Multivariate associations of sleep quality, depressive symptoms, and grey matter volume with motor performance in young and old adults

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[1]Department of Nuclear Medicine, Faculty of Medicine and University Hospital Cologne, University of Cologne, Cologne, Germany; [2]Institute of Neuroscience and Medicine (INM-7: Brain and Behaviour), Research Centre Jülich, Jülich, Germany; [3]Institute of Systems Neuroscience, Heinrich Heine University Düsseldorf, Düsseldorf, Germany; [4]Institute of Neuroscience and Medicine (INM-2: Molecular Organization of the Brain), Research Centre Jülich, Jülich, Germany; [5]German Center for Neurodegenerative Diseases (DZNE), Bonn-Cologne, Germany

INTRODUCTION

- Lower motor performance (e.g. grip strength) is linked to sleep disturbances and depressive symptoms, but the underlying neurobiological mechanisms are unclear

- Impairments in all three domains, co-occur in neurodegenerative diseases like Parkinson's and Alzheimer's

- Sleep pattern, depressive symptoms, and motor performance change with age

How are sleep quality, depressive symptoms and grey matter volume (GMV) related to motor performance in young and old adults in the general population?

METHOD

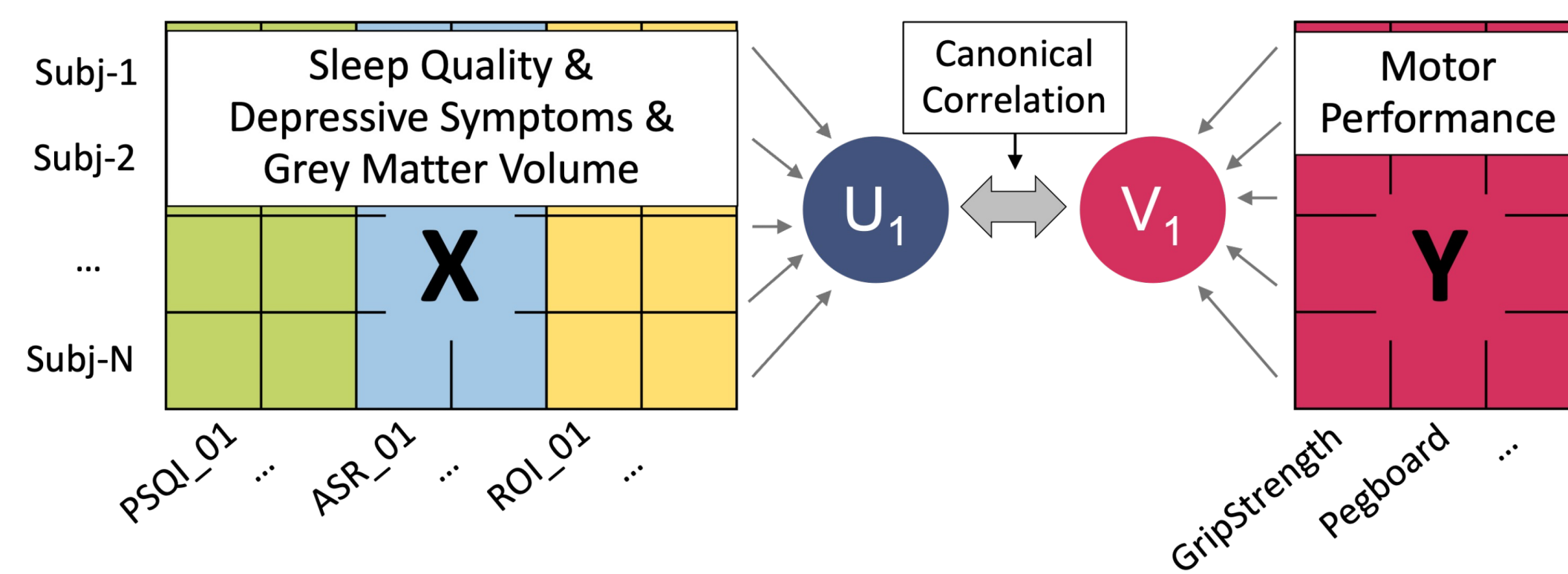**Three datasets[1,2,3] divided in younger and older adults**

Young adults:
- HCP Young (22-37 years; N=1086, 587f.)
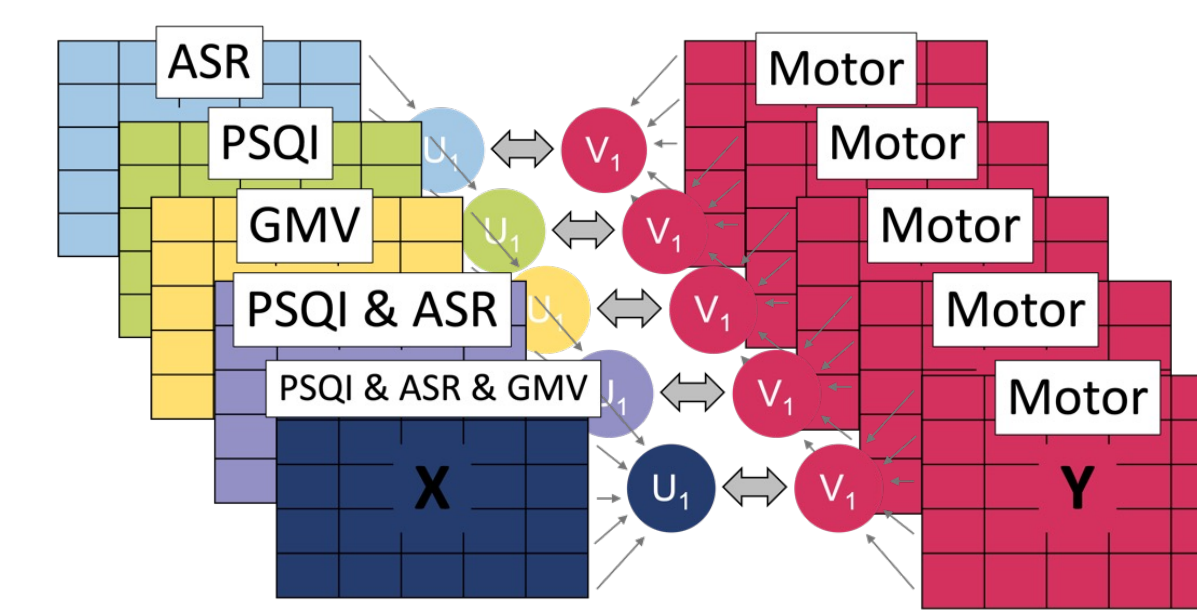- eNKI young (18-40 years; N=230, 128f.)

Older-aged adults:
- HCP Aging (50-85 years; N=354, 198f.)
- eNKI old (50-85 years; N= 280, 199f.)

Analysis: Regularized Canonical Correlation Analysis (rCCA)[4]

5 feature (X) spaces

Machine learning framework: Hold-out validation

Outer split (100 repeats) Test generalisability

20 % Holdout-set

Inner split (50 rep.) Hyperparameter tuning

64 % Training-set

16 % Test-set

Sleep disturbances, depressive symptoms, grey matter volume (X)
- Pittsburgh Sleep Quality Index (PSQI)
- Adult Self Report (ASR)
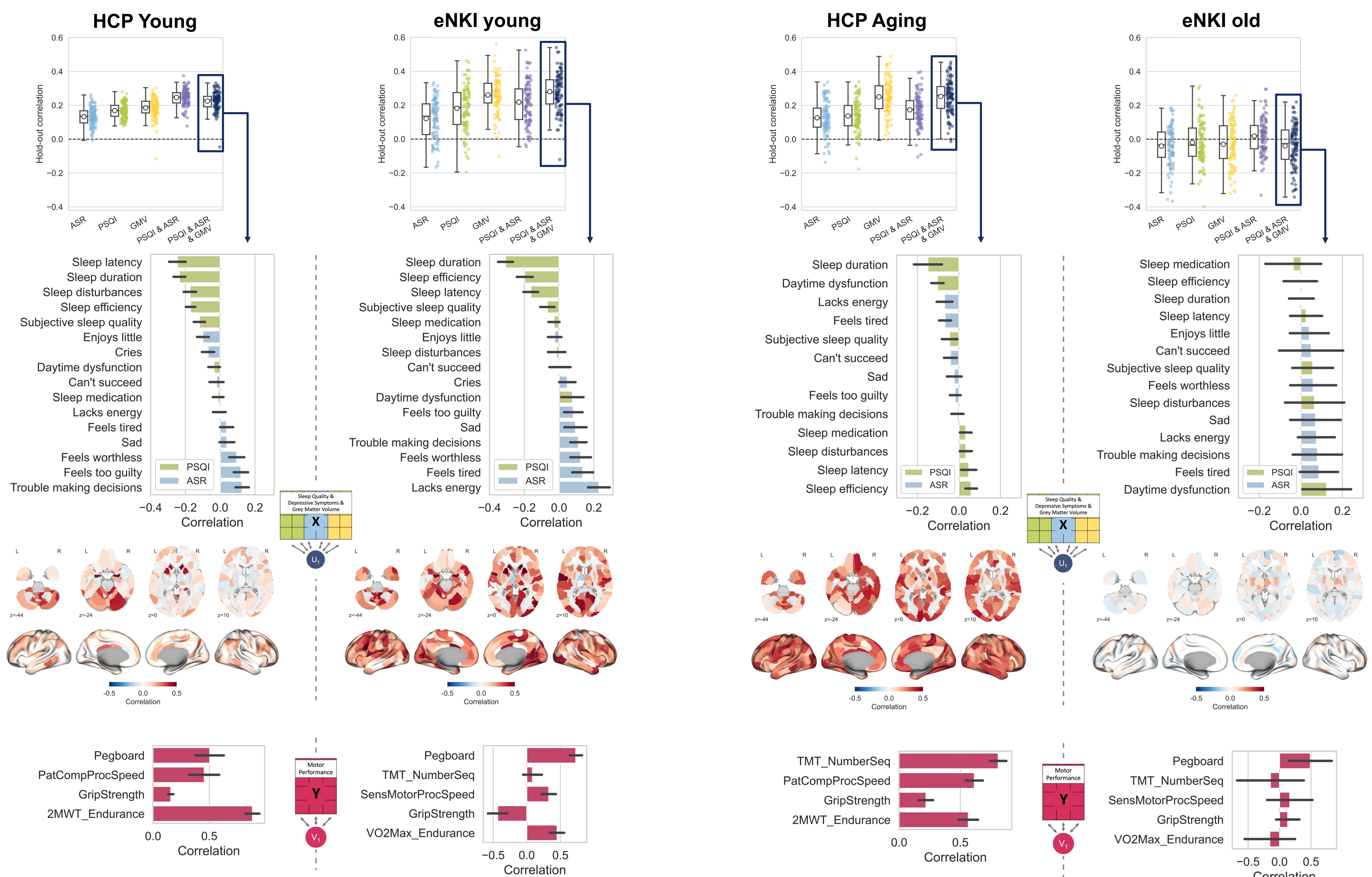- GMV: 262 regions (Schaefer 200, Tian S2, SUIT atlases)

Motor performance (Y)
Grip strength (Strength); 2-Minute Walk test/ Bike test (Endurance), Pegboard (Dexterity); Trail Making Test Number Seq./ Pattern Comparison/ Mouse Practice Task (Processing Speed)

Confounds: Age, Age-squared, Sex, Total Intracranial Volume

RESULT

CONCLUSION

- Better sleep quality and higher depressive symptoms associated with higher motor performance (endurance, dexterity, processing speed) in younger adults
- Consistent association observed in both HCP Young and eNKI young

- In older adults, motor component reflected primarily motor speed, secondarily endurance, and stronger association with GMV variability (HCP Aging dataset)
- In HCP Aging, better sleep quality (mainly sleep duration) and fewer depressive symptoms associated

with higher motor performance (motor speed, endurance)
- Associations not replicated in eNKI dataset for older adults

REFERENCES

[1] Nooner et al., Frontiers in neuroscience, 2012. [2] Van Essen et al., Neuroimage, 2013 [3] Bookheimer et al., NeuroImage, 2019, [4] Mihalik et al., Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 2022.

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