Bone–brain cross-talk: Evidence from the UK Biobank

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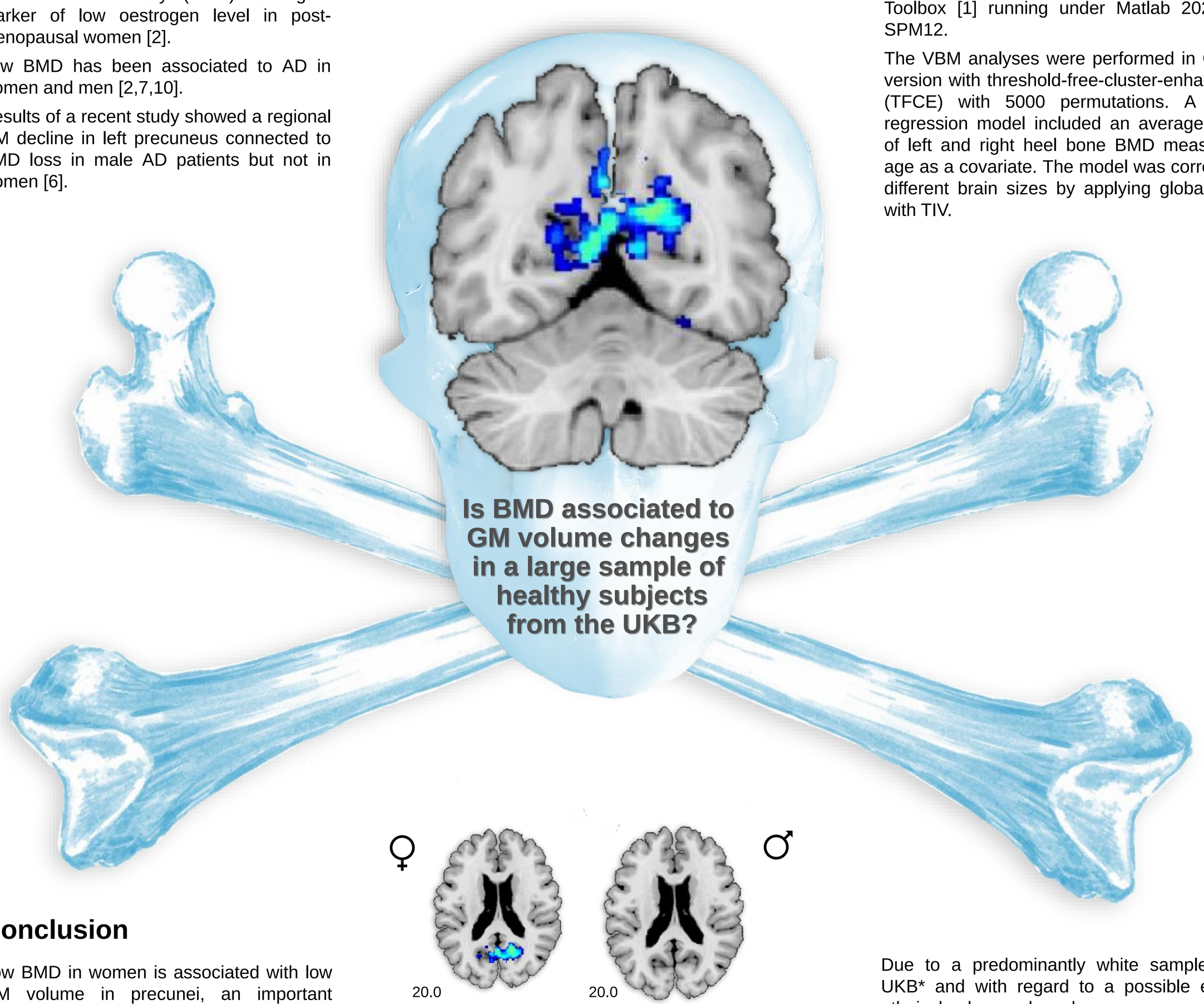
Introduction

Bones are an endocrine organ with bidirectional communication to the brain [4].

Bone mineral density (BMD): surrogate marker of low oestrogen level in post-menopausal women [2].

Low BMD has been associated to AD in women and men [2,7,10].

Results of a recent study showed a regional GM decline in left precuneus connected to BMD loss in male AD patients but not in women [6].



Method

We ran separate analyses for men and women on a subsample from the UKB. T1-images were processed using default parameters in CAT12.7 Toolbox [1] running under Matlab 2021a and SPM12.

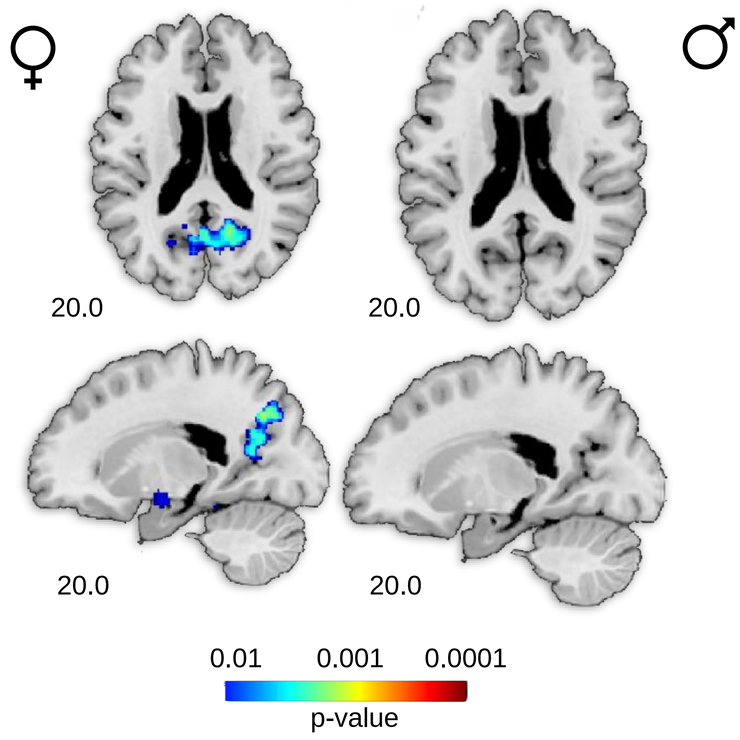
The VBM analyses were performed in CAT12.8 version with threshold-free-cluster-enhancement (TFCE) with 5000 permutations. A multiple regression model included an average T-score of left and right heel bone BMD measure and age as a covariate. The model was corrected for different brain sizes by applying global scaling with TIV.

Conclusion

Low BMD in women is associated with low GM volume in precunei, an important default mode network hub and a target of amyloid plaques [9].

Stronger results observed in women are expected due to the connection of oestrogens and BMD and a higher prevalence of osteoporosis in women [2].

A similar pattern of GMV loss as in AD can be observed before the potential onset of neurodegenerative diseases in women.



A prominent decrease of GMV was observed only in women in precunei, calcarine cortex, R planum polare, supplementary motor cortices, R parahippocampal gyrus and R fusiform gyrus. No region survived correction for multiple-comparisons in men. (P_{FWE}< 0.01)

Data

Due to a predominantly white sample in the UKB* and with regard to a possible effect of ethnic background on bone measures [3], the analyses were applied only to a neurologically and psychiatrically unimpaired sample of participants of British and Irish descent who had available MRI and heel bone BMD measures. The sample consisted of:

7031 women (63.33 ± 7.40 years)
6073 men (64.50 ± 7.61 years)

The information on the acquisition of BMD and MR data is available in UKB documentation [5,8].

*This research was conducted using data from the UKB under data application number 41655.

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