

Cardiorespiratory Fitness and Its Associations with Brain Structure and Incident Dementia

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Cardiorespiratory fitness (CRF)

- Efficiency in oxygen delivery to muscle
- Influences persistency of exercise on a certain intensity
- Dependent to behaviors of physical activity, also affected by diet, sleep, and other factors
- Can be objectively measured/estimated

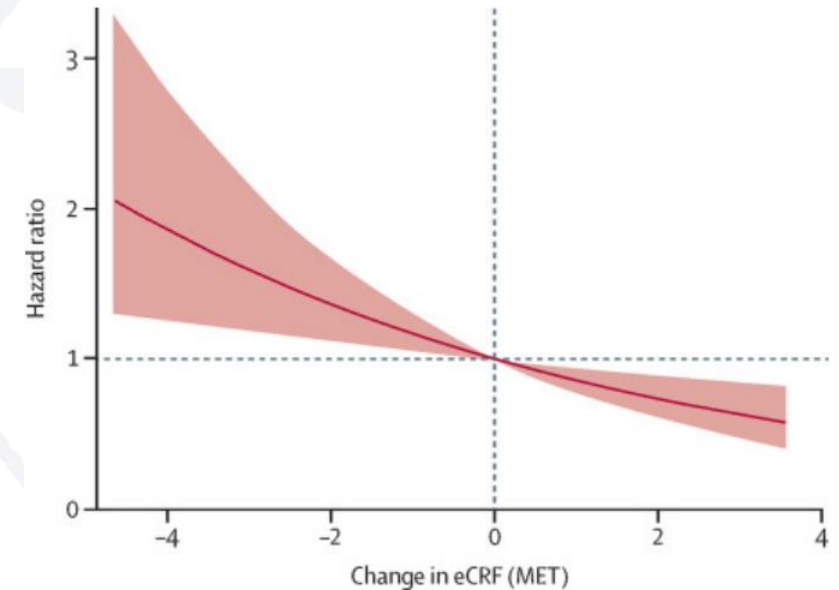


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CRF and DEMENTIA

- 10 mil new dementia cases each year
- A better predictor for incident dementia?
- CRF and AD, Vascular dementia, and other types of dementia
- Can we find direct evidence from the brain which links CRF with cognition?



Tari et al. (2019) *Lancet Public Health*

METHODS



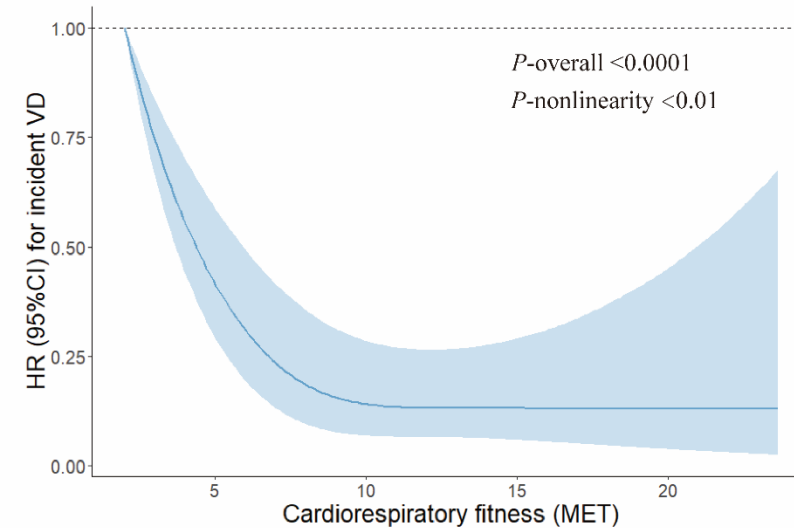
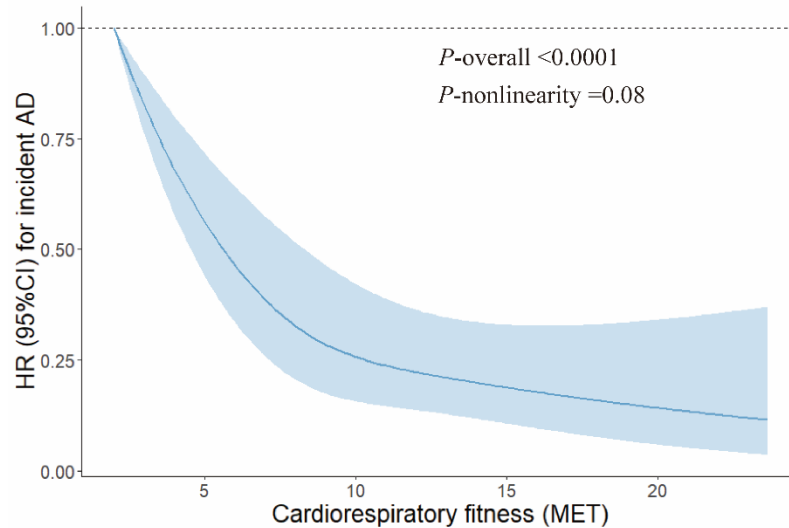
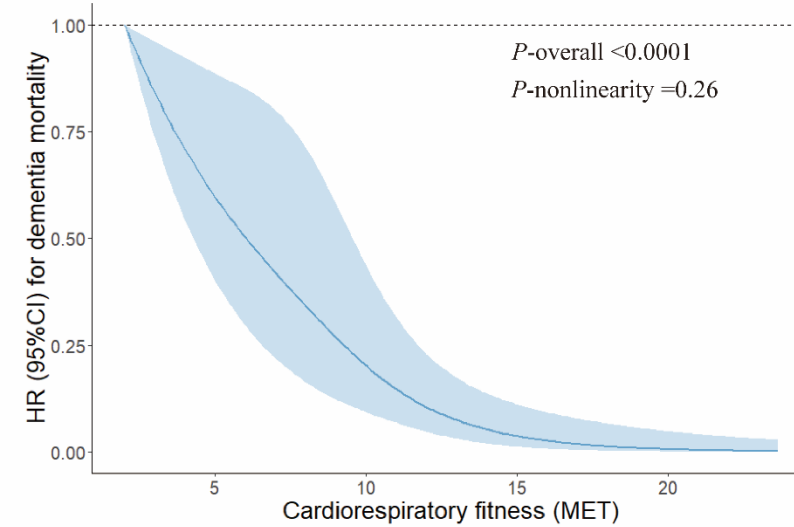
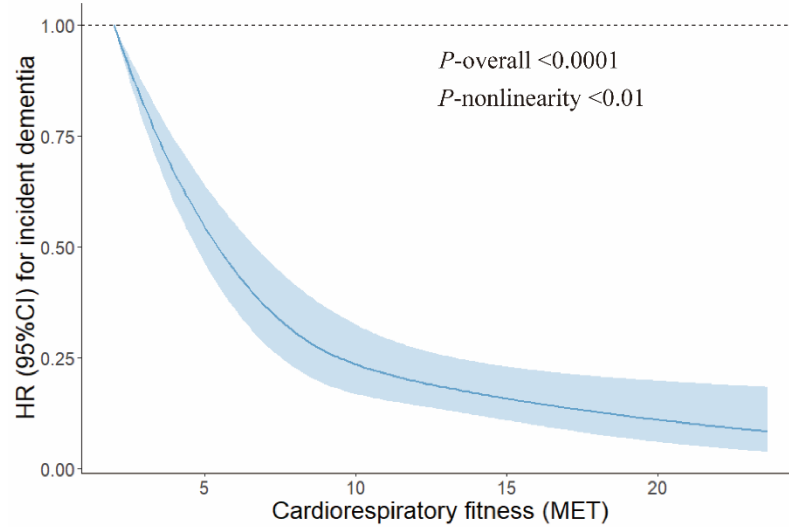
- UK Biobank (cohort data)
- 73,460 participants free from dementia, from 89,319 individuals underwent CRF test
- Bicycle ergometer for VO₂max (in METs)



- Incident dementia and subtypes
- Cognitive performance
- MRI brain image
- Genotype for dementia polygenic risk score

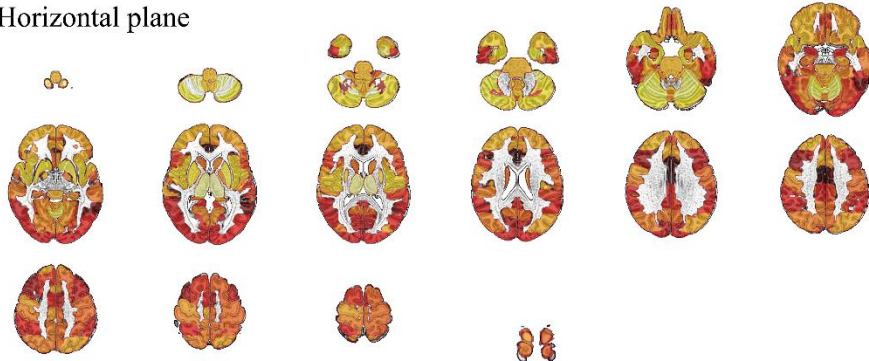


CRF and incident dementia

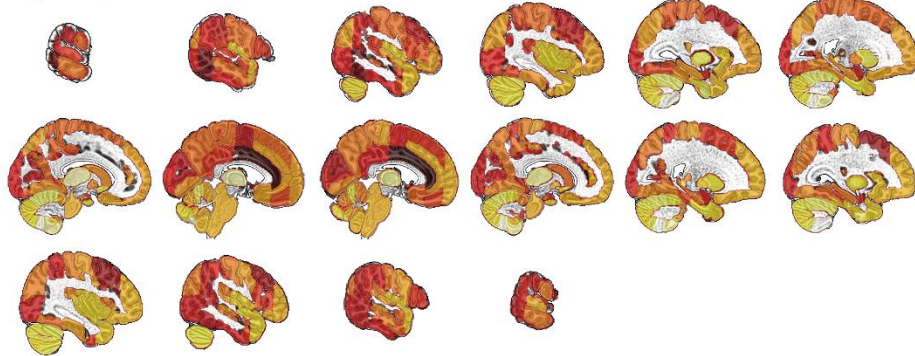


CRF and neuroimaging outcomes

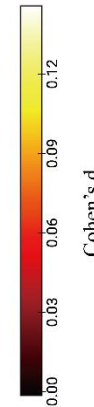
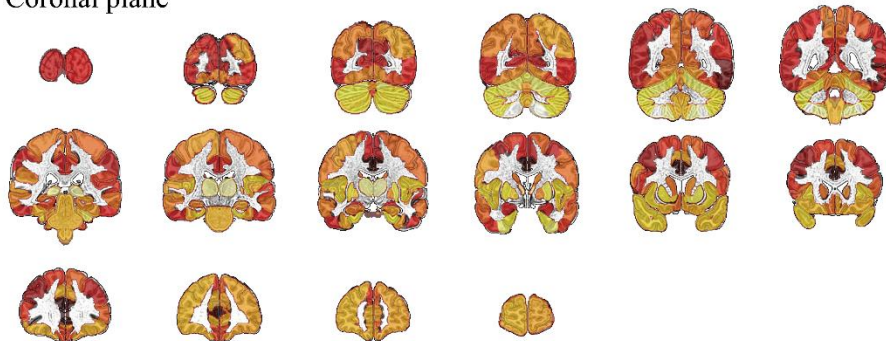
Horizontal plane



Sagittal plane



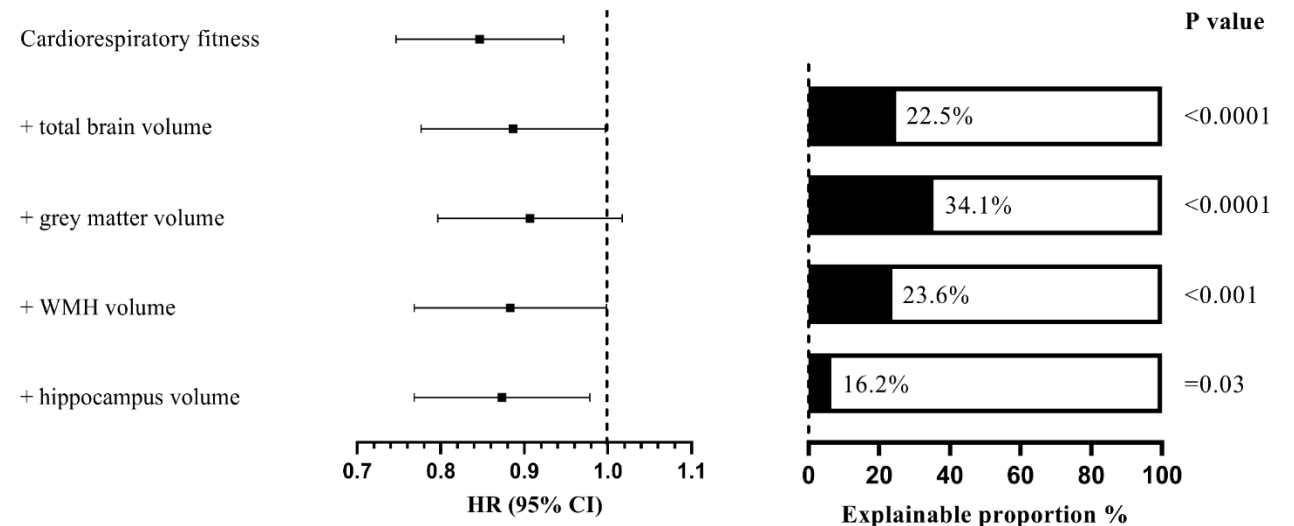
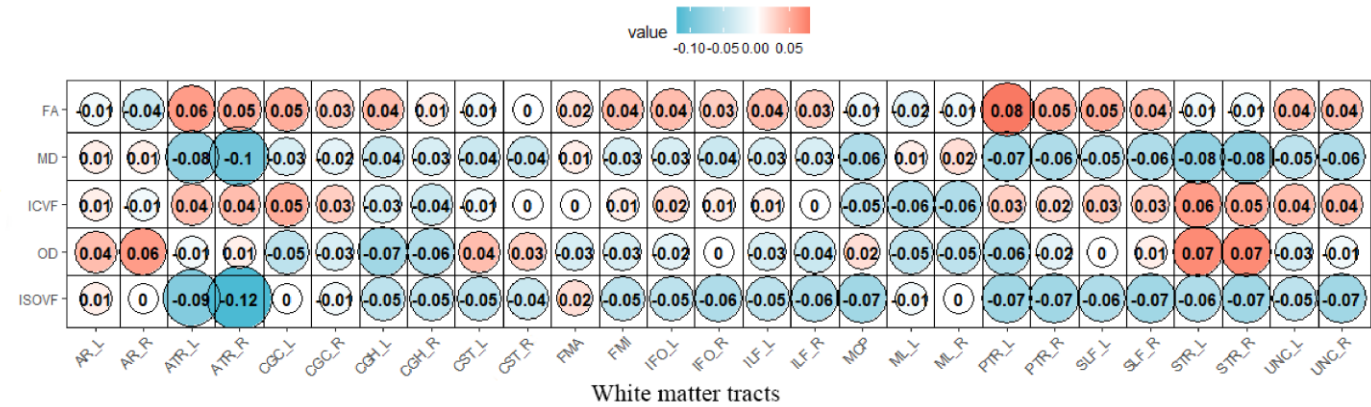
Coronal plane



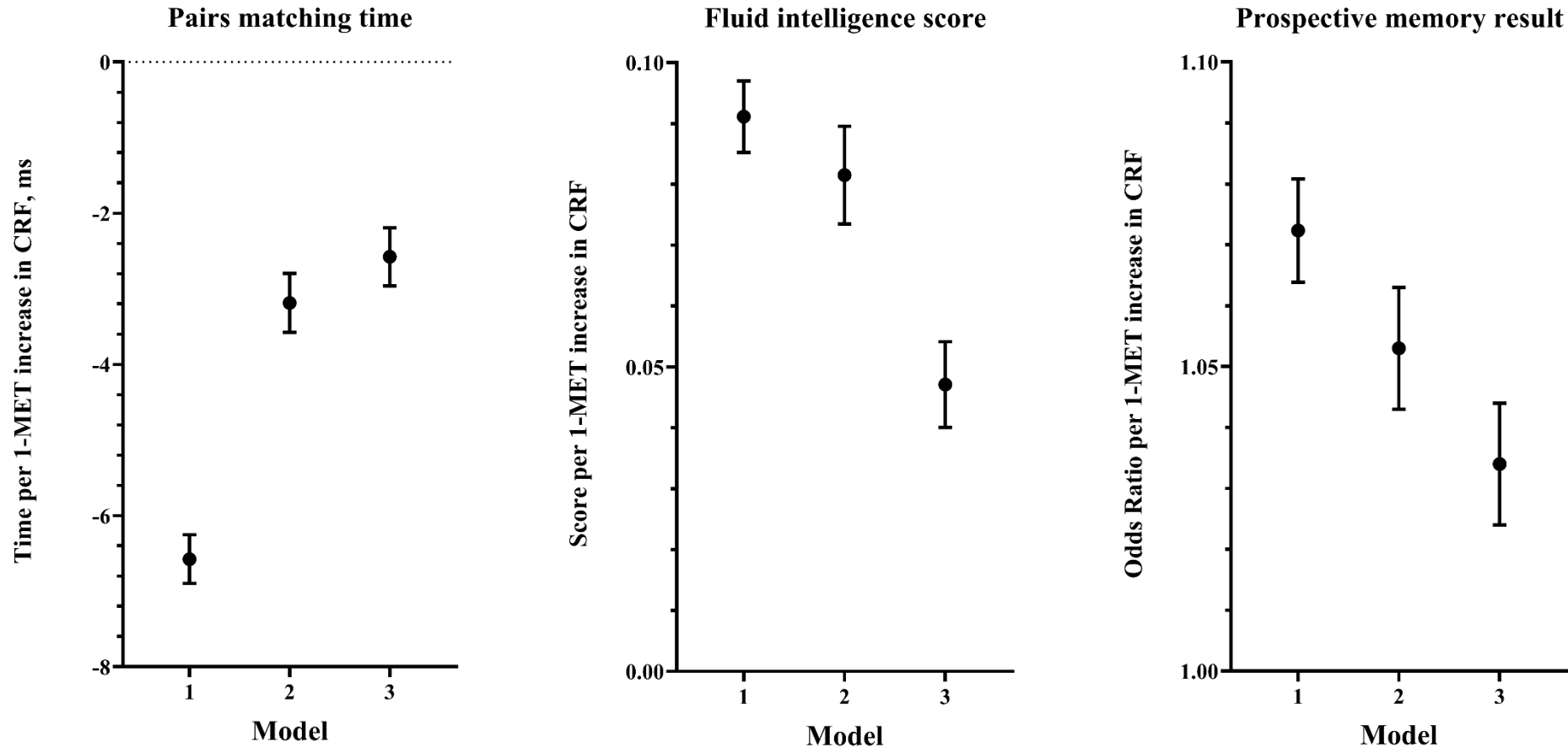
- Correlations between CRF and grey matter volumes in different regions of brain
- Temporal fusiform cortex ($d = 0.123$, $P_{FDR} = 1.71E-31$, left; $d = 0.119$, $P_{FDR} = 8.09E-31$, right)
- Parahippocampal gyrus ($d = 0.110$, $P_{FDR} = 1.83E-26$, left; $d = 0.107$, $P_{FDR} = 5.96E-26$, right)

CRF and neuroimaging outcomes

- Negative correlation between CRF and white matter hyperintensity
- CRF and anterior/posterior thalamic radiation,
- Substantial mediating effects of brain structure on the relationship between CRF and all-cause dementia



CRF and cognitive performance



Model 1 was crude model, model 2 was adjusted for age, sex, and BMI, and model 3 was additionally adjusted for smoking status, drinking status, healthy diet score, living alone, visiting friends, educational level, Townsend deprivation index, physical activity, hypertension, diabetes, cardiovascular disease, family history of dementia, dementia-PRS (dementia incidence and mortality analysis), AD-PRS (AD incidence analysis) first 10 principal components of ancestry (except for vascular dementia analysis), and genotype measurement batch (except for vascular dementia analysis).

Take home message & acknowledgement

- A good cardiorespiratory fitness help reducing the risk of dementia
- Significance of regular exercise
- Important brain regions connecting CRF with pathogenesis of AD



More about ZJU SLEEP LAB



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Jiahe Wei (Master student, Zhejiang University)



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