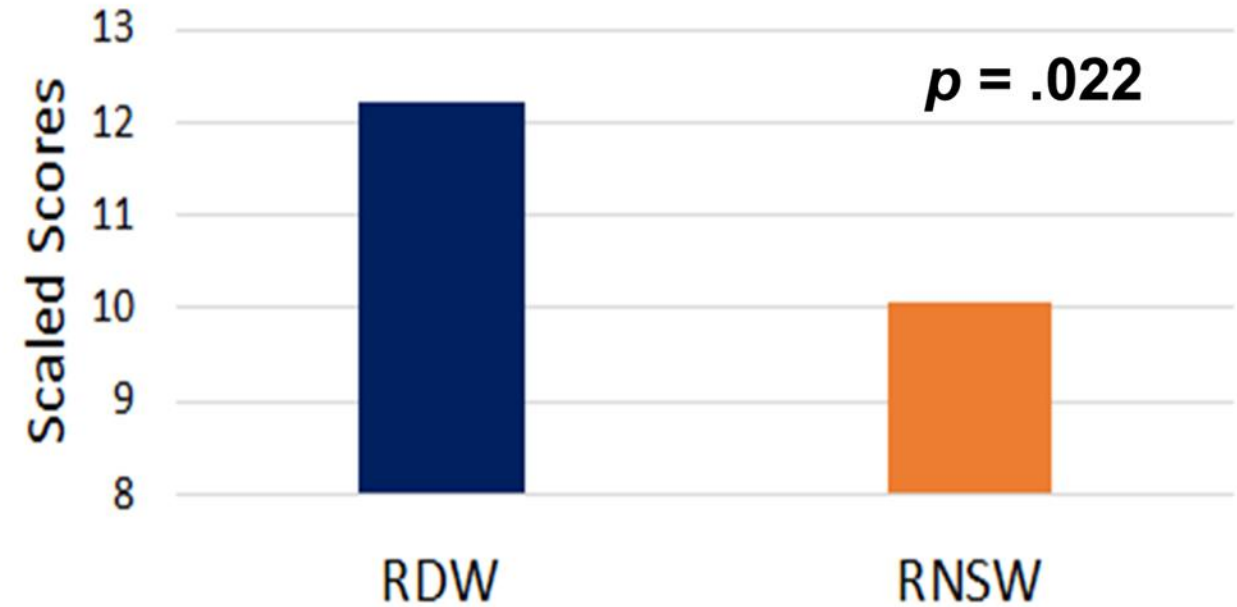
## Executive Function

DKEFS Trail Making Test: Letter-  
Number Switching (Adjusted)



AGo47139-S1, Hall & Butters

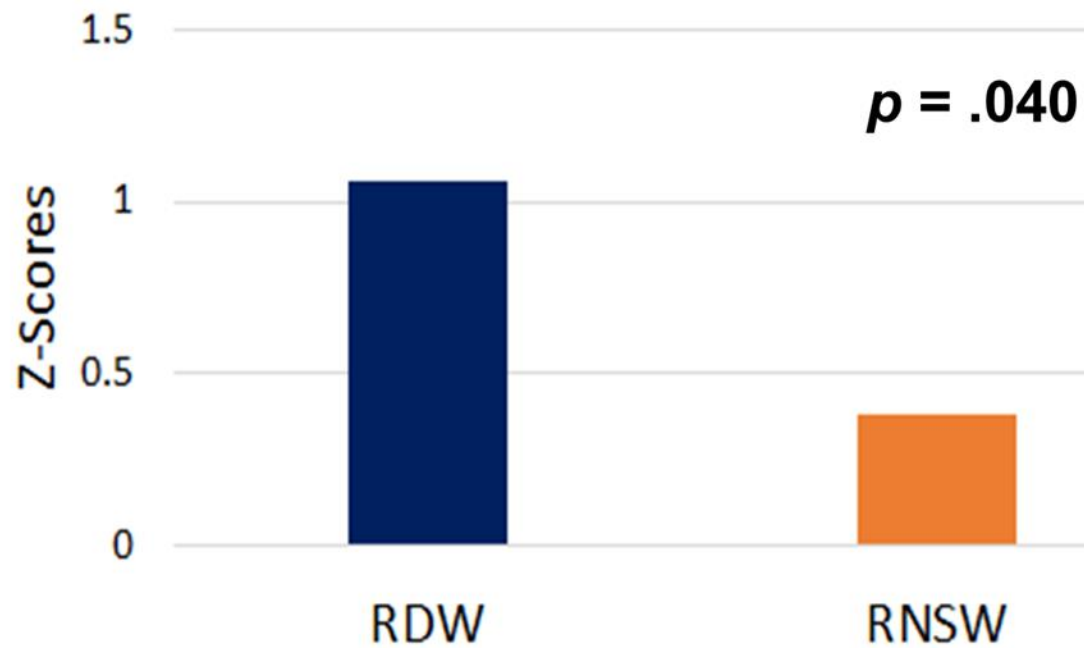
DKEFS Color Word Inhibition:  
Condition Three (Inhibition)



Bowman, Runk, Hall, et al., under preparation

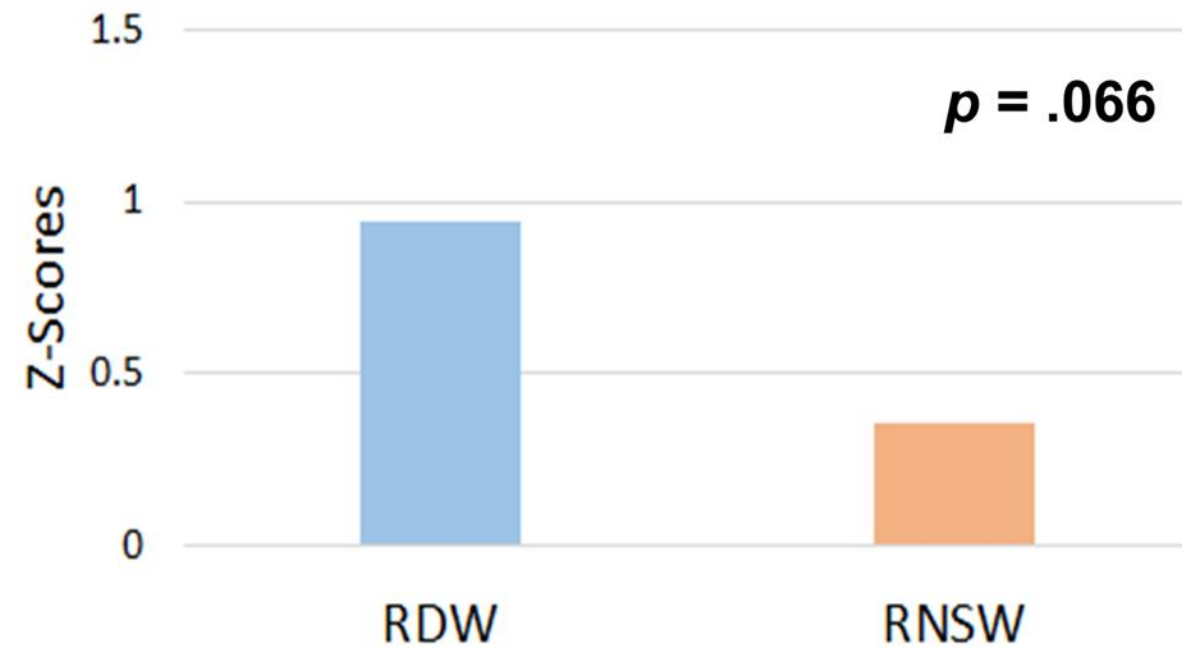
# Episodic Memory

CVLT-II Short Delay Free Recall



AGo47139-S1, Hall & Butters

CVLT-II Long Delay Free Recall



Bowman, Runk, Hall, et al., under preparation