

SLEEP DEFICITS CAN BE EFFICIENTLY TREATED USING E-THERAPY AND A SMARTPHONE

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INTRODUCTION

Sleep deficiencies, such as insomnia are prevalent. They are known to affect mood, performance and well-being and were even linked to increased morbidity. Mobile technology and the growing availability of wearable devices open new opportunities for self-help for sleep disorders. We present a novel mobile e-therapy service, SleepRate, that combines:

- Sleep evaluation based on reported and subjective data.
- Quantified sleep architecture measurement derived from Heart Rate Variability.
- Cognitive Behavioral Therapy (CBT).

METHODS

297 users have started the sleep improvement e-therapy, over a period of 15 months, and adhered with the program for at least 20 days. The night sleep was characterized using the following parameters: total sleep time, sleep efficiency, sleep latency and wake after sleep onset (WASO). Each of these parameters had a subjective and objective value. In addition, the users reported their sleep satisfaction and daily sleepiness. The first 6 nights (assessment stage) were compared with the 15th-20th nights (during CBT stage) using paired t-test with $p < 0.05$ as the criterion for statistical significance.

Nightly Sleep Tracking

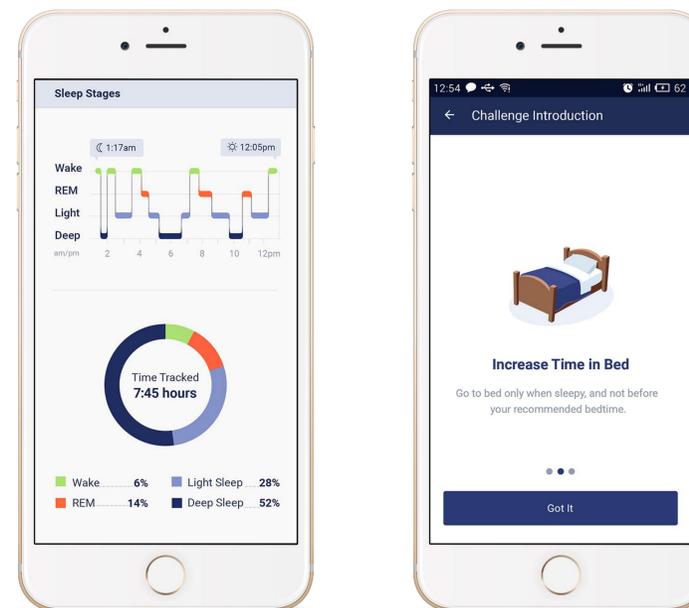
Users indicate when they go to bed and get up, provide subjective information and use wearable heart rate monitor for objective, HRV-based sleep analysis.

Assessment

Data is collected over a week and a determination is made if a sleep problem is present: insomnia, circadian disorder, insufficient sleep, etc.

Therapy

User is presented weekly goals following CBT protocols. Progression from goal to goal is automated and individual, determined through weekly evaluation of progress.



RESULTS

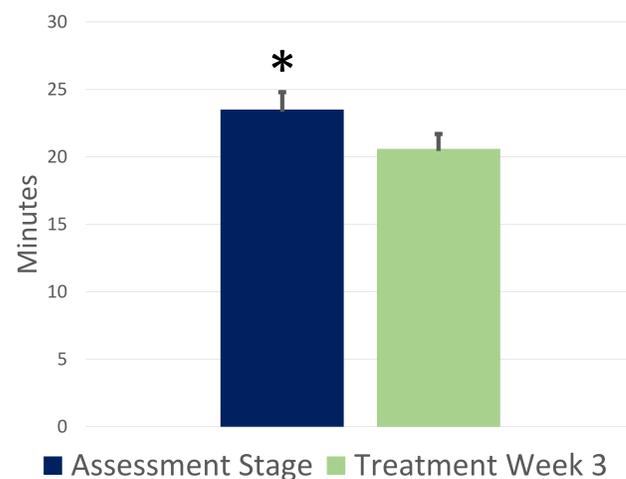
Statistically significant improvement were found in various parameters with e-therapy, demonstrating the positive impact e-therapy has on sleep.

- Perceived sleep latency improved from 23.5 ± 1.3 minutes (mean \pm SE) to 20.6 ± 1.1 minutes.
- Objective WASO improved from 50.6 ± 1.0 minutes to 48.8 ± 0.9 minutes.
- Subjective sleep satisfaction increased from 45.7 ± 0.7 to 47.1 ± 0.7 .
- Subjective daytime sleepiness decreased significantly from 21.5 ± 1.1 to 18.3 ± 1 .

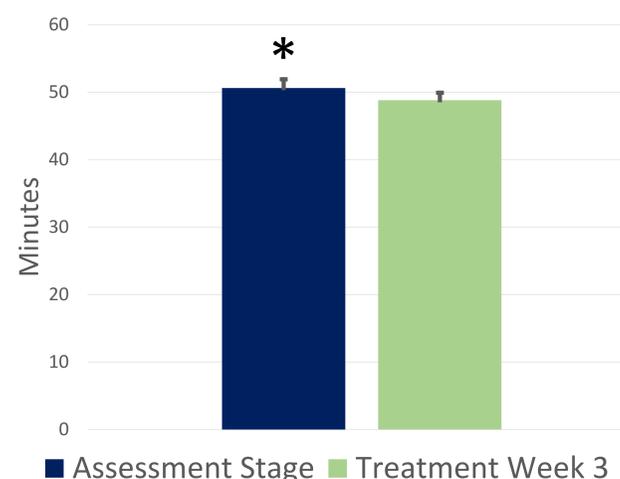
CONCLUSION

The availability of devices that are capable of evaluating objectively sleep duration, structure and quality allows a deeper understanding of sleep in the natural sleep environment. The findings indicate that after 20 days of adherence with the program, there was significant improvement in several sleep variables. In addition, they show that while the service was efficient, the main barriers were users' engagement and the availability of accurate and minimally intrusive wearables. These barriers are likely to diminish with the improvement of wearable technology.

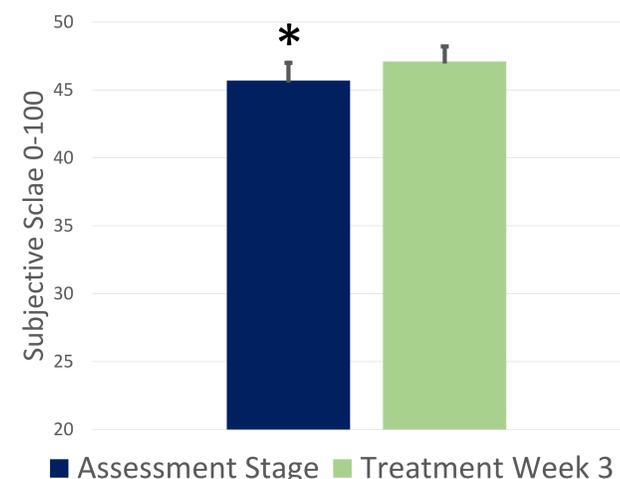
Subjective Sleep Latency



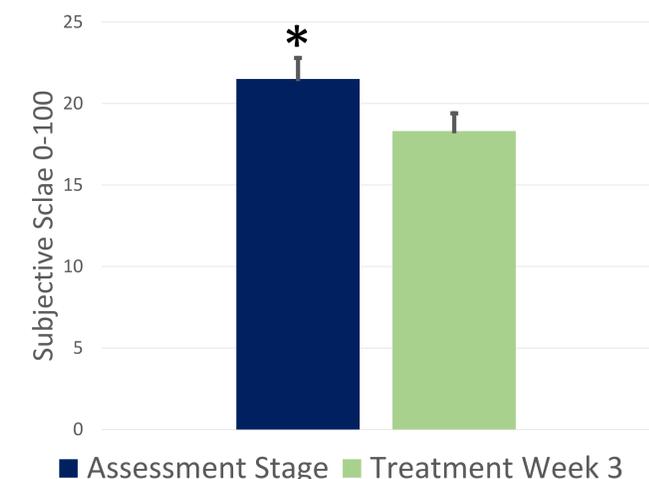
Objective WASO



Sleep Satisfaction



Daily Sleepiness



* $p < 0.05$