#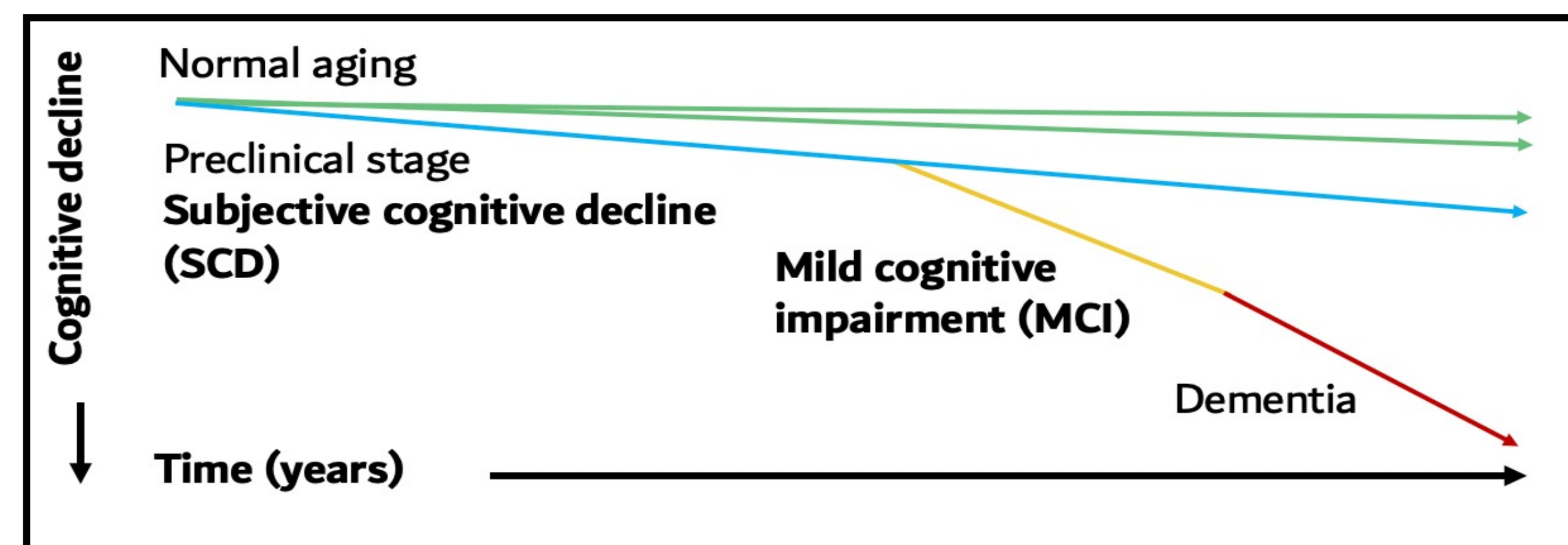 Volumetry of the olfactory-related structure as a new biomarker of individuals at risk of Alzheimer disease? Results from the CIMA-Q cohort

Smaller GM Volume of central olfactory structures in MCI compared to SCD or HC

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- Olfactory impairment is a clinical biomarker of Alzheimer's disease (AD) is already present at the MCI stage.
- Olfactory impairment may be due to early neuronal damage within limbic regions.

Objective: to compare grey matter volume (GMV) of central olfactory structures of three groups, a group of older adults with SCD, with MCI, and a control group of healthy older adults (HC).

Hypothesis: compared to HC, older adults with SCD or MCI have smaller GMV of olfactory limbic brain structures compared to HC.
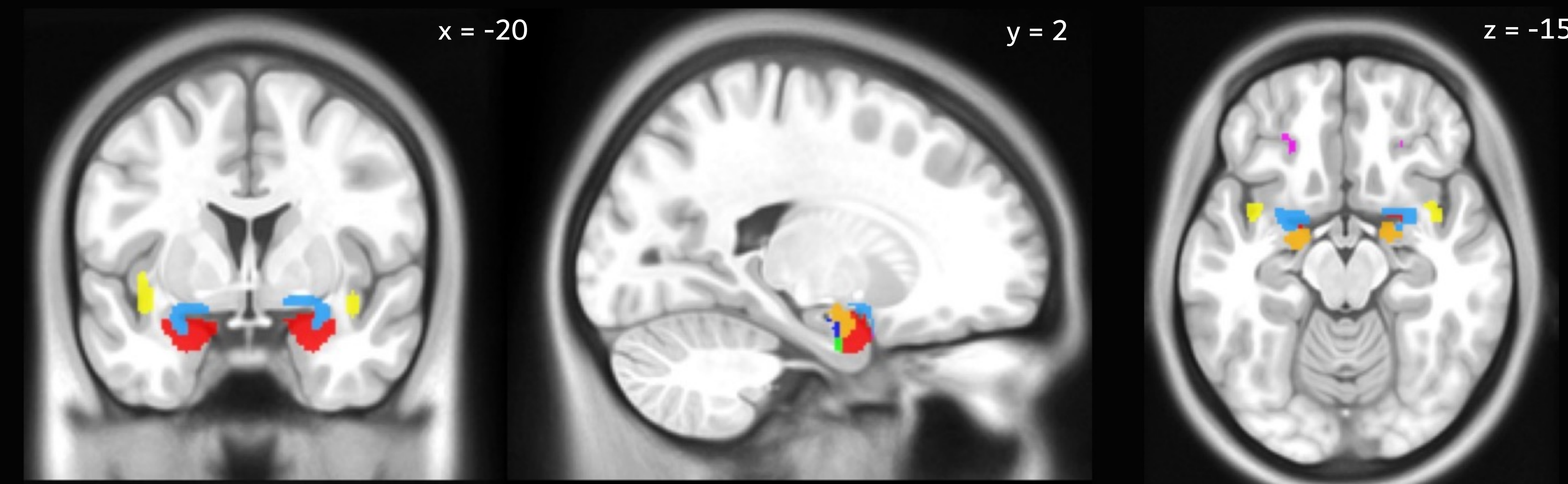
Method

- T1-W MRI images were processed with the Computational Anatomy Toolbox (CAT12) for Statistical Parametric Mapping Version 12 (SPM12) using MatLab and were segmented and spatially normalized within MNI space.
- Grey matter volume (GMV) of ROIs has been estimated and compared across groups.
- Total intracranial volume, age, and sex were used as covariates.

Piriform cortex
Amygdala
Entorhinal cortex
Left hippocampus
Left parahippocampus
Insula
Orbitofrontal cortex
Left caudate

Generated mask from functionnal regions that are activated during olfactory stimulation resulting from a meta-analysis of 81 studies (Torske et al. 2021) that have been integrated within the Neuromorphometrics anatomical atlas.

Results

- An ANCOVA revealed a **smaller total GMV of olfactory regions in MCI group compared to HC group ($p = 0.019$) and to SCD group ($p = 0.003$).** These significant differences remained significant after the Holm-Bonferroni correction.
- rmANOVA revealed a smaller GMV in MCI group compared to both SCD and HC groups within the **piriform cortex**, **amygdala**, **entorhinal cortex**, and the **left hippocampus** ($p \leq .05$). These significant differences remained significant after the Holm-Bonferroni correction.

Participants

Consortium for the Early Identification of Alzheimer's Disease (CIMA-Q)

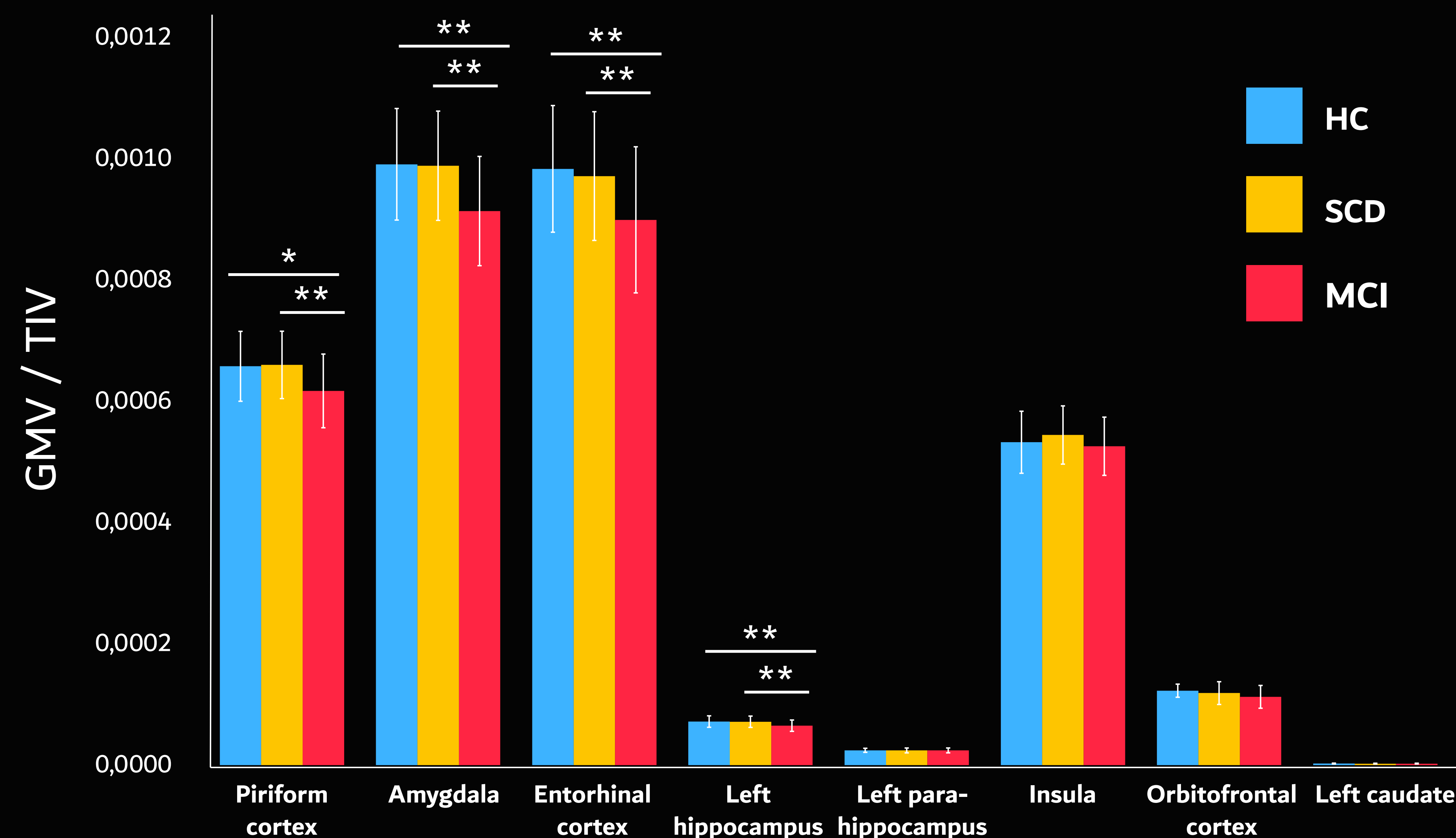|	HC (n=34)	SCD (n=92)	MCI (n=40)	P values HC vs. SCD	HC vs. MCI	SCD vs. MCI
Age in years	72.08 (5.51)	72.18 (4.77)	75.22 (5.11)	ns.	.024*	.005*
Women/Men	26/9	63/29	18/22	ns.	.011	.013
Years of Education	15.03 (3.08)	15.05 (3.09)	14.98 (3.13)	ns.	ns.	ns.
Logical Memory II delayed free recall	14.74 (4.67)	14.20 (3.86)	10.13 (4.42)	ns.	< .001*	< .001*
MoCA	28.35 (1.37)	27.66 (1.41)	24.53 (2.34)	ns.	< .001*	< .001*
Memoria, free word recall	8.18 (1.87)	7.33 (2.10)	6.07 (2.56)	ns.	< .001*	.003*
Face-Name Test, delayed free recall	5.35 (1.77)	4.68 (2.60)	2.95 (2.31)	ns.	< .001*	< .001*

Discussion

- Limbic and medial-temporal olfactory structures are smaller in MCI.
- This potential specific atrophy pattern follow Braak stages of tau pathology.
- These specific damages may explained the more severe olfactory identification impairment within AD and MCI patients.

Grey Matter Volume of Different Olfactory Regions

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