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## Introduction

- Children and adolescents with chronic pain are more likely to report difficulty falling and staying asleep, associated daytime fatigue, and decreased energy levels.
- However, few studies track both subjective and objective sleep measures and their impact on daily functioning and mental health.
- We propose that both self-reported and objective measures of sleep and functionality will improve after participation in an intensive interdisciplinary pain treatment (IIPT) program.
- We evaluated relationships between sleep changes and measures of pain, disability, anxiety, and depression.

## Methodology

This was a prospective, longitudinal study of adolescents with chronic pain age 13-17 who completed a 3-6 week non-pharmacological highly structured intensive interdisciplinary pain treatment program.

### Program Admission Criteria:

- Functional Disability
- Failure of Outpatient Treatment

### Program Discharge Criteria:

- Achieves PT & OT functional Goals
- Self-directs therapies

### Program Structure:

- Outpatient/Day Hospital (Monday – Friday)
- 4-5 hours daily intensive PT and OT
- Daily yoga and/or self-regulation
- Group and individual acceptance-based talk therapy
- Therapeutic art and music
- Twice weekly parent group

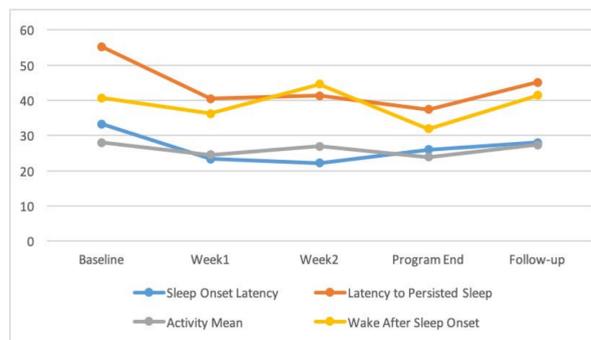
62 adolescents with chronic musculoskeletal pain were evaluated at program baseline, weekly during treatment, and again at 1-month after program completion by self-report PROMIS (Patient Reported Outcomes Measurement Information System) measures, sleep diaries, and by actigraphy using Motionlogger watches. Paired samples t-tests were conducted with SPSS (V.23) and supplemented with hierarchical linear modeling (HLM7) for time-series analyses.

## Results

**Table 1.** Demographics

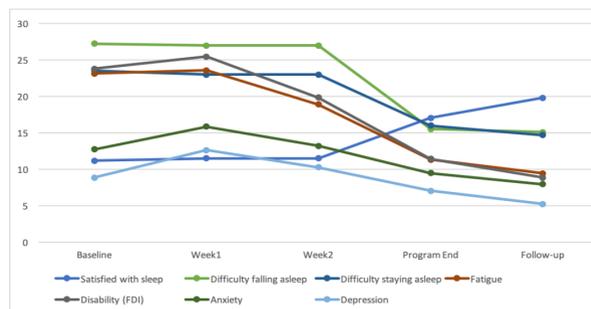
Baseline characteristics (total N=62)	Mean±S.D., or n(%)
Age (years)	15.6±1.7
Gender	53 (87%) female
Ethnicity	8 (13%) Hispanic
Race	55 (89%) White 3 (5%) Black or biracial 2 (3%) Asian American
Pain duration (years)	3.8±3.1
Average pain intensity (VAS, 0-100)	55.3±18.1
Primary pain diagnosis	46 (74%) widespread, constant 12 (19%) localized or CRPS 2 (3%) other
Weeks in program	13 (21%) 3 weeks 33 (53%) 4 weeks 13 (21%) 5 weeks 3 (5%) 6-7 weeks
Impairment (FDI)	23.8±11.0
Parent-reported impairment (FDI)	24.4±10.9

**Figure 1.** Changes in Objective Sleep Variables (by actigraphy)



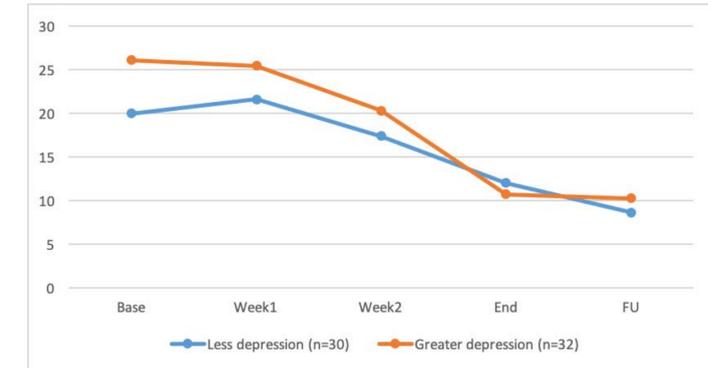
**Summary:** Actigraphy shows mild improvement in latency to persisted sleep and sleep onset latency; however, none of the objectively measured variables reached statistical significance by end of program or at 2 week follow up (all  $p$ 's>.01).

**Figure 2.** Self-reported measures of sleep, impairment, anxiety and depression



**Summary:** Participants reported difficulty falling and staying asleep at baseline with significant improvements by program end ( $p$ 's<.001). Impairment (measured with FDI) improving by program end and through follow up ( $p$ 's<.001). Statistically-significant improvements were also observed at program end for sleep satisfaction, energy level, and daytime fatigue, with continued improvement at the 2 week follow up (all  $p$ 's<.01).

**Figure 3:** Changes in fatigue correlated to measured level of depression.



**Summary:** Self reported levels of fatigue greater in participants who reported more severe depression at baseline, but improved to similar levels following program. HLM supports the difference in these trajectories ( $p$ <.001).

**Table 2:** HLM analysis of subjective sleep outcomes, with other predictors in model

Outcome	Intercept	Pain	Functioning	Anxiety	Depression	Summary:
Probs. falling asleep	.86***	.01	.04***	.01	.03*	For difficulty falling asleep, change in pain-related disability is the best predictor of improvement. For difficulty staying asleep, changes in pain intensity and pain-related disability both predict improvements. For fatigue, changes in depression and pain-related disability are related to improvement. * $p$ <.05, ** $p$ <.01, *** $p$ <.001).
Probs. staying asleep	.71***	.01**	.03***	.01	.01	
Daytime fatigue	2.54*	.02	.53***	.08	.37***	

## Summary/Conclusion

- Children with chronic musculoskeletal pain report sleep impairments and decreased daily functioning before participating in an intensive interdisciplinary pain treatment (IIPT) program.
- After completion of the program, patients reported statistically significant improvements in sleep satisfaction, difficulty falling asleep, energy level, and daytime fatigue
- However, improvements on objective (actigraphy-based) measures were not statistically significant.
- Improvements in sleep satisfaction and difficulty falling asleep were correlated with improvements in daily functioning.
- Improvement in depression was a strong predictor for less daytime fatigue, a relationship that needs further exploration.
- Long-term follow up is needed to determine reasons for the discrepancy between subjective and objective changes.