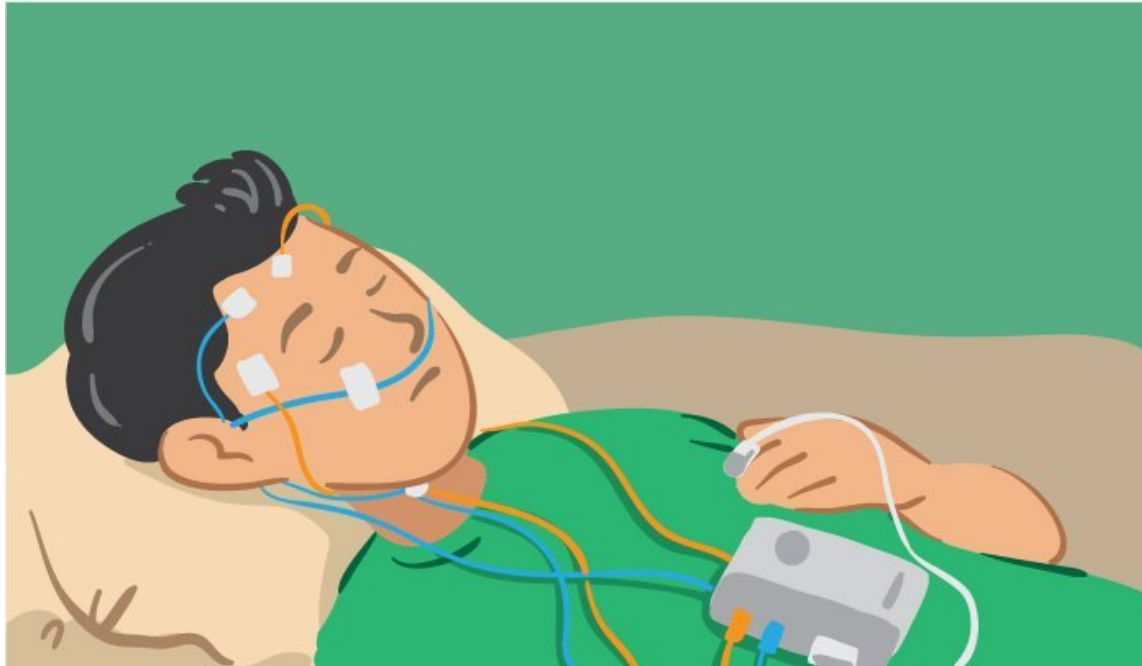


Sleep Time Series

**Annah Moore, Sharon Varghese, Leema
Krishna Murali, Wendy Zhai**

**Novartis – Academia Hackathon 2019
Cambridge, August 23rd, 2019**

WHY A SLEEP STUDY IS NECESSARY



1. Polysomnography, also called a sleep study, is a test done at a sleep center used to diagnose sleep disorders.
2. It records brain waves, the oxygen level in your blood, heart rate and breathing, as well as eye and leg movements
3. Helps adjust treatment plans, if diagnosed with a sleep disorder

We had access to longitudinal sleep data



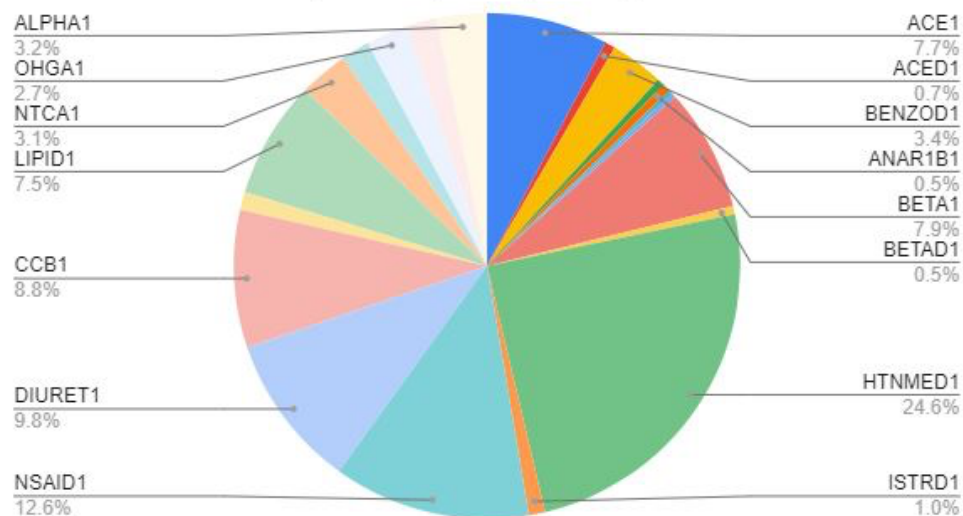
Visit 1 – 5,804 participants aged ≥ 40 (1995-1998)

Visit 2 – 4,080 participants (Jan 2001 – Jun 2003)

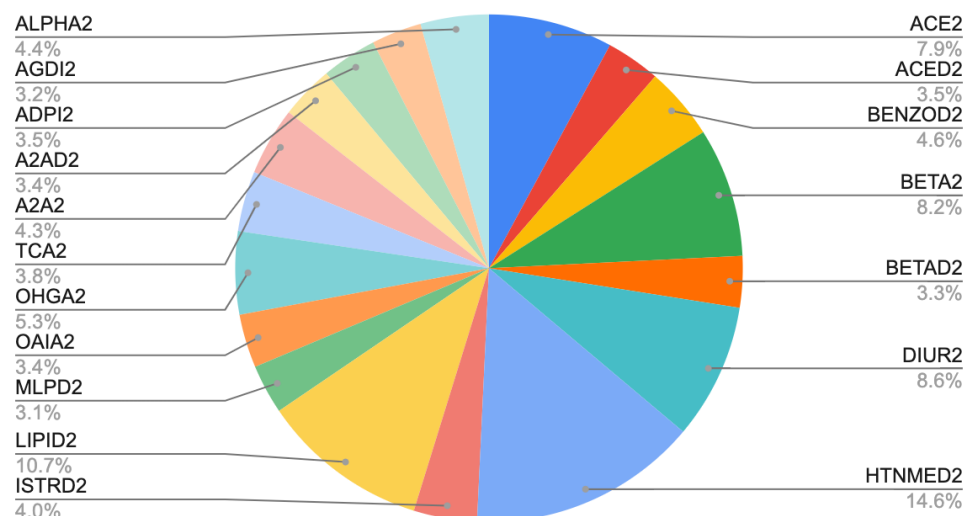
CVD Outcomes data were monitored and adjudicated by parent cohorts between baseline and 2011.

The majority of participants were on anti-hypertensive medication at timepoints 1 and 2

Medications taken by Participants (Visit 1)



Medications taken by participants (Visit 2)



Are any sleep parameters at timepoint 1 associated with acetylcholinesterase inhibitor treatment at time point 2?



Clinical Cornerstone
Volume 6, Issue 1, Supplement A, 2004, Pages S16-S28



Sleep disorders in Alzheimer's disease and other dementias

Donald L Bliwise PhD

REVIEW ARTICLE

Front. Pharmacol., 20 June 2019 | <https://doi.org/10.3389/fphar.2019.00695>

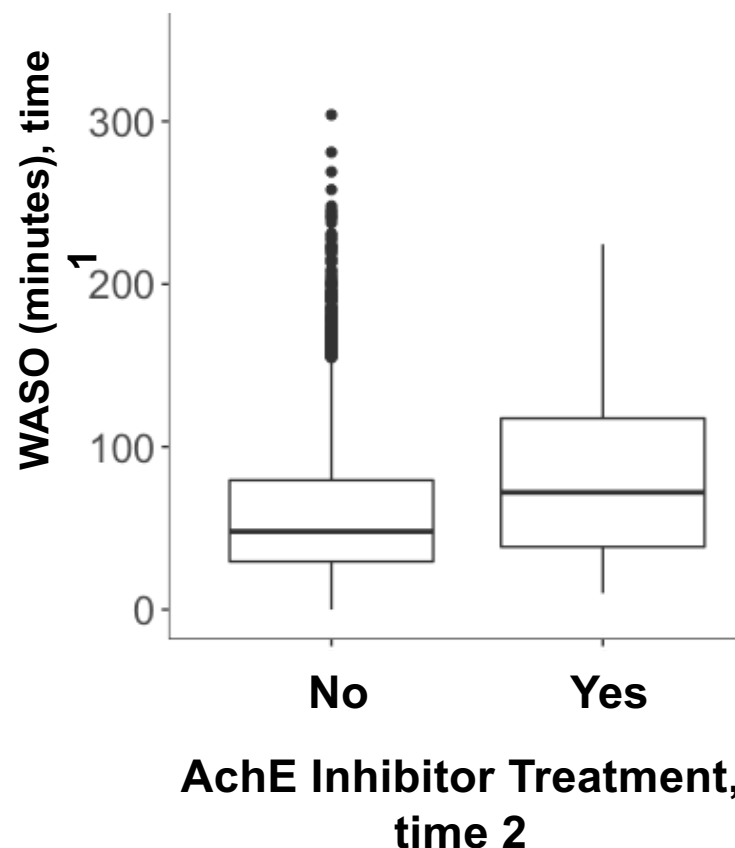


Sleep and β -Amyloid Deposition in Alzheimer Disease: Insights on Mechanisms and Possible Innovative Treatments

 Susanna Cordone¹,  Ludovica Annarumma¹,  Paolo Maria Rossini^{2,3} and  Luigi De Gennaro^{1*}

Increased wakefulness after sleep onset (WASO) is associated with acetylcholinesterase inhibitor treatment

Parameter	Beta	SE	DF	P	P.fdr
WASO	1.1E-04	3.8E-05	3618	0.0035	0.035
% time, S1	8.8E-04	3.8E-04	3530	0.02	0.11
Sleep time	-4.2E-05	2.9E-05	2484	0.15	0.50
% time<90% O2	-1.6E-04	1.7E-04	3613	0.34	0.85
Sleep efficiency	-6.9E-05	2.0E-04	2131	0.73	0.87
% time<75% O2	-3.1E-04	1.4E-03	3613	0.82	0.87
% time<80% O2	-2.7E-04	9.2E-04	3613	0.77	0.87
% time<95% O2	-2.3E-04	5.5E-04	3613	0.67	0.87
Sleep latency	-1.5E-05	9.0E-05	2131	0.87	0.87
% time, S2	5.5E-05	1.3E-04	3530	0.66	0.87



This effect did not differ by gender, or based on medications taken at time 1.

What available data can we use to predict risk for hypertension?

Hypertension Accelerates Alzheimer's Disease-Related Pathologies in Pigs and 3xTg Mice

Yao-Hsiang Shih¹, Shih-Ying Wu¹, Megan Yu², Sheng-Huai Huang³, Chu-Wan Lee⁴, Meei-Jyh Jiang^{1,3}, Pao-Yen Lin⁵, Ting-Ting Yang⁶ and Yu-Min Kuo^{1,3*}

Hypertension and Alzheimer Disease

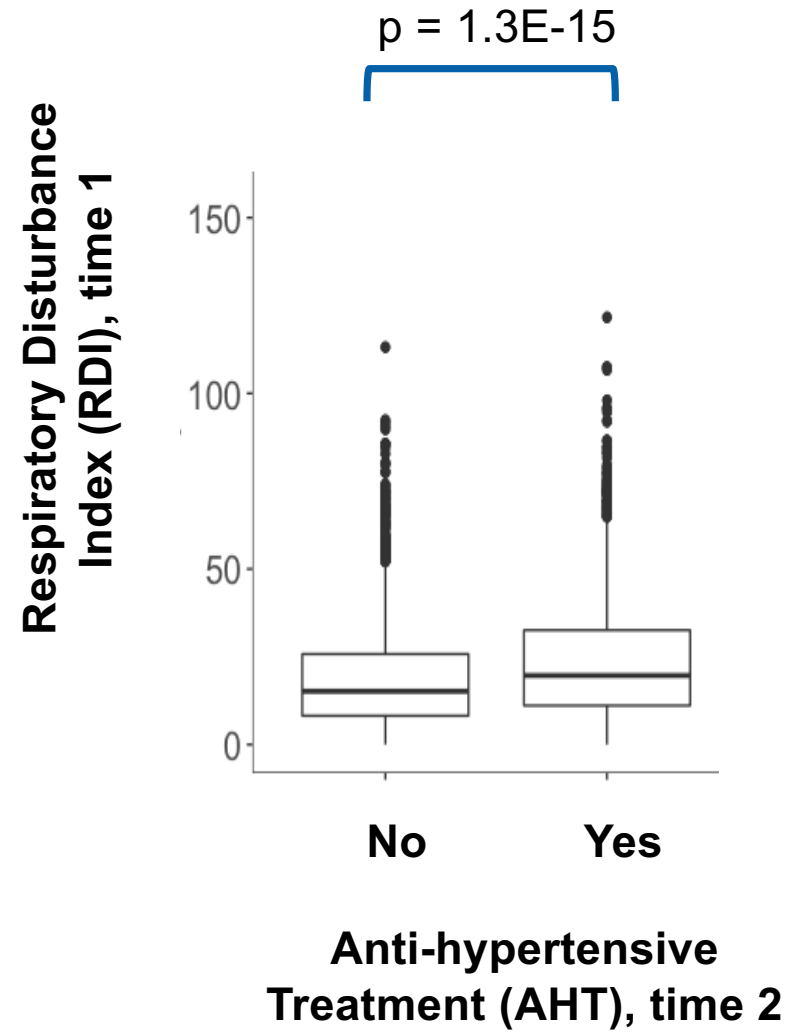
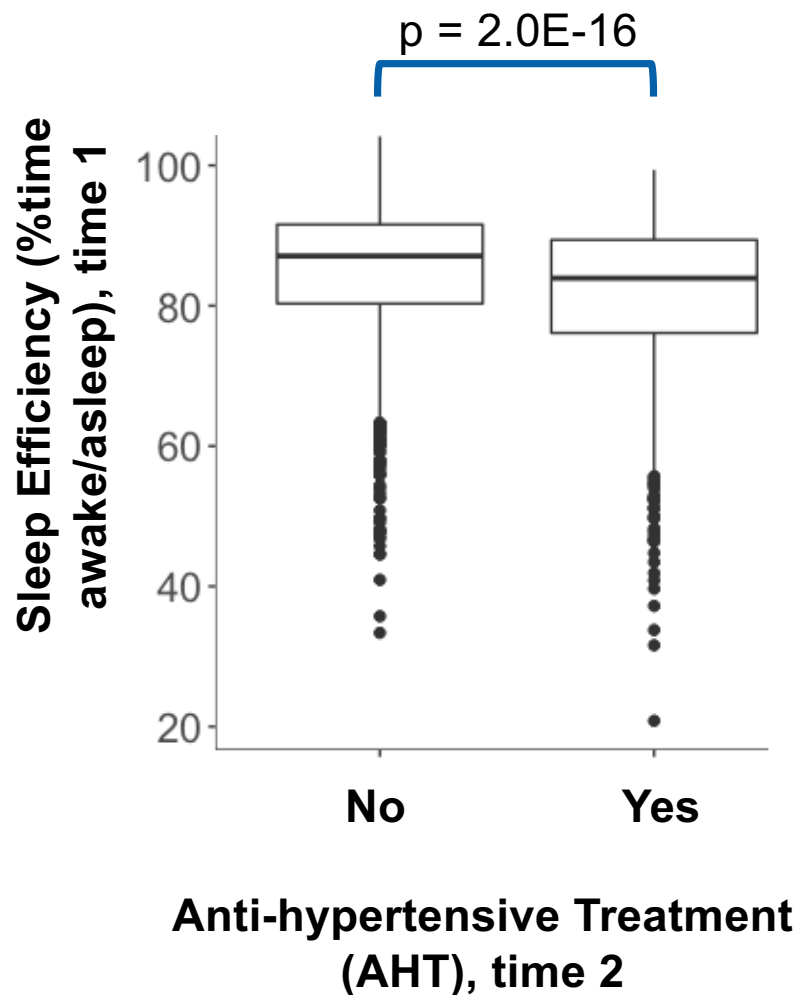
Another Brick in the Wall of Awareness

Eric Thorin 

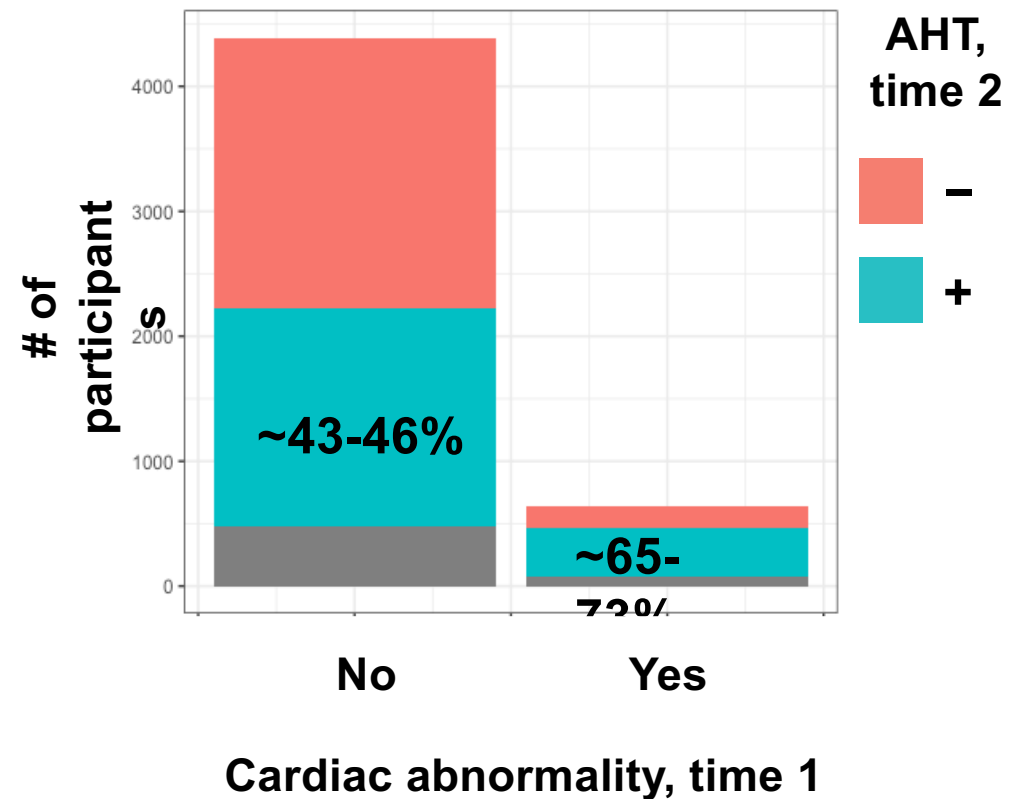
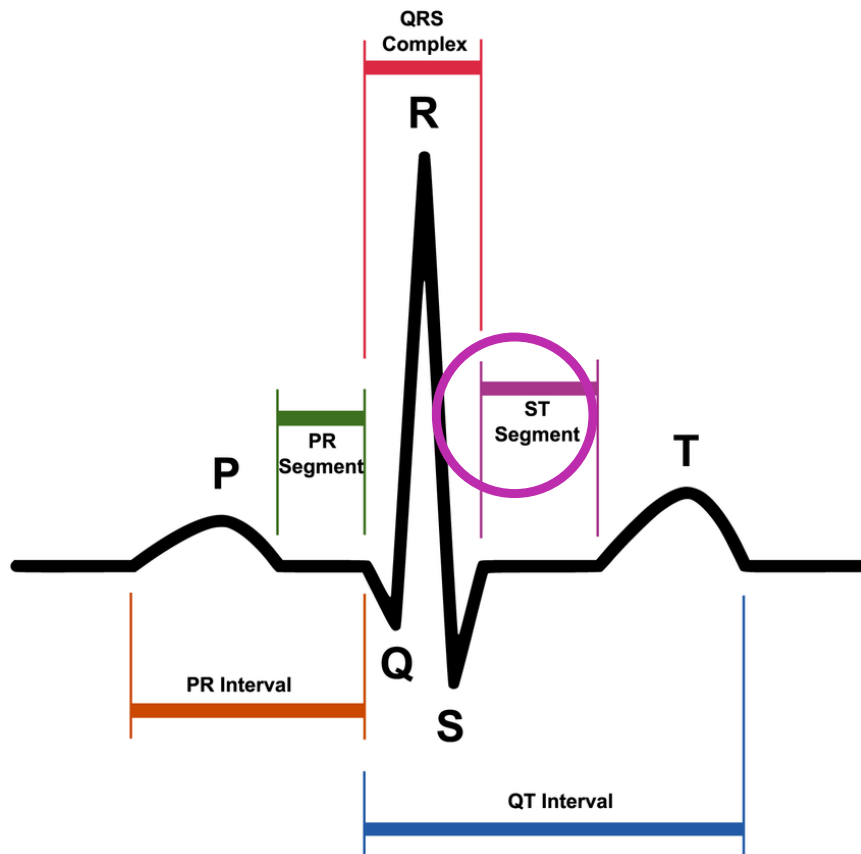
Originally published 20 Oct 2014 |

<https://doi.org/10.1161/HYPERTENSIONAHA.114.04257> | Hypertension. 2015;65:36–38

Sleep and respiratory phenotypes are predictors of anti-hypertensive treatment



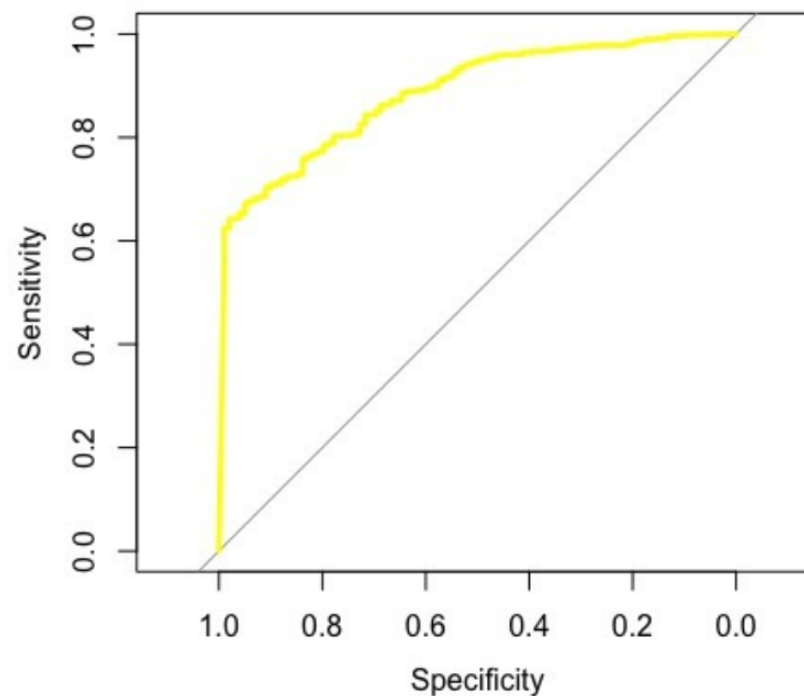
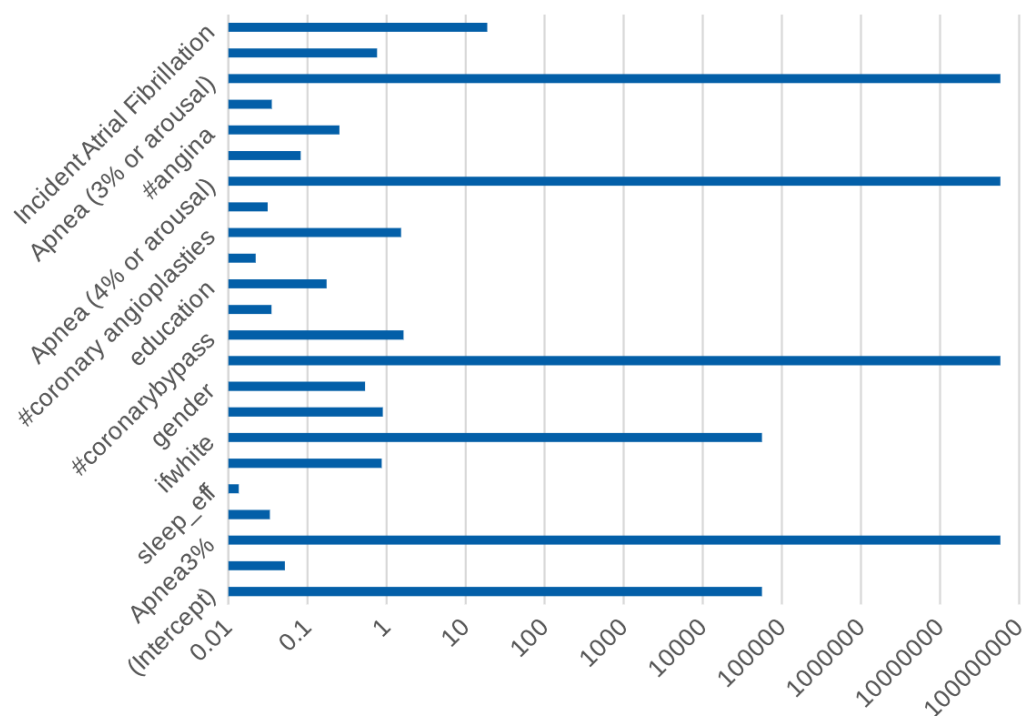
Sleep, respiratory and cardiac phenotypes predict anti-hypertensive treatment, in addition to cardiac abnormalities



Elgendi, M. et al. *PLoS One*. 2014.

Can we predict patient vital status 5 years in advance?

log-scale abs estimates



AUC = 0.896

Conclusions

- The majority of participants were on anti-hypertensive medication at timepoints 1 and 2
- Increased wakefulness after sleep onset (WASO) is associated with acetylcholinesterase inhibitor treatment
- Sleep and respiratory phenotypes are predictors of anti-hypertensive treatment

Limitations and future directions

- Sparsity in data - Associations between heart rate variability and sleep phenotypes
- Future follow-up studies should optimize data collection for the most biologically relevant measurements
- Spectral analysis of EEG data to understand the effect of various medications on sleep transitions

OPEN  ACCESS Freely available online



Obstructive Sleep Apnea Alters Sleep Stage Transition Dynamics

Matt T. Bianchi^{1*}, Sydney S. Cash¹, Joseph Mietus², Chung-Kang Peng², Robert Thomas³

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