The association between sleep quality and epigenetic aging acceleration with metabolic syndrome in Korean adults

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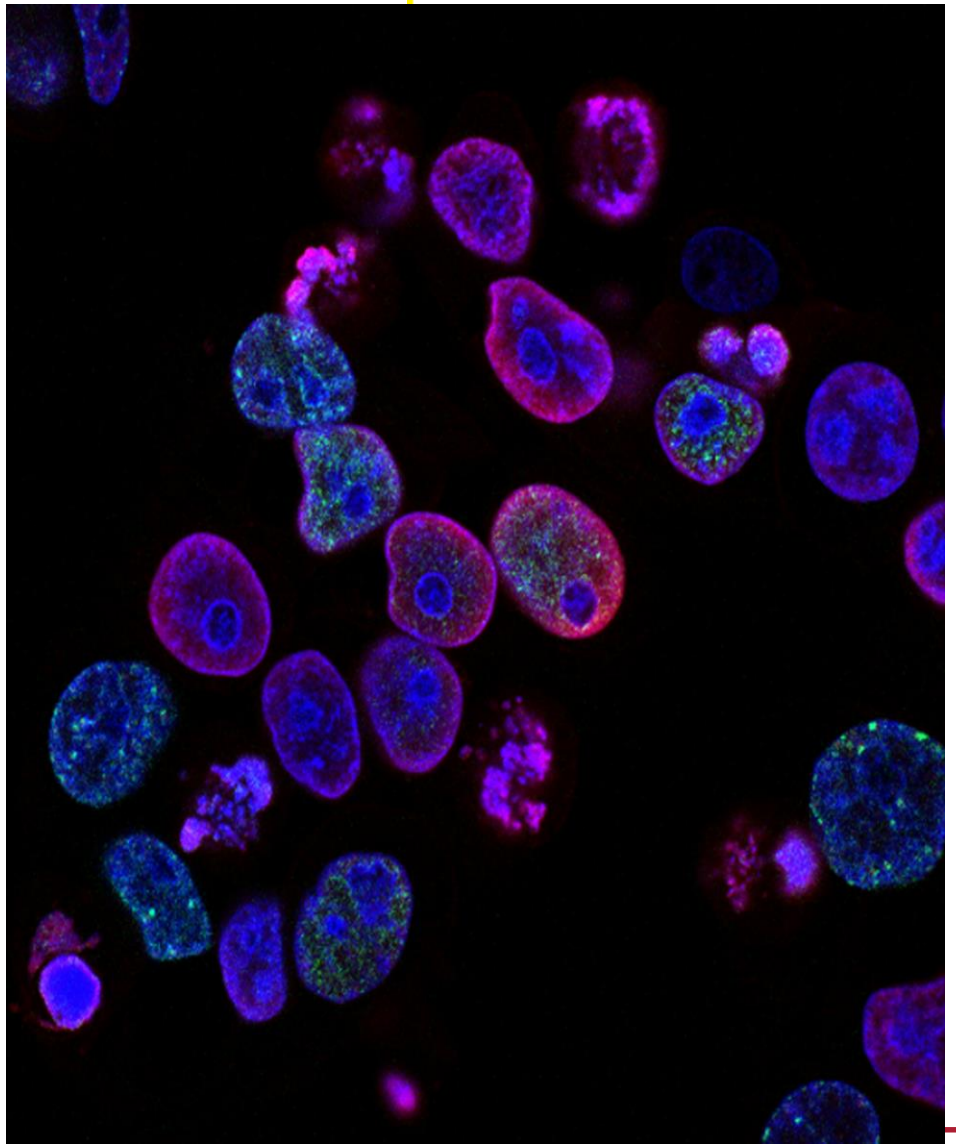

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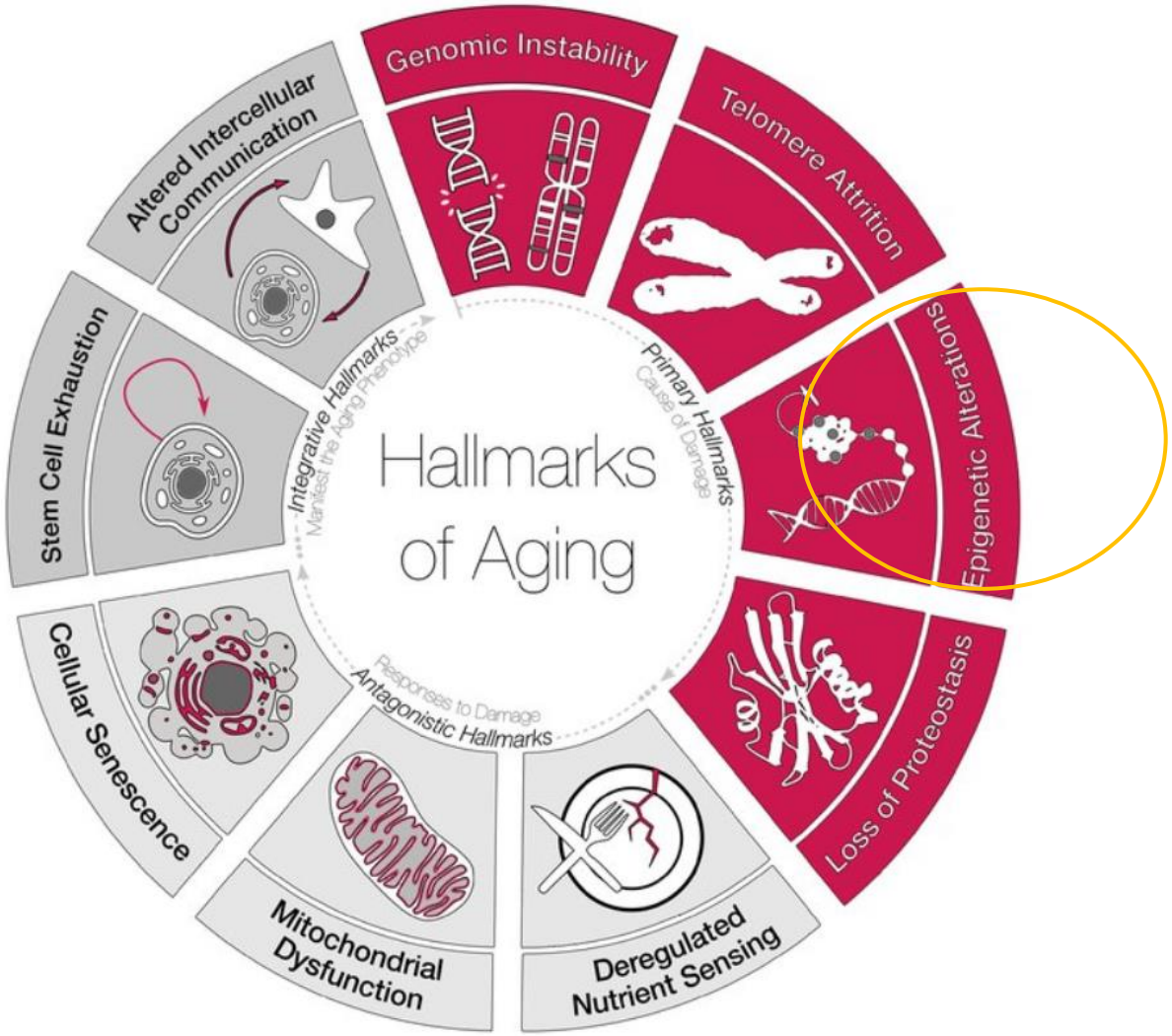
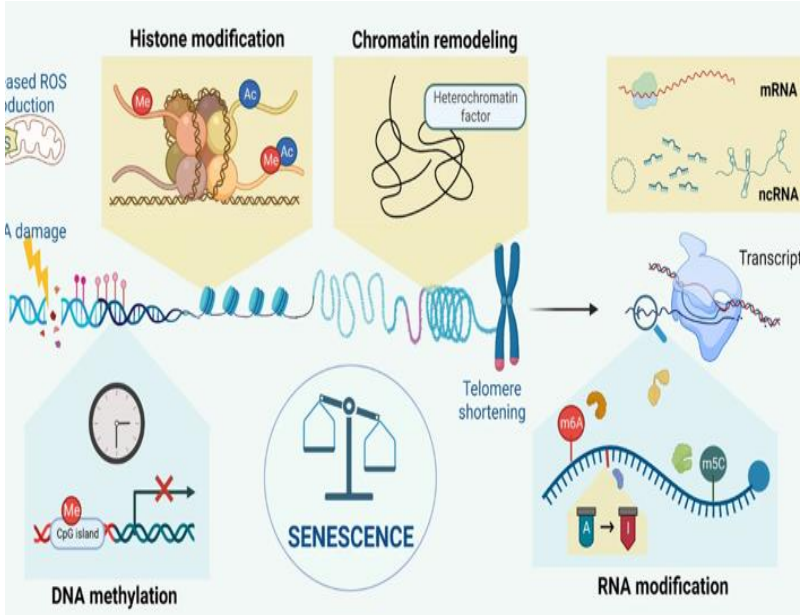
The nine hallmarks of **aging**



DNA methylation
Histone modification
Chromatin remodeling
Non-coding RNA



Lopez-Otin C et al, ***Cell*** 2013 , Aleksandar Vujin et al, **Health Science Inquiry**, 2020

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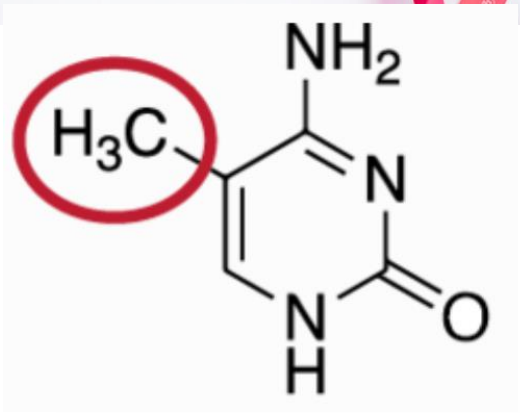
Epigenetic age (epigenetic clock)

- Based on cytosine methylation
- Significant attention in the field of ageing research
- Understanding and calculation of human biological age
- Risk prediction of mortality, cancer, coronary heart disease, etc.



cytosine

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Chronology of Epigenetic Clocks

2013

51 tissues/cells, 353 CpGs from 8000 individuals, 0.97 correlation w/ CA, all-cause mortality

Horvath's clock

Hannum's clock

2013

71 CpG sites in whole blood of 656 individuals, 0.96 correlation w/ CA, all cause mortality

Weidner's clock

2014

2018

513 CpGs in WB, tissue dependent, 0.68, 0.74 correlation w/ CA, mortality risk, cancer, Alzheimer

PhenoAge by Levine

GrimAge by Lu

2019

1030 CpGs in plasma proteins, predict lifespan (time-to-death), healthspan (time-to-disease), T2D

2022

Epigenetic rate of aging with 173 CpGs, in WB, 19 biomarkers, 4 time point, healthoutcome, longevity

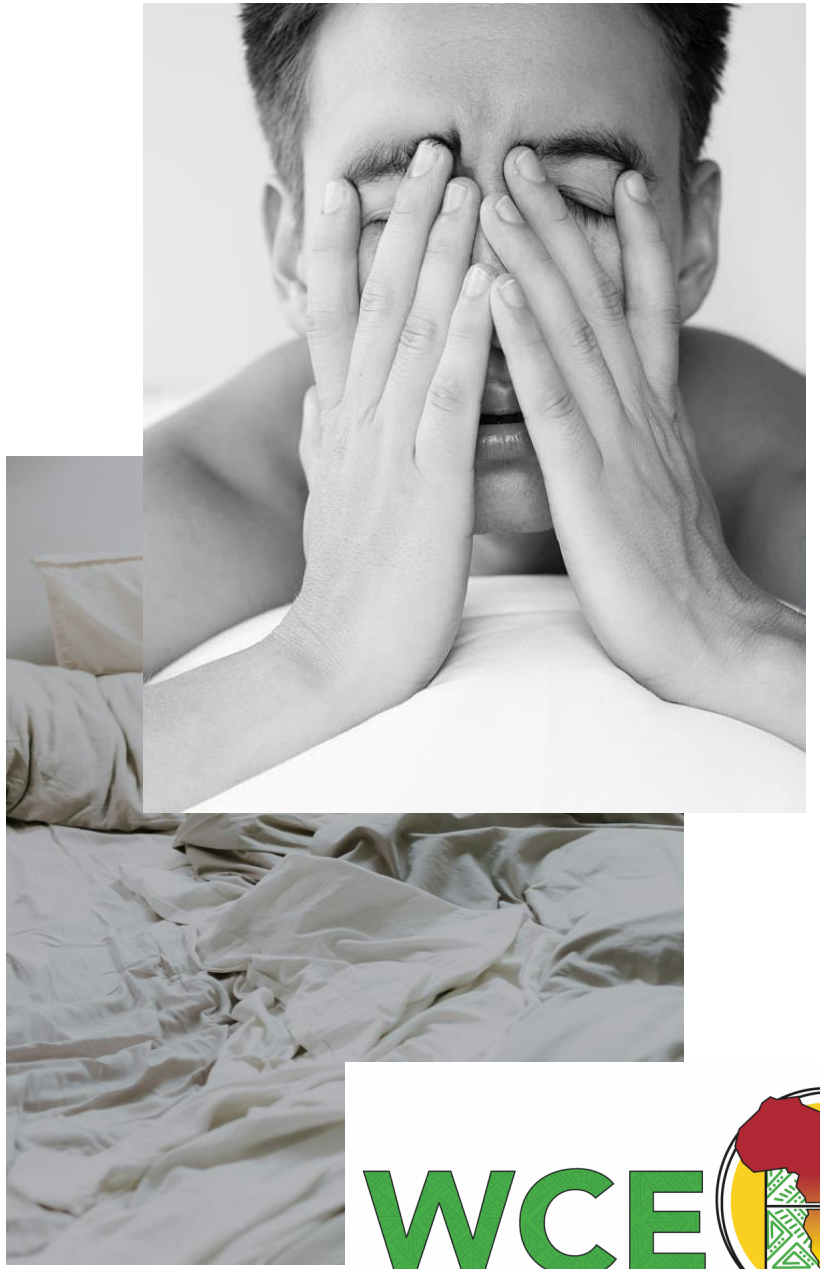
DunedinPACE

DNAmTL

2020.

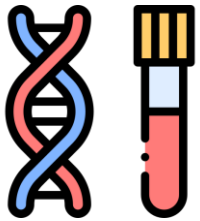
As we age, the sleep quality changes

1. Degeneration of the hypothalamus
2. Lower level of melatonin, growth hormone
3. Age-related change in sleep pattern
4. Frequent night time bathroom trip
5. Poor sleep quality is linked to health problems such as depression, dementia, chronic pain, obesity, diabetes and heart disease



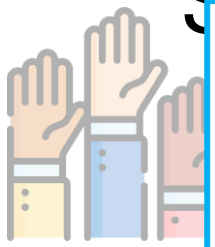
To investigate whether epigenetic ages can be candidate markers for sleep quality

Epigenetic ages



Whole blood
Illumina EPIC array (850k)
4 epigenetic ages (Horvath, Hannum, Pheno, GrimAge) and DunedinPACE
ChAMP, BMIQ, GLINT, Combat using R

Study Participants



1. Subjective sleep quality
2. Sleep latency
3. Sleep duration
4. Sleep disturbance
5. Sleep efficiency
6. Use of sleep medication
7. Daytime dysfunction

Metabolic Syndrome 33 %

Sleep Quality

Pittsburgh Sleep Quality Index (PSQI-7 domains)

36% (n=251)
Poor sleep quality
(PSQI > 5)

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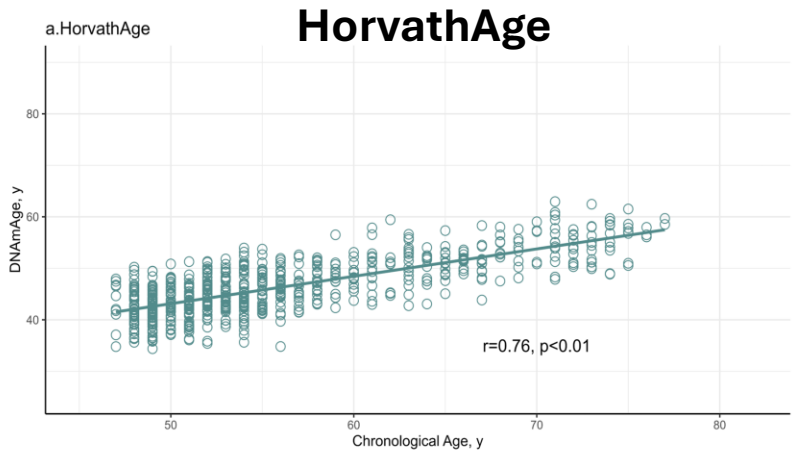
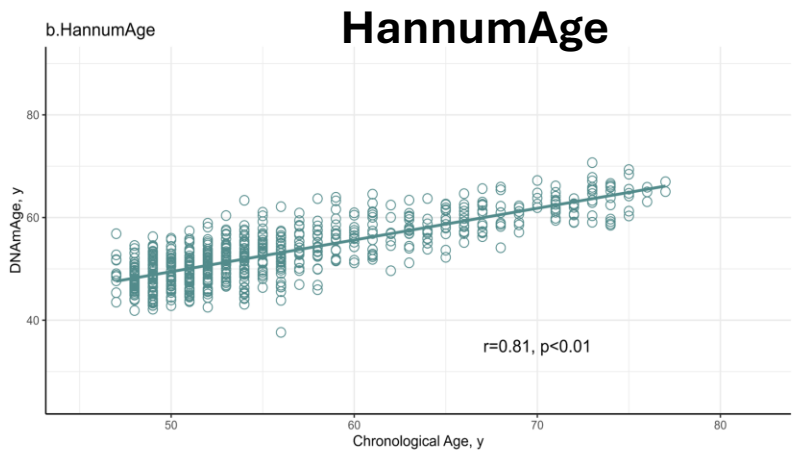
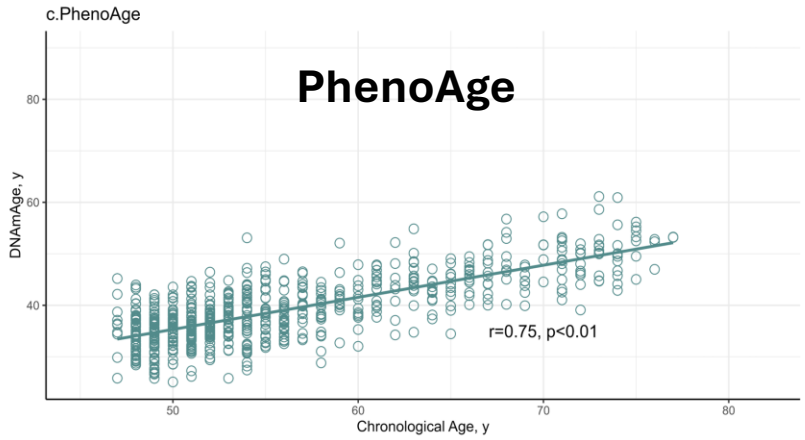
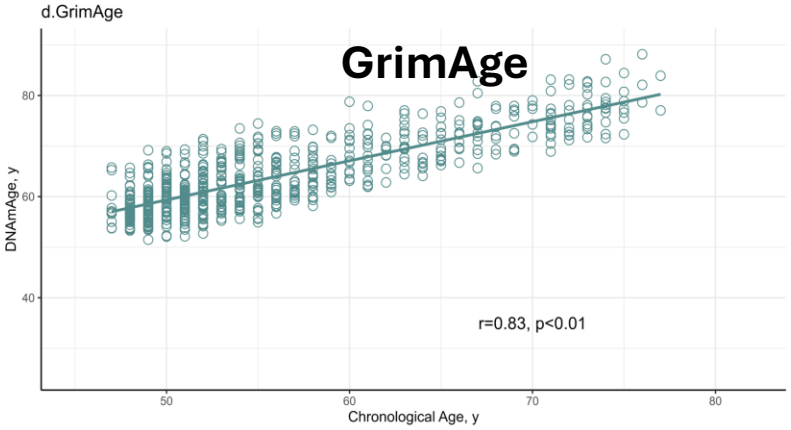
Association between EA and CA









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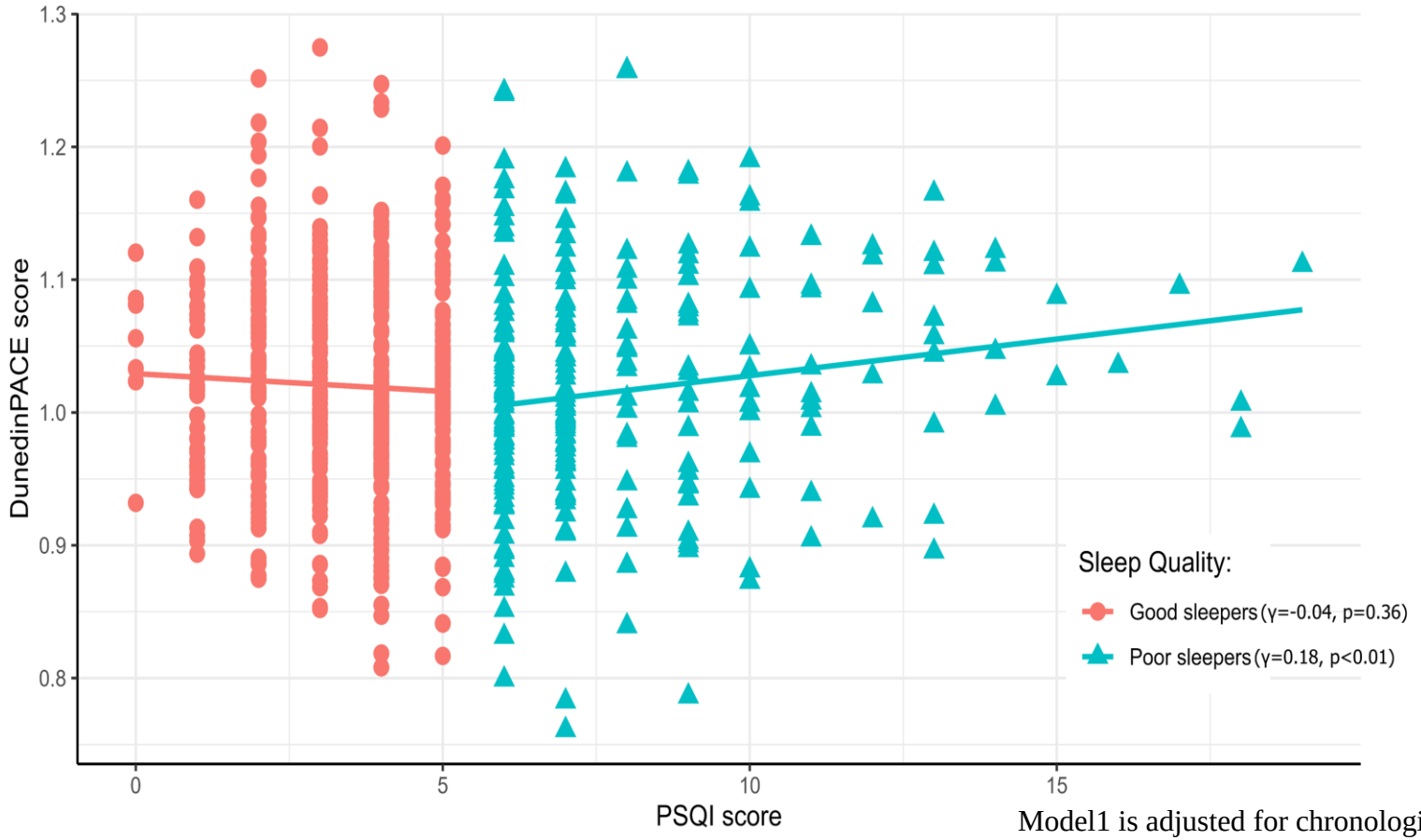
Association between EAA and PSQI between sleepers

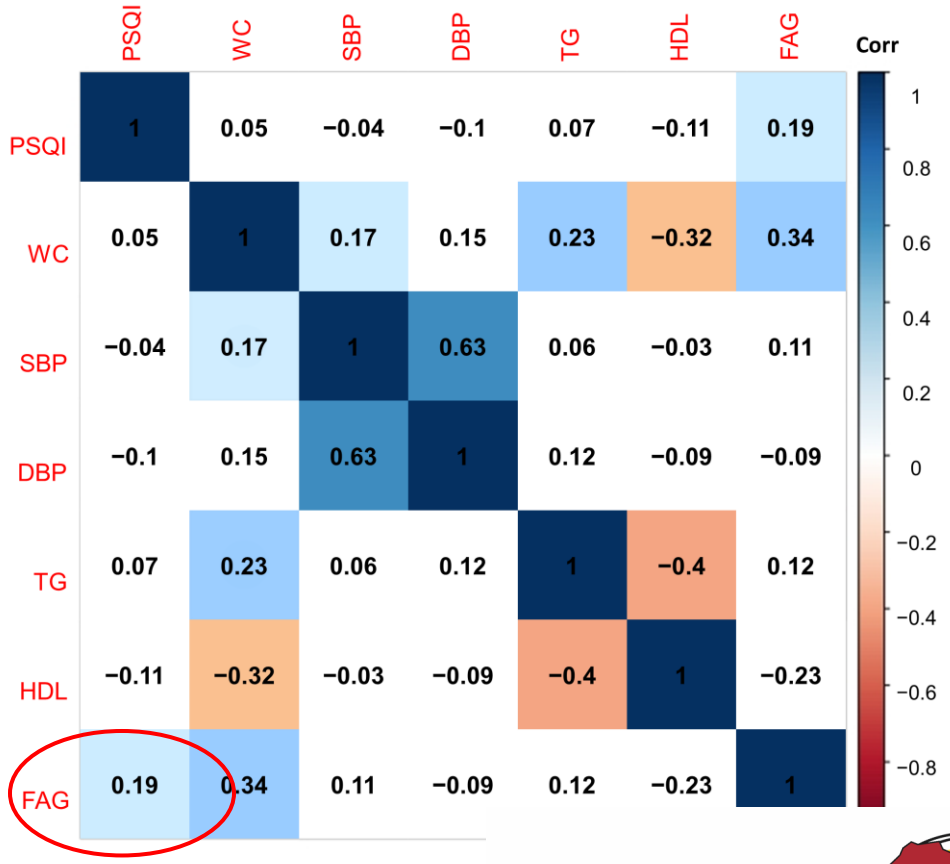
Age Accelator	G
Model 1	
HorvathAgeAccel	-0
HannumAgeAccl	-0
GrimAgeAccel	0
PhenoAgeAccel	0
DunedinPACE	-0
Model 2	
HorvathAgeAccel	0
HannumAgeAccl	-0
GrimAgeAccel	0
PhenoAgeAccel	0
DunedinPACE	-0.001	0.003	0.960	0.004	0.002	3.63



Model1 is adjusted for chronological age and sex.
Model 2 includes chronological age, sex, smoking status, drinking status, BMI as covariates.

The risk of chronic disease by PSQI in poor sleepers

Chronic diseases	Poor sleepers (N=251)		
	OR	95% CI	p-value
Model 1			
Type2 diabetes	1.02	0.76, 1.27	0.89
Hypertension	1.10	0.87, 1.33	0.36
Hyperlipidemia	1.08	0.85, 1.31	0.49
Metabolic Syndrome	1.18	1.06, 1.32	<0.01
Model 2			
Type2 diabetes	1.01	0.75, 1.26	0.96
Hypertension	1.07	0.84, 1.31	0.50
Hyperlipidemia	1.06	0.82, 1.30	0.62
Metabolic Syndrome	1.16	1.04, 1.30	<0.01



Model1 is adjusted for chronological age and sex.
Model 2 includes chronological age, sex, smoking status and DunedinPACE as covariates.

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Conclusion and limitation

- Poor sleep quality may involved in aging acceleration using DunedinPACE.
- Worsening sleep index in poor sleepers was associated with increased risk of MetS with fasting glucose level.
- Causality of these associations are needed for the future study.
- Objective sleep quality assessment using such as wearable devices, etc.

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