Characterising the structural and functional architecture of falls risk and response to exercise therapy in people with dementia: feasibility using Magnetic Resonance Imaging (MRI)

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Introduction

PrAISED is a high-intensity, exercise-based therapy programme. We plan to use MRI to quantify exercise-induced structural and functional plasticity in motor and postural control networks, and study if baseline quantitative imaging markers of network integrity predicts treatment response.

Results

21 people agreed to take part, and 20 tolerated scanning. Mean age was 76 (range 67-92) years, mean Mini-Mental State Examination was 26/30 (range 19-30). Participants agreed that tolerability was good, and all would be willing to be scanned again. Initial analysis included correlating fMRI images with MMSE, demonstrating positive correlations with deep brain structures, including those associated with memory, and negative correlations with visual association areas.
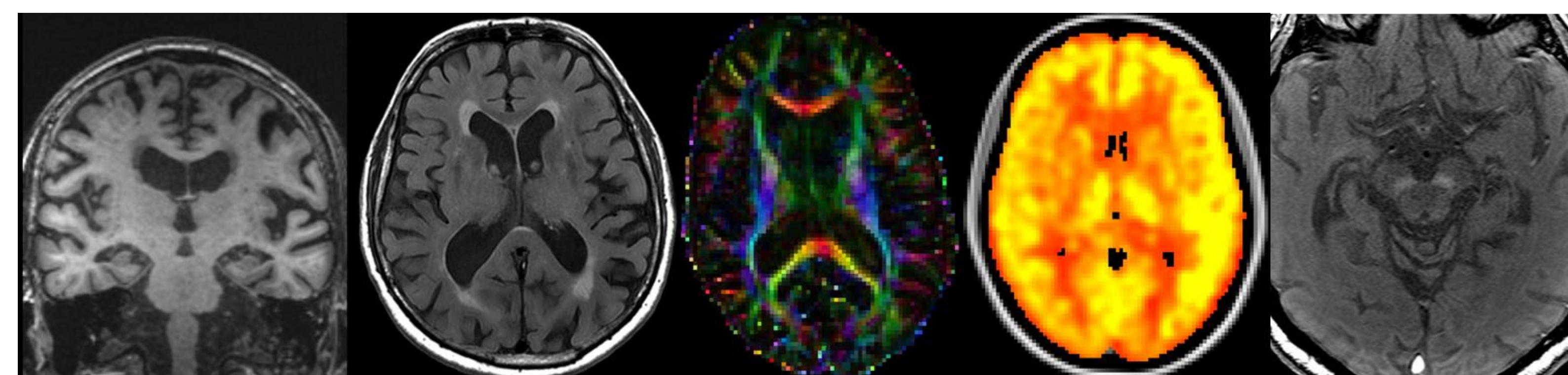
Correlation between CBF and MMSE
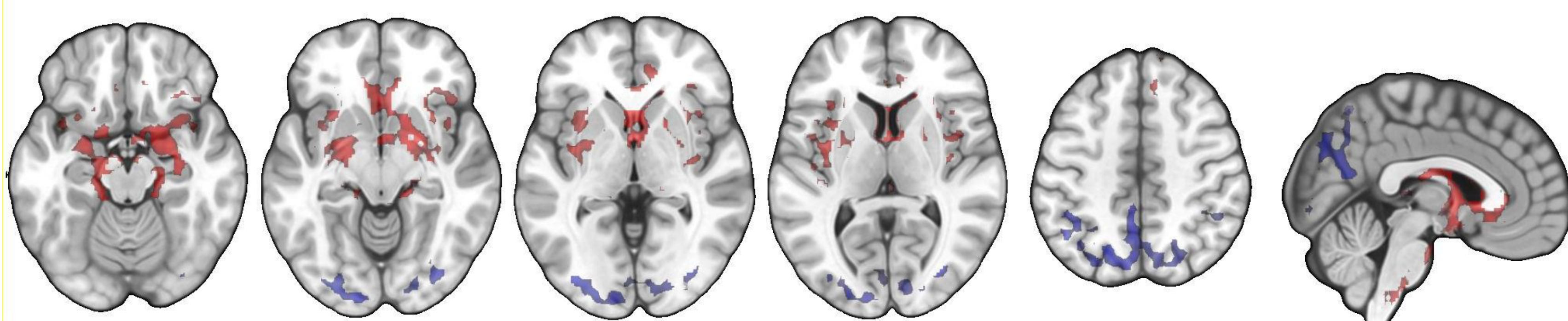
Red clusters are positively correlated
**Blue clusters are negatively correlated**

N=17, ran using permutation analysis (5,000 permutations) and clustered using the TFCE (threshold-free cluster enhancement) tools within FSL.

CBF Cerebral Blood Flow
MMSE mini mental state examination

Method

We invited 23 people with diagnosed dementia who took part in the PrAISED study to undergo a battery of multi-modal MRI imaging on a 3.0 Tesla GE Discovery MR 750 scanner. We included functional imaging of a virtual reality-based, imagined, walking and obstacle avoidance tasks, and a novel postural instability experience (a stumble). We obtained structural T1-weighted, T2-weighted FLAIR, 3D ASL perfusion, neuromelanin-sensitive T1, Re-fMRI, Rs-fMRI and task fMRI images and diffusion tensor imaging to map white-matter tracts.
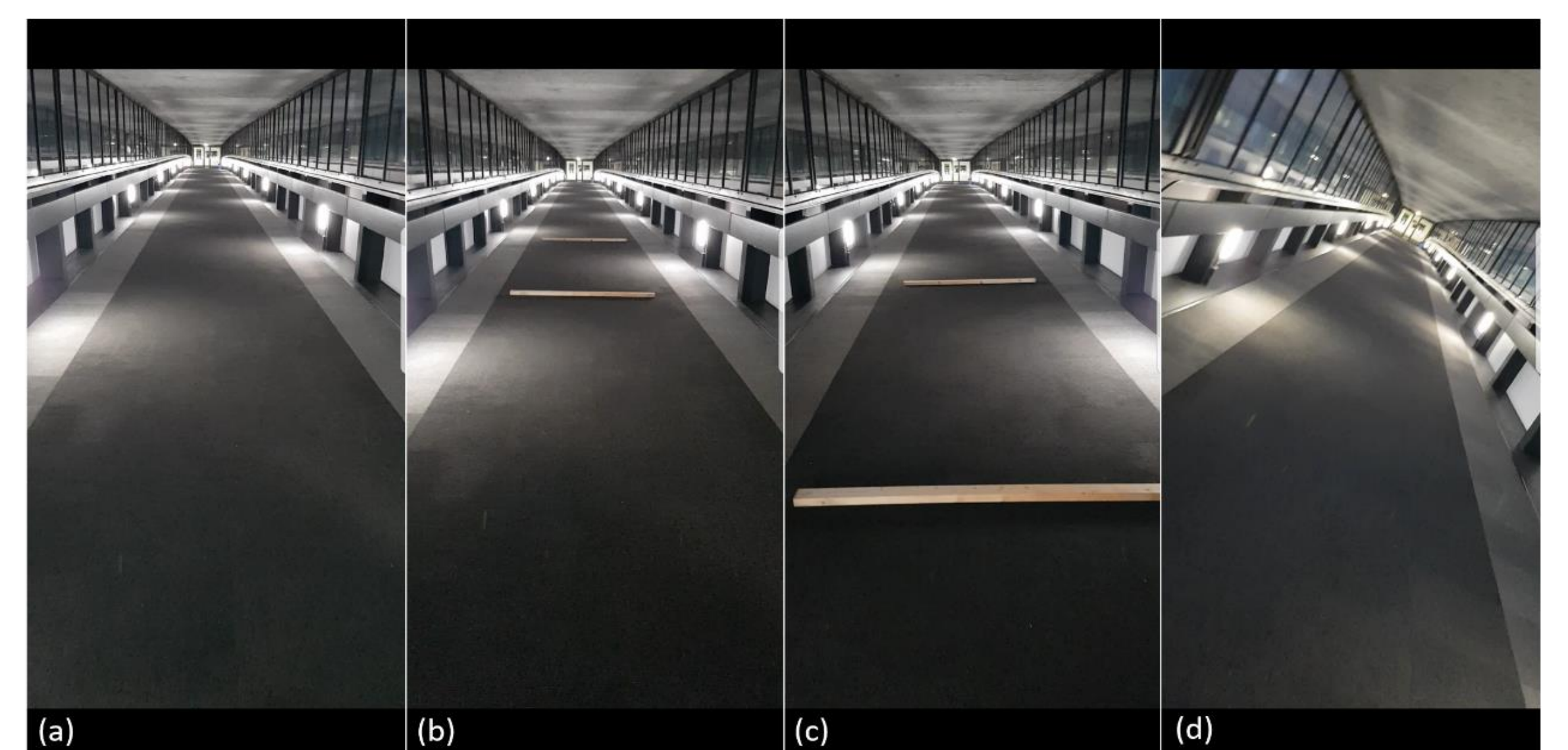
Views of the VR task

Discussion

Multi-modal research MRI scanning is feasible and well tolerated. Functional imaging of imagined walking, and obstacle avoidance tasks, and brain responses to a loss of balance, is possible.

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