

# How Somno-Art Software fills the gap between actimetry and polysomnography in accurately and efficiently characterizing sleep

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## AIM OF THE STUDY

Actimetry is widely used as an alternative to gold standard polysomnography (PSG) for assessing objectively sleep in large or long-term studies where PSG is not suitable or difficult to apply. However, actimetry doesn't allow to reach by no mean the level of sleep exploration achieved by PSG. For example it is not reliable especially for sleep latency and other key parameters necessary to allow an accurate and reliable interpretation of the data by sleep researchers or clinicians.

A lot of research efforts have been put, over the last decade, in coming up with algorithms aiming to achieve sleep architecture and continuity as close as PSG evaluation.

We here present the performances of the Somno-Art Software, a sleep scoring algorithm based on wrist movement and cardiac activity, in comparison to actimetry and PSG in healthy and pathological subjects.

## METHODS

Eighteen nights from 12 healthy subjects, 14 nights from 14 insomniac, 33 from 33 depressed and 15 from 15 obstructive sleep apnea (OSA) patients, all free of drug, were analyzed.

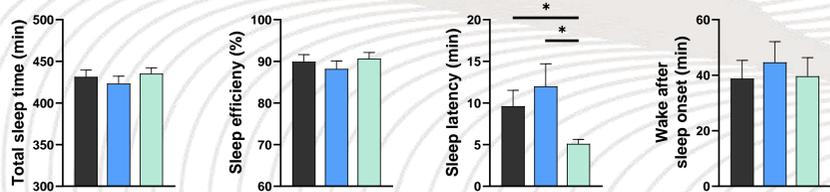
- **PSG** was recorded and scored by experts following the AASM guidelines.
- **Somno-Art Software** was used to assess sleep parameters from synchronized heart rate and wrist activity.
- **Wrist activity** was measured with ActiGraph LLC and analyzed with Actilife Software.

Pairwise intra-class correlation (ICC) was used to determine the agreement between the devices (PSG vs Somno-Art Software; PSG vs actimetry; Somno-Art Software vs actimetry) on the overall group and the subgroups.

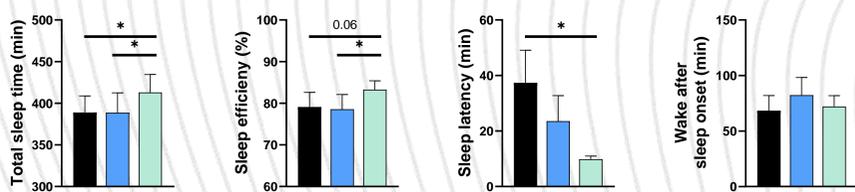
Mixed-model analysis were performed for each sub-group. Statistical significance was set at  $p < 0.05$ .

## RESULTS

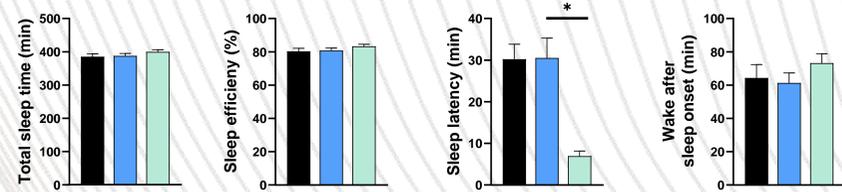
### Healthy control (n nights= 18)



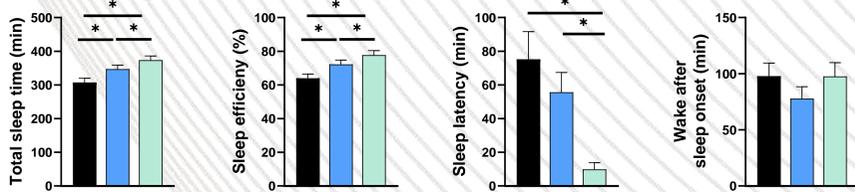
### Obstructive sleep apnea (n nights= 15)



### Major depressive disorder (n nights= 33)



### Insomniacs (n nights= 14)



■ Polysomnography ■ Somno-Art Software ■ Actimetry

### Total sleep time (TST) and sleep efficiency (SE)

- In **healthy controls**: TST and SE had excellent ICC with Somno-Art Software and actimetry compared to PSG.
- In **OSA and depressive patients**: TST and SE had good or excellent ICC with Somno-Art Software and actimetry. Unlike Somno-Art Software, actimetry overestimated mean TST and SE in OSA patients (Figure 1).
- In **insomniac patients**: Somno-Art Software's estimation of TST and SE was in-between PSG and actimetry.

### Sleep latency (SL)

- For all study populations, actimetry systematically underestimated SL, while Somno-Art Software was consistent to PSG.

### Wake after sleep onset (WASO)

- Somno-Art Software and actimetry correctly estimated mean WASO and agreement between the devices was excellent or good for all study populations, except insomnia patients with poor agreement between PSG and Somno-Art Software or actimetry.

Agreement between PSG and Somno-Art Software for **light sleep (N1+N2), N3 sleep and REM sleep** was respectively fair, good and excellent for the overall study group.

Figure 1: Sleep parameters assessed with polysomnography, Somno-Art Software and actimetry. \*  $p \leq 0.05$

	n	Total Sleep Time			Sleep Efficiency			Sleep Latency			Wake After Sleep Onset			Light Sleep	N3 sleep	REM sleep
		PSG-SA	PSG-Act	SA-Act	PSG-SA	PSG-Act	SA-Act	PSG-SA	PSG-Act	SA-Act	PSG-SA	PSG-Act	SA-Act	PSG-SA	PSG-SA	PSG-SA
All	80	0,86	0,77	0,91	0,84	0,73	0,88	0,70	0,10	0,12	0,81	0,68	0,80	0,54	0,73	0,76
Healthy	18	0,81	0,82	0,88	0,81	0,82	0,89	0,74	0,32	0,12	0,79	0,82	0,93	0,77	0,73	0,61
OSA	15	0,93	0,87	0,94	0,89	0,81	0,86	0,72	0,12	0,30	0,90	0,83	0,81	0,86	0,61	0,87
Depression	33	0,76	0,63	0,86	0,75	0,63	0,86	0,63	0,04	0,10	0,82	0,63	0,74	0,56	0,19	0,54
Insomnia	14	0,52	0,32	0,76	0,53	0,32	0,77	0,47	0,02	-0,03	0,29	-0,32	0,65	0,63	0,26	0,64

Tableau 1: Intra-class correlation coefficient between Polysomnography (PSG), Somno-Art Software (SA) and Actimetry (Act) for the all dataset and separated for each sub-group (healthy and patients suffering from obstructive sleep apnea (OSA), major depressive disorder (MDD) or insomnia).

According to the cut off of Cicchetti et al: **poor ICC**: 0-0,39 / **fair ICC**: 0,4-0,59 / **good ICC**: 0,6-0,74 / **excellent ICC**: 0,75-1

## CONCLUSION

Overall, Somno-Art Software is more consistent than actimetry in characterizing sleep structure of healthy and pathological subjects. Furthermore, Somno-Art Software discriminates sleep stages closely to PSG. These results place Somno-Art Software as a valuable alternative to PSG to accurately assess key sleep parameters with minimum constraints.