

Effects of a Workplace Sedentary Behavior Intervention on Sleep in Office Workers with Sleep Complaints: Results from the Stand and Move at Work Trial

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Introduction

Chronic sleep insufficiency has been associated with a variety of adverse health outcomes including hypertension, coronary artery disease, heart attack, stroke, immunodeficiency and obesity. A significant body of research has investigated the effects of physical activity on sleep, though the majority of these studies focus on the effects of moderate-to-vigorous exercise on subjectively-measured sleep. By objectively measuring both 24/7 activity levels, including postural change (standing vs. sitting) and light-intensity physical activity (LPA), and sleep quality and quantity intermittently over a 12-month period, our study aimed to provide new insight into the effects of daily sedentary habits on sleep health.

Research Question

Does increased standing and/or light-intensity physical activity at work improve sleep quality and/or duration in sedentary office workers with mild-to-moderate sleep complaints?

Materials and Methods

- Prospective two-arm group randomized trial of 37 adults with sedentary office jobs at worksites in Arizona and Minnesota (sub-study of the *Stand and Move at Work* trial, 2015-2018).
- MOVE+ intervention: a multi-level behavioral intervention targeting increases in LPA at the worksite.
- STAND+ intervention: the MOVE+ intervention with the addition of sit-stand workstations.
- Sleep was measured with wrist-worn actigraphy sensors (GeneActiv, Activinsight, Wimbolton, UK) for 7 consecutive days at baseline, 3 and 12-months.
- Standing and LPA were measured 24/7 for 7 consecutive days at these same timepoints using a thigh-worn actigraphy tracker (activPAL3, PAL Technologies, Glasgow, UK).

Results

51 participants enrolled and met exclusion/inclusion criteria, and 37 participants completed data collection at the 12-month timepoint and these results were analyzed. Baseline characteristics of the MOVE+ and STAND+ groups are presented in Table 1.

- The sit-stand workstation intervention was effective, with the STAND+ participants sitting on average 70 minutes/day less than the MOVE+ participants at 12 months. The STAND+ group decreased their daily sitting time at 12 months by 36.2 minutes compared to baseline ($p < 0.05$). The MOVE+ group increased their daily sitting time by 34.4 minutes sitting daily at 12 months ($p < 0.05$).
- There was no statistically significant difference in any of the objective or subjective sleep measures in either group at 3 or 12 months (Table 2).
- On an individual level, adjusting for group assignment, there was no statistically significant correlation between sitting time and objective or subjective sleep measures at 3 or 12 months (Figures 1 and 2).

	MOVE+	STAND+
Number	20	17
Age: mean \pm SD	40.7 \pm 10.0	46.5 \pm 13
Gender: M/F	5/15	2/15
Accelerometer-measured total sleep time (hours): mean \pm SD	6.07 \pm 0.8	5.47 \pm 1.3
Accelerometer-measured sleep efficiency (%): mean \pm SD	83.5 \pm 10.1	73.3 \pm 12.4
Hours/day spent sitting: mean \pm SD	10.0 \pm 1.5	10.3 \pm 1.5
Hours/day spent standing: mean \pm SD	4.3 \pm 1.2	4.0 \pm 1.3
Minutes/day spent in LPA: mean \pm SD	84.1 \pm 26.9	83.9 \pm 28.8

Table 1: Baseline characteristics, sleep measurements, and activity measurements of MOVE+ and STAND+ groups.

	MOVE+	STAND+	Effect estimate (95% CI; p-value)
Change in accelerometer-measured total sleep time (mins): mean (95% CI)	+20.4 (+3.0, +37.8)	+19.2 (+0.7, +37.7)	+1.2 (-25.9, +28.3; $p=0.93$)
Change in accelerometer-measured sleep efficiency (%): mean (95% CI, p-value)	+0.1% (-2.9%, 3.2%)	+0.2% (-3.0%, +3.5%)	-0.1% (-4.9%, +4.7%; $p=0.96$)
Change in mins/day spent sitting: mean (95% CI, p-value)	+34.3 (-9.7, +78.3)	-36.2 (-83.0, +10.6)	+70.5 (+1.6, +139.4; $p=0.045$)

Table 2: Change from baseline to 12 month timepoint. Effect estimate gives the difference in change between STAND+ and MOVE+, demonstrating the effect of the sit-stand workstation intervention.

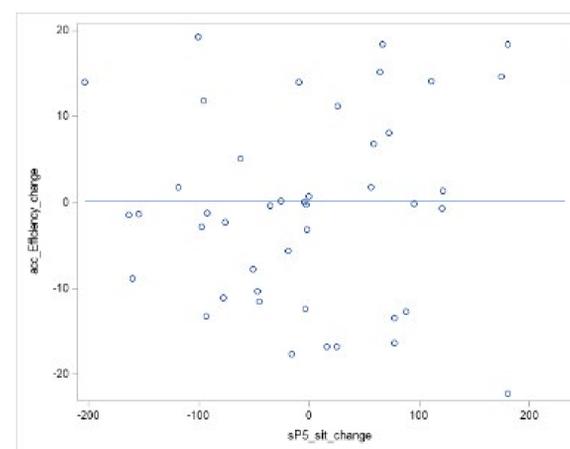


Figure 1: Individual change in accelerometer-measured sleep efficiency vs. change in sitting time at 12 months ($r=0.002$)

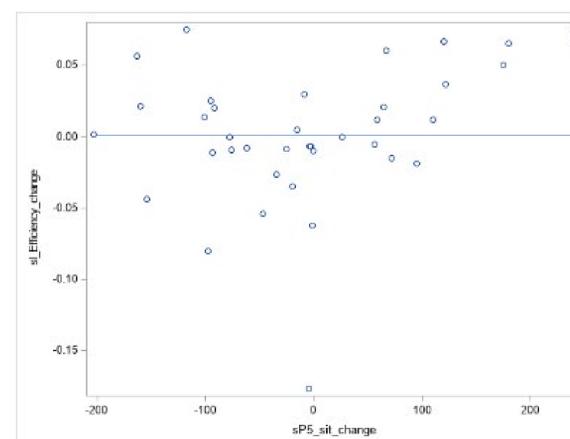


Figure 2: Individual change in sleep log-reported sleep efficiency vs. change in sitting time at 12 months ($r=0.00003$)

Conclusion

Our study was the first of its kind to examine the impact of sit-stand workstations on sleep quality and quantity, with objectively-measured physical activity and sleep over a 12 month intervention period. Unfortunately, we found no statistically significant improvement in sleep between the MOVE+ and STAND+ intervention arms, or on the individual level.

Our results are not surprising given that the nature of our intervention is rather low-dose (standing rather than intentional exercise). Limitations of this study include underpowering due to small sample size and potential significance of differences in baseline demographics and sleep/sedentary behavior between groups, as well as the fact that our participants were rather healthy sleepers to begin with. Given these limitations, it is possible that a small positive effect does exist but could not be detected. Future studies should include larger sample sizes and consider including participants with more significant sleep complaints.

Summary

- The sit-stand workstation (STAND+) intervention decreased sitting time by 70 minutes per day compared to the MOVE+ group
- No significant difference in any of the objective or subjective sleep measures was found in either group at 3 or 12 months
- There was no correlation on the individual level between sedentary time and sleep measures

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