

Cyclical Changes in Sleep and Pain in Temporomandibular Disorders

Francis Westbrooks^{1*}, Luana Colloca^{1,2,3,4}, Akintola Titilola^{1,2,4}, Yang Wang^{1,3,4*}

¹Department of Pain and Translational Symptom Sciences University of Maryland School of Nursing,

²Department of Anesthesiology/Psychiatry University of Maryland School of Medicine,

³UMB Center for Advance Chronic Pain Research.

⁴UMB Center Placebo Beyond Opinions (PBO) Center

*e-mail: fwestbrooks@umaryland.edu and yang.wang@umaryland.edu



Background

Chronic pain, such as temporomandibular disorders (TMD), is associated with sleep disturbance.¹⁻² Previous studies suggest those two symptoms may vary seasonally.³

There is scientific consensus that recent years have seen a significant increase in the frequency and intensity of extreme weather. Understanding how sleep and pain change over seasons and climate is critical for tailoring interventions for better symptom management in chronic pain.

This study examined if there was a seasonal shift effect in sleep patterns and chronic pain severity, and how the seasonal component of sleep and pain were correlated in a large cohort of TMD participants.

Methods

Data were collected from 277 TMD participants who were enrolled between June 2017 and January 2020 (HP-00068315). Self-reported sleep and wake times were used to calculate total sleep time (TST), and sleep efficiency (SE), which was defined as the ratio of actual sleep to total time in bed (see Fig. 1).

Current pain severity was assessed using the Graded Chronic Pain Scale.⁴

We applied seasonal decomposition analysis to identify cyclical trends in TST, SE, and pain severity over time.

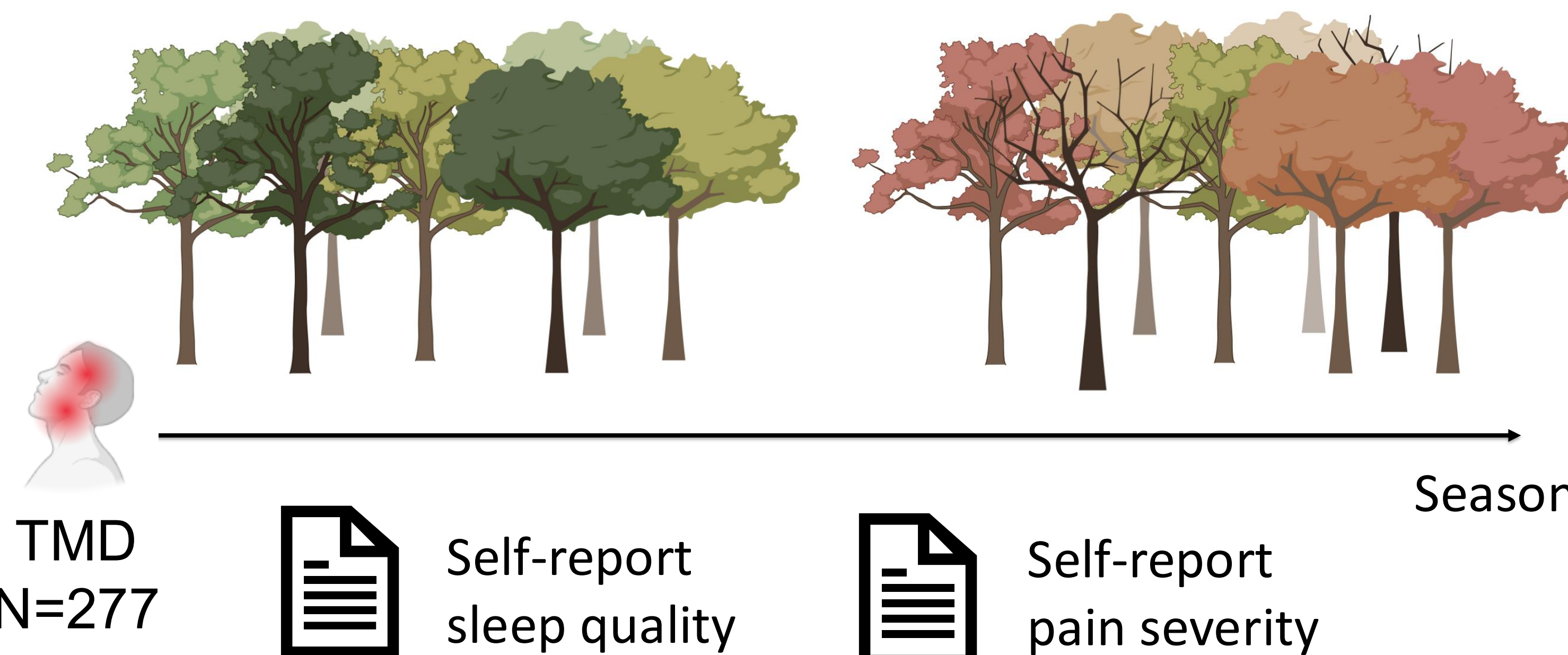


Figure 1. Study design.

Participants characteristics

Enrolled TMD participants were primarily women (213 women vs. 64 men). This sample included diverse groups of race (White, African-American/Black, Asian, and mixed races). The majority of the participants had an education level of college graduate or higher. Most participants were not married.

Results - I

Seasonal components explained 19.27% of the variance in TST, 27.03% in SE, and 21.81% in pain severity, indicating moderate seasonal fluctuations. Pain severity peaked and sleep efficiency declined during winter months (Fig. 2 to 4).

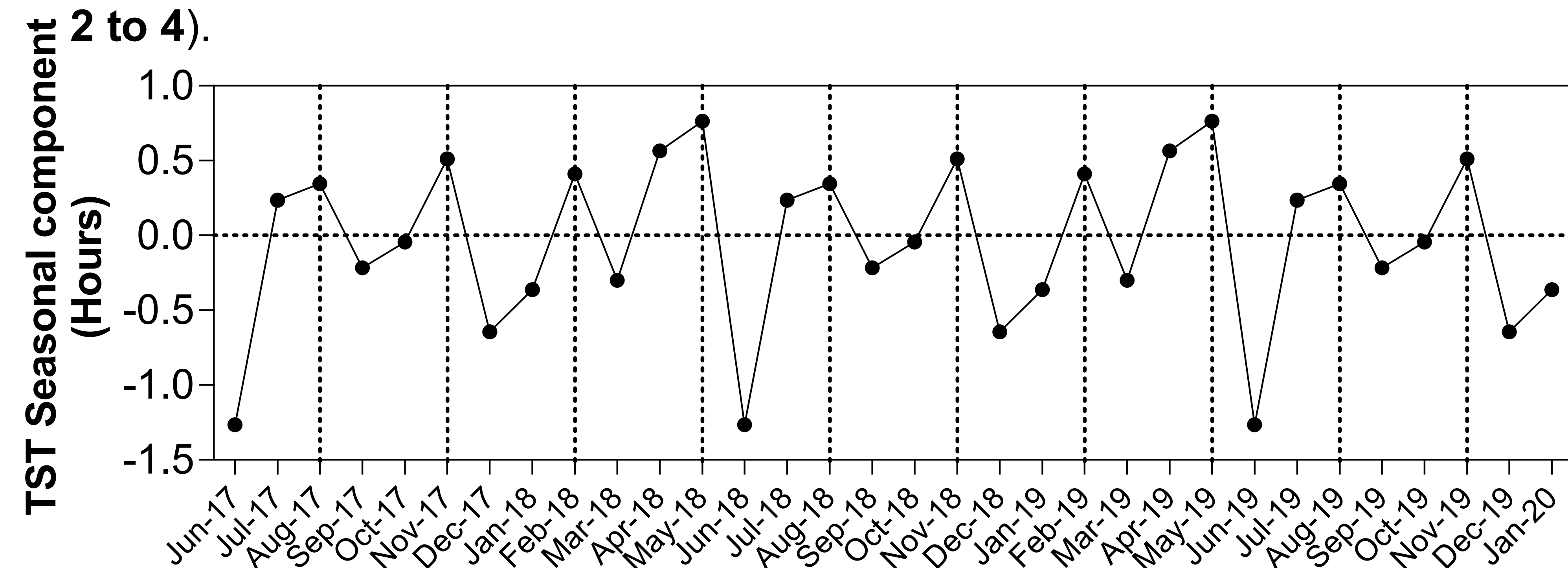


Figure 2. Seasonal component decomposed for total sleep time. After removing long-term trends and random noise, total sleep time (TST) exhibited clear periodic changes over months. The Y-axis indicated Seasonal deviation in hours (from the average). Positive values indicate months where people sleep more than average. Negative values indicate months with less sleep than average. A consistent drop in TST occurs around early summer, and mid winter every year.

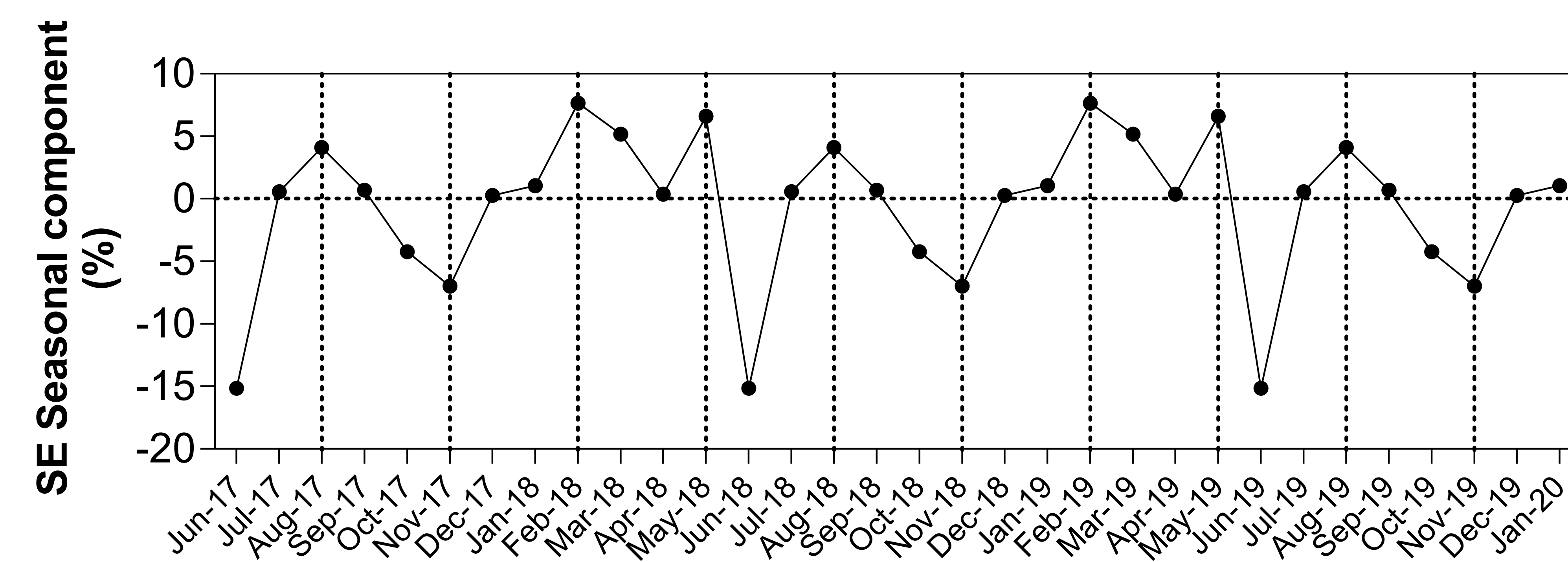


Figure 3. Seasonal components for sleep efficiency. The Y-axis indicated Seasonal Sleep efficiency measured as total time asleep while in bed compared to average. Notably, there is a considerable drop in sleep efficiency during the early summer months, and mid-winter in a yearly pattern.

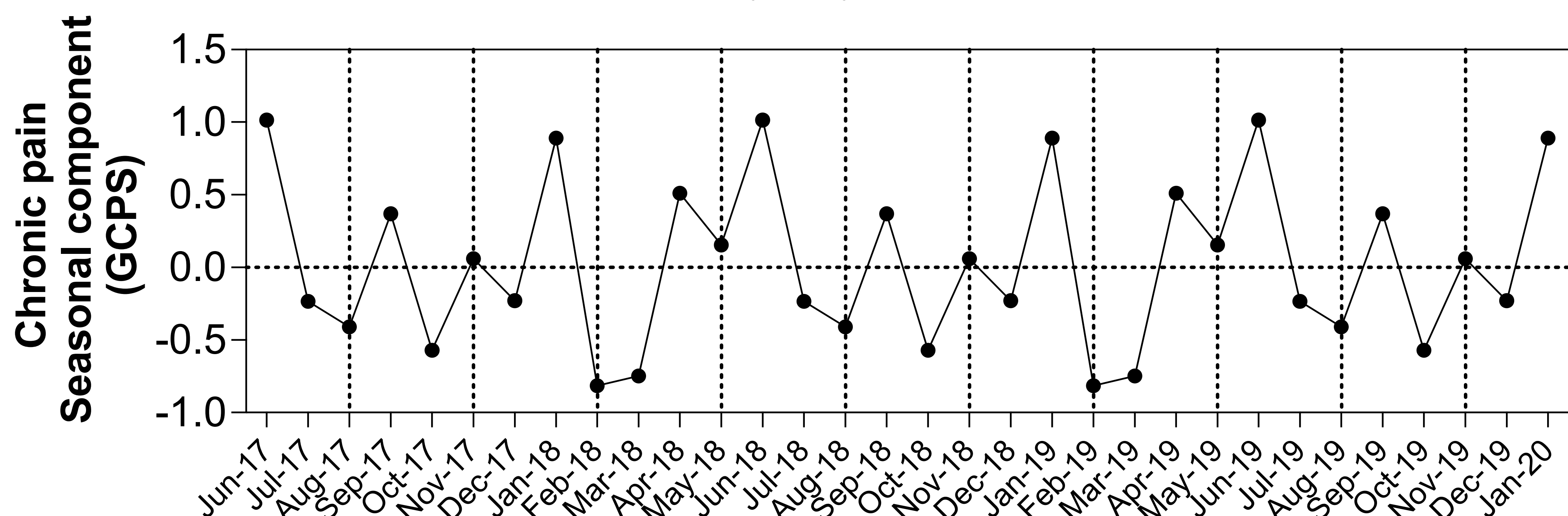


Figure 4. Seasonal components for chronic pain severity. The Y-axis indicated Seasonal pain severity self report as compared to the average. Early summer and winter exhibited consistently higher chronic pain in a yearly cycle, while early spring and fall had lower pain severity.

Results - II

Significant negative correlations were found between the seasonal components of SE and pain severity ($r = -0.53$, $p = 0.002$, Fig. 5a), and between TST and pain severity ($r = -0.42$, $p = 0.016$, Fig. 5b), suggesting an inverse seasonal relationship between sleep quality and pain.

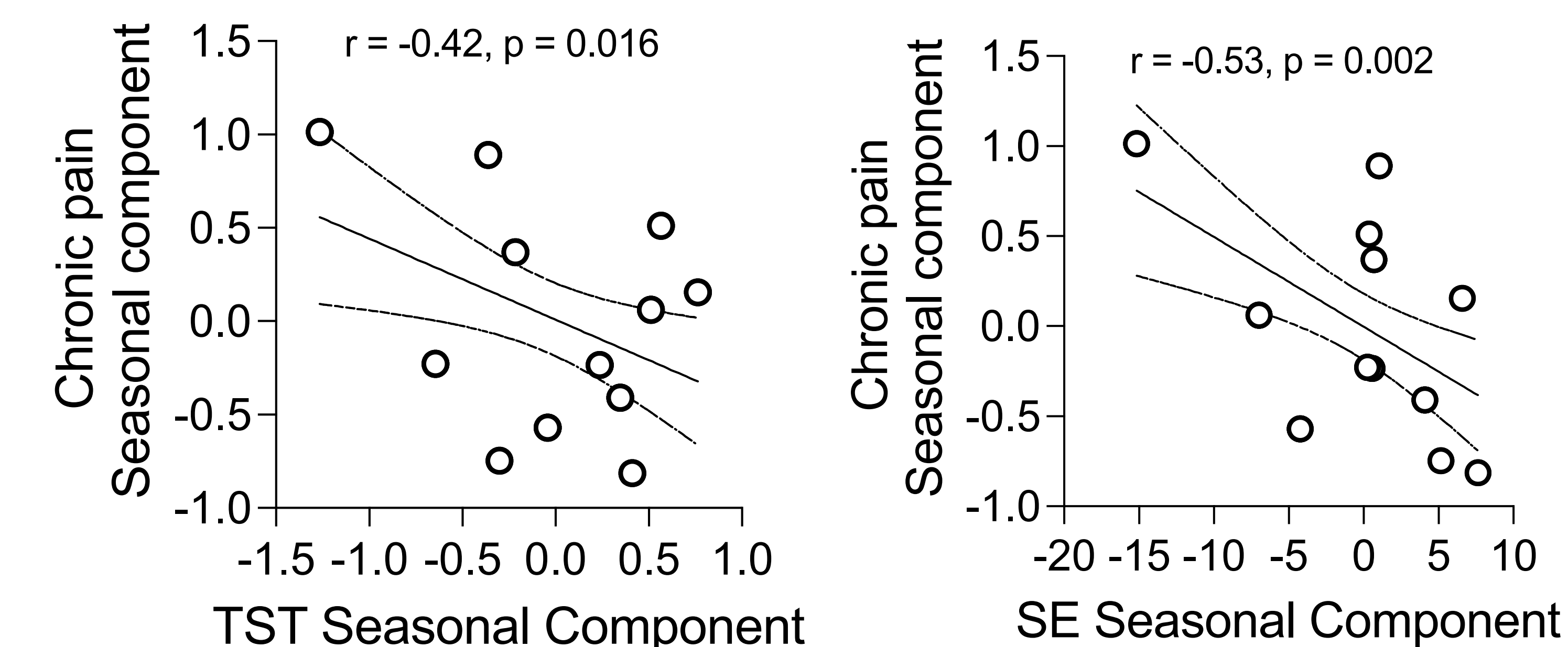


Figure 5. Correlations between TST, SE, and chronic pain seasonal component

Conclusion

- This study demonstrates that both sleep patterns and chronic pain severity in TMD participants follow seasonal trends, with notable declines in sleep efficiency and increases in pain during the winter months.
- The observed inverse relationship between sleep quality and pain severity suggests that seasonal disruptions in sleep may exacerbate pain symptoms.
- These findings underscore the importance of recognizing and addressing seasonal influences in the clinical management of TMD. Incorporating season-sensitive approaches—such as targeted sleep interventions during winter—may help improve outcomes and quality of life for individuals with TMD.

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