Effect of Sleep and Physical Activity on Markers of Inflammation

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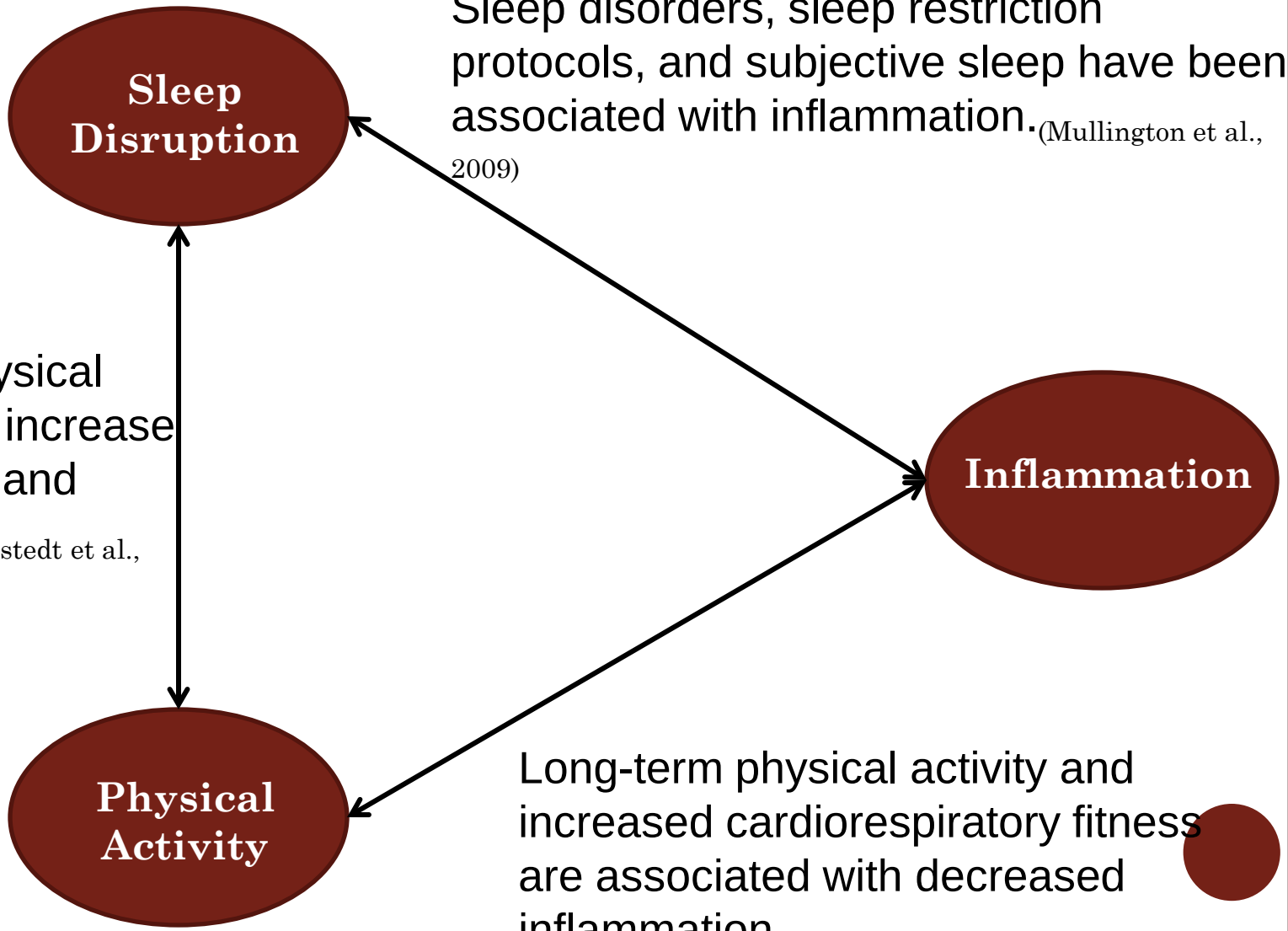
Background & Significance



Sleep disorders, sleep restriction protocols, and subjective sleep have been associated with inflammation.(Mullington et al., 2009)

Regular physical activity can increase sleep need and quality.(Youngstedt et al., 2006)

Long-term physical activity and increased cardiorespiratory fitness are associated with decreased inflammation.(Lavie et al., 2011)

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Purpose

- Hypothesis: hsCRP and IL-6 would be greater among those with sleep characteristics indicative of 'unhealthy' sleep and this relationship would be modified by PA.

- Study Population: Baseline data were used from a randomized trial designed to test the feasibility of a home-based intervention to increased PA among PLWHA.(Jaggers et al., 2013)
  - PLWHA have been shown to suffer disproportionately from various sleep problems.(Parish et al, 2009)
  - Increased inflammation has been observed among PLWHA.(Deeks 2013)

Methods

- PA measurements: Due to the limited sample size, a median split of MVPA minutes categorized subjects into low and high PA.

Table: Inflammation by PA Categories

MVPA	hsCRP	p	IL-6	p
<70	3.8 (1.9-7.7)		4.1 (3.4-4.9)	
>70	1.4 (0.7-2.8)	0.05	3.0 (2.2-3.8)	0.04

- Sleep measurements: Minute-by-minute data from Bodymedia's Sensewear® PA monitor was used to calculated sleep metrics.
  - Sleep/wake times; sleep duration, latency, and efficiency; and WASO

Methods

- Potential confounders: WHR, BMI, demographics, sexual orientation, route of infection, smoking status, comorbidities, and numerous psychosocial and behavioral questionnaires.

- Variable selection: Based on a backward elimination procedures.

- Main analyses: General linear models were used to compute least square (LS) means and 95% confidence intervals (95%CI) for hsCRP and IL-6 among median splits of each sleep metric.

- Stratification: Combined measures of PA and sleep into one variable.

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Results

Table: Baseline mean C-Reactive Protein and Interleukin-6 by Combined Sleep Metric Levels and MVPA Minutes					
Sleep Metric	MVPA Level	hsCRP (n=45)		IL-6 (n=42)	
		Mean (95%CI)	p	Mean (95%CI)	p
Bedtime					
<11:46PM	**>70 Min**	**1.1 (0.4-3.7)**	**Ref**	**3.4 (2.3-4.6)**	**Ref**
>11:46PM	**<70 Min**	**6.5 (1.7-25.1)**	**0.03**	**5.0 (4.0-6.0)**	**0.02**
Sleep Duration					
<339 Min	**<70 Min**	**6.7 (1.9-23.9)**	**0.01**	**5.3 (4.5-6.1)**	**0.02**
>339 Min	**>70 Min**	**1.0 (0.3-3.1)**	**Ref**	**4.0 (3.0-4.9)**	**Ref**

C-reactive protein adjustments: **Bedtime** = race, education, sexual orientation, and PSS; **Total Sleep Time** = race, education, and Social Support for PA family subscale. **Interleukin-6 adjustments: Bedtime** = employment, HIV/AIDS stage, route of infection, PSS, and SF-36 physical functioning subscale; **Total Sleep Time** = route of infection, PSS, WHR, and POC social liberation subscale.

Results

Table: Baseline mean C-Reactive Protein and Interleukin-6 by Combined Sleep Metric Levels and MVPA Minutes					
Sleep Metric	**MVPA Level**	hsCRP(n=45)		IL-6 (n=42)	
		Mean (95%CI)	p	Mean (95%CI)	p
Sleep Efficiency					
<73%	**<70 Min**	**7.8 (2.3-27.2)**	**0.02**	4.3 (3.3-5.2)	0.30
>73%	**>70 Min**	**1.3 (0.4-4.4)**	**Ref**	3.7 (2.6-4.7)	Ref
WASO					
<85 Min	**>70 Min**	**1.0 (0.4-3.0)**	**Ref**	4.6 (3.5-5.8)	Ref
>85 Min	**<70 Min**	**3.9 (1.4-11.0)**	**0.04**	4.1 (3.2-5.0)	0.46

C-reactive protein adjustments: **Sleep Efficiency** = marital status, religion, race, education, Social Support for PA family subscale, POC self-reevaluation subscale, and SF-36 emotional wellbeing, pain, and social functioning subscales; **WASO** = religion, race, education, and POC self-reevaluation and counterconditioning subscales. **Interleukin-6 adjustments: Sleep Efficiency** = employment, route of infection, and POC social liberation, helping relationships, and reinforcement management subscales; **WASO** = route of infection, PSS, WHR, POC self-reevaluation and counterconditioning subscales, and SF-36 limitations due to physical health subscale.

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Discussion

- Those in categories representing more PA and ‘healthier’ sleep had lower levels of hsCRP or IL-6.
- Future studies are necessary to further elucidate the combined effects of sleep and PA on inflammation, as well as to incorporate other lifestyle factors, such as diet.
- Determining which combination of these lifestyle factors is most strongly associated with inflammation could aid in developing lifestyle intervention programs that would be most effective in reducing inflammation levels.

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