Sex Differences in Physical Activity Moderating the Association Between **Pre-Sleep Arousal and Pain Intensity**

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Women Men

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INTRODUCTION

- Physical activity can reduce chronic pain¹ and improve sleep². Additionally, poor sleep and higher pain have been shown to be associated³
- Women have an increased pain sensitivity⁴ and have a higher prevalence of insomnia than men⁵
- Research regarding the sex-specific interactive associations of different types of physical activity and sleep on pain is limited

Study Goal

- Determine whether physical and/or sedentary activity moderates associations between sleep characteristics and pain, and whether sex moderates these relationships

METHODS

Participants

- 127 participants age 50+ (Mage = 64.7, SD = 7.9)

Measures

- Pittsburgh Sleep Quality Index (PSQI, Total Score M = 7.0, SD = 4.1)
- Pre-Sleep Arousal (PSAS, M = 28.8, SD = 11.2)
- International Physical Activity Questionnaire (IPAQ, M = 562.2, SD = 1001.6
- Pain (Average pain intensity over the last month, M = 38.5, SD = 24.34)

Data Analysis

- Moderated Regressions: PSQI subscores, PSAS, IPAQ, sex
- Covariates: education, difficulty walking, BMI, number of medical conditions, pain medication, and depression/anxiety symptoms



Figure 1. Statistical relationship between sex, physical activity, sleep, and pain.

- arousal (p=0.03, R²=0.02; see Figure 3) in their associations with pain
- (p=0.43)
- (p=0.87)
- (*p*'s>0.05)



Figure 2. Sex specific associations between somatic pre-sleep arousal and average pain intensity

- In middle-aged and older adults, sex moderates the interactive association of sitting time and pre-sleep arousal with pain intensity - Specifically, in women, prolonged sitting and higher pre-bedtime

physiological arousal was associated with higher pain intensity

Finding

Key

References

- 1. Ambrose, K. R., & Golightly, Y. M. (2015). Best Practice & Research Clinical *Rheumatology*, *29*(1), 120–130.
- 2. Kredlow, M. A. et al. (2015). Journal of Behavioral Medicine, 38(3), 427-449.
- 3. Sivertsen, B. et al. (2015). *Pain, 156*(8).
- 4. Fillingim, R. B. (2000). *Current Review of Pain*, 4(1), 24–30. 5. Zhang, B., & Wing, Y.-K. (2006). Sleep, 29(1), 85–93.



RESULTS

- Sex moderated the association between time spent sitting and **somatic** pre-sleep arousal (p=0.02, $R^2=0.02$; see **Figure 2**) and **total** pre-sleep

- Higher somatic arousal was associated with worse pain at highest levels of sitting time in women (B=3.65, SE=1.66, p=0.03), but not men

- Higher total arousal was associated with worse pain at highest levels of sitting time in women (B=2.05, SE=0.89, p=0.02), but not men

- Sex did not significantly moderate the interaction between physical or sedentary activity and **PSQI** sub-scores in its association with pain intensity

Male

Figure 3. Sex specific associations between total pre-sleep arousal and average pain intensity

DISCUSSION

- Future studies should investigate mechanisms underlying these sex-differences (e.g., cardiovascular autonomic regulation) in order to inform sex-specific recommendations and treatment efforts for chronic pain in mid-to-late life

Women are more vulnerable to worse pain in the presence of higher pre-sleep arousal and prolonged sitting

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