



Joel Ramirez,^{1,2} Vincent N. Marraffino,¹ Oshin Vartanian,^{3,4} Shawn G. Rhind,^{3,5} Alex P. Di Battista,^{3,5} Kristen King,³ Robert Miles, Christopher JM. Scott,¹ Fuqiang Gao,¹ Melissa Holmes,¹ Shamus Allen,⁶ Miriam Palmer,⁶ Gary Gray,⁶ Sandra E. Black,^{1,7} Joan Saary^{6,8}

¹ Dr. Sandra Black Centre for Brain Resilience and Recovery, Sunnybrook Research Institute, Toronto, Ontario (ON), Canada; ² Graduate Department of Psychological Clinical Science, University of Toronto (UofT), Canada; ³ Defence Research and Development – Toronto Research Centre, Canada; ⁴ Department of Psychology, UofT, Canada; ⁵ Faculty of Kinesiology and Physical Education, UofT, Canada; ⁶ Canadian Forces Environmental Medicine Establishment, Toronto, ON, Canada; ⁷ Department of Medicine, Division of Neurology, Sunnybrook Health Sciences Centre and UofT, Canada; ⁸ Department of Medicine, Division of Occupational Medicine, UofT, Canada.



Background

- White matter hyperintensities (WMH) and enlarged perivascular spaces (PVS) are MRI biomarkers associated with cerebrovascular disease and cognitive impairment
- Previously, U.S. Air Force U-2 pilots were found to have a higher burden of WMH correlating with lower cognitive performance^{1,2}

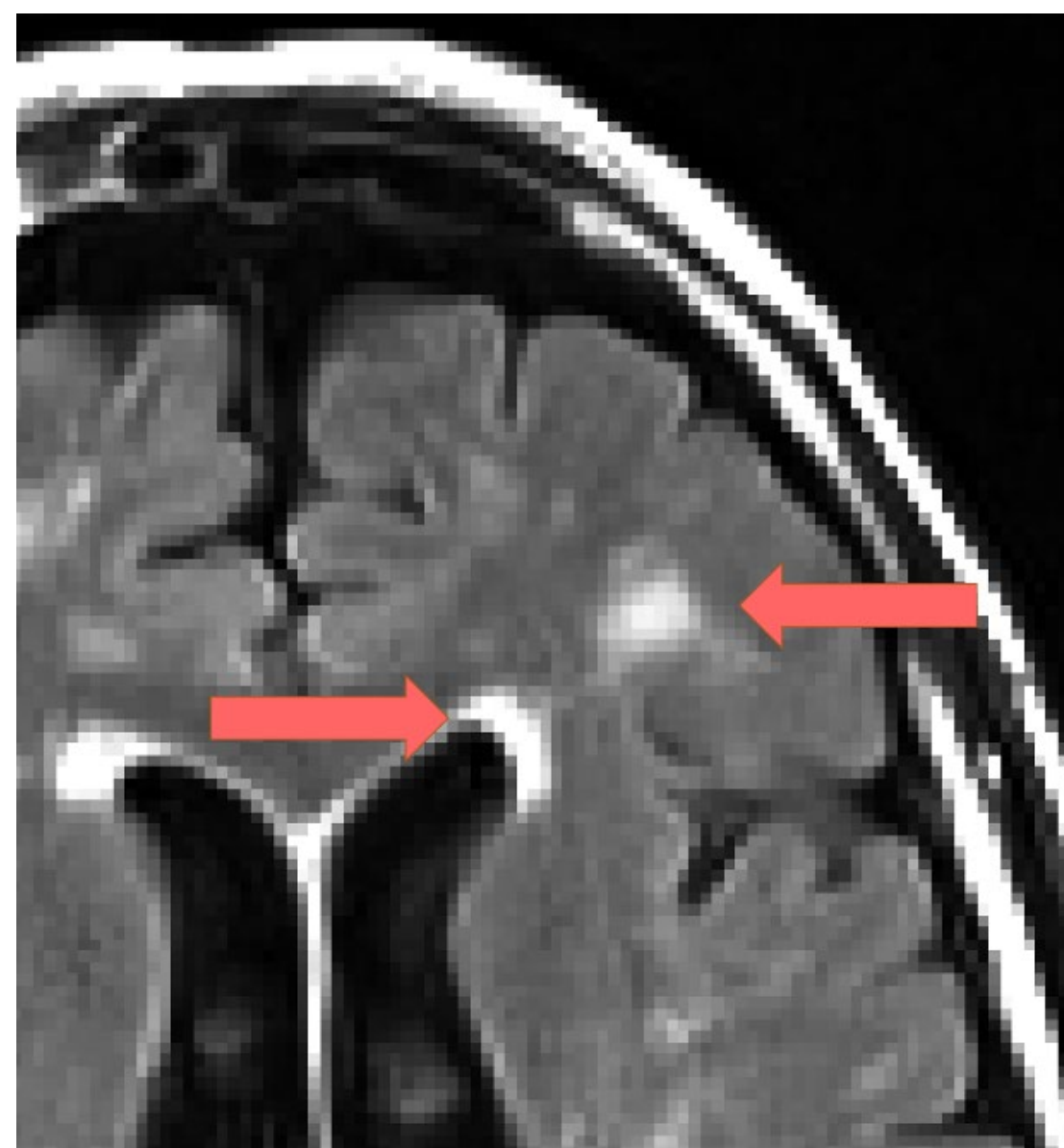


Figure 1. Periventricular (left) and deep (right) WMH on FLAIR MRI

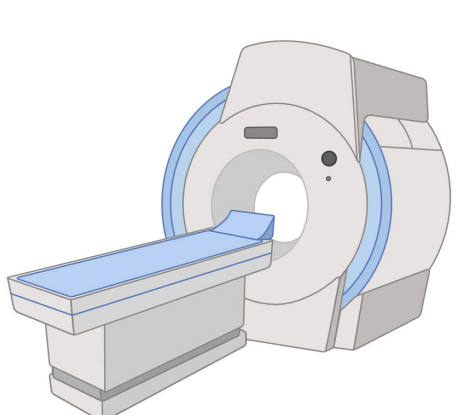
Objective

- To examine WMH/PVS burden and investigate correlates in Royal Canadian Air Force (RCAF) personnel



Figure 2. CF-188 Hornet

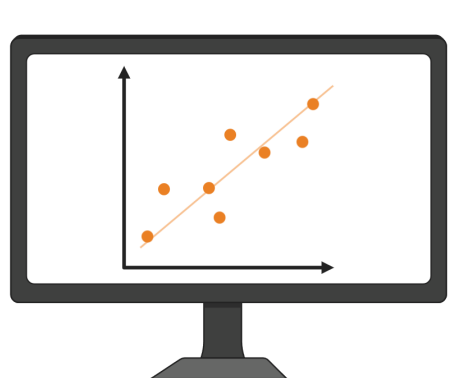
Methods



RCAF pilots and aircrew (n=48) underwent 3T MRI and neurocognitive testing



A validated MRI segmentation processing pipeline was used to acquire WMH volumes



Mann-Whitney U tests and regression models were used for analyses

Results

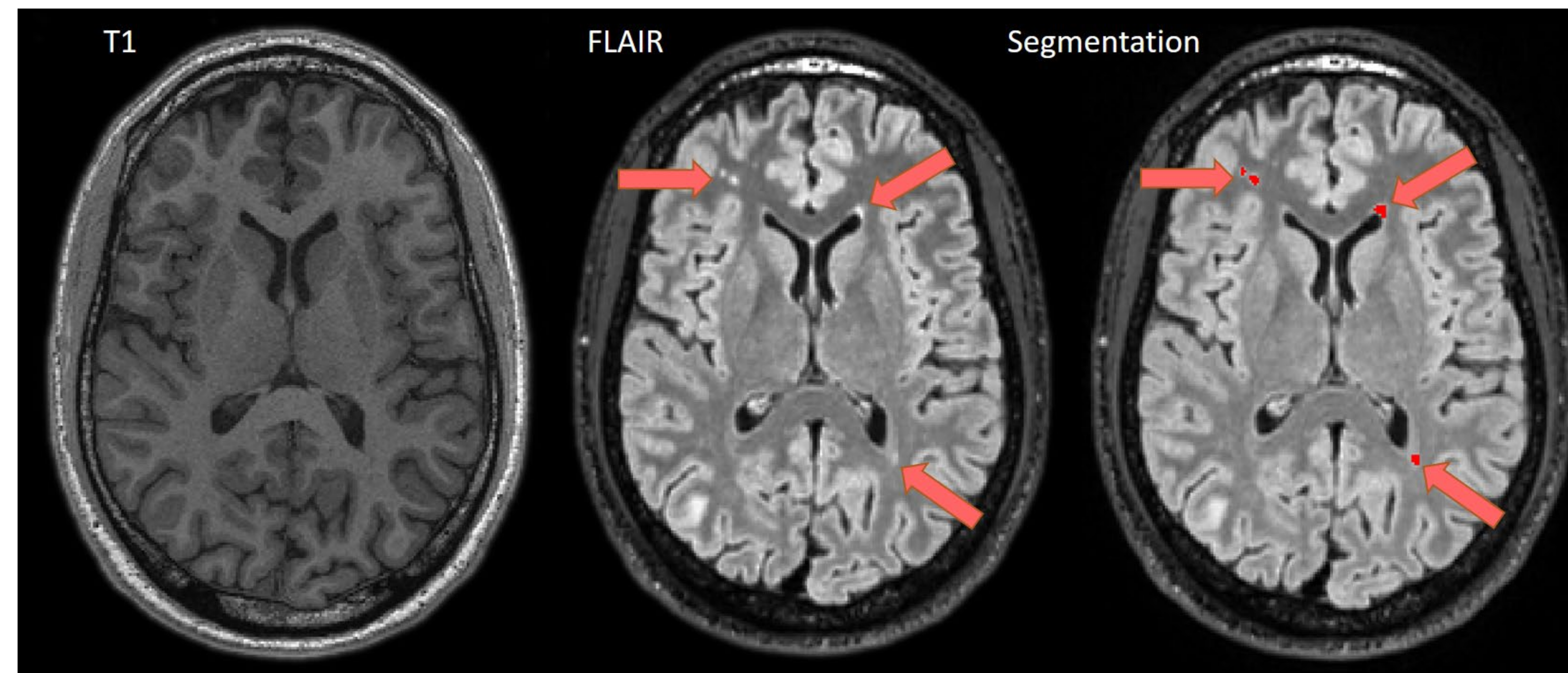


Figure 3. RCAF participant's co-registered T1 and FLAIR MRI with a WMH segmentation. Red arrows point to WMH

The RCAF group had a higher mean WMH volume than the normal control group (n=12)

RCAF: 497.62mm³ vs NC: 158.58mm³, p=0.001

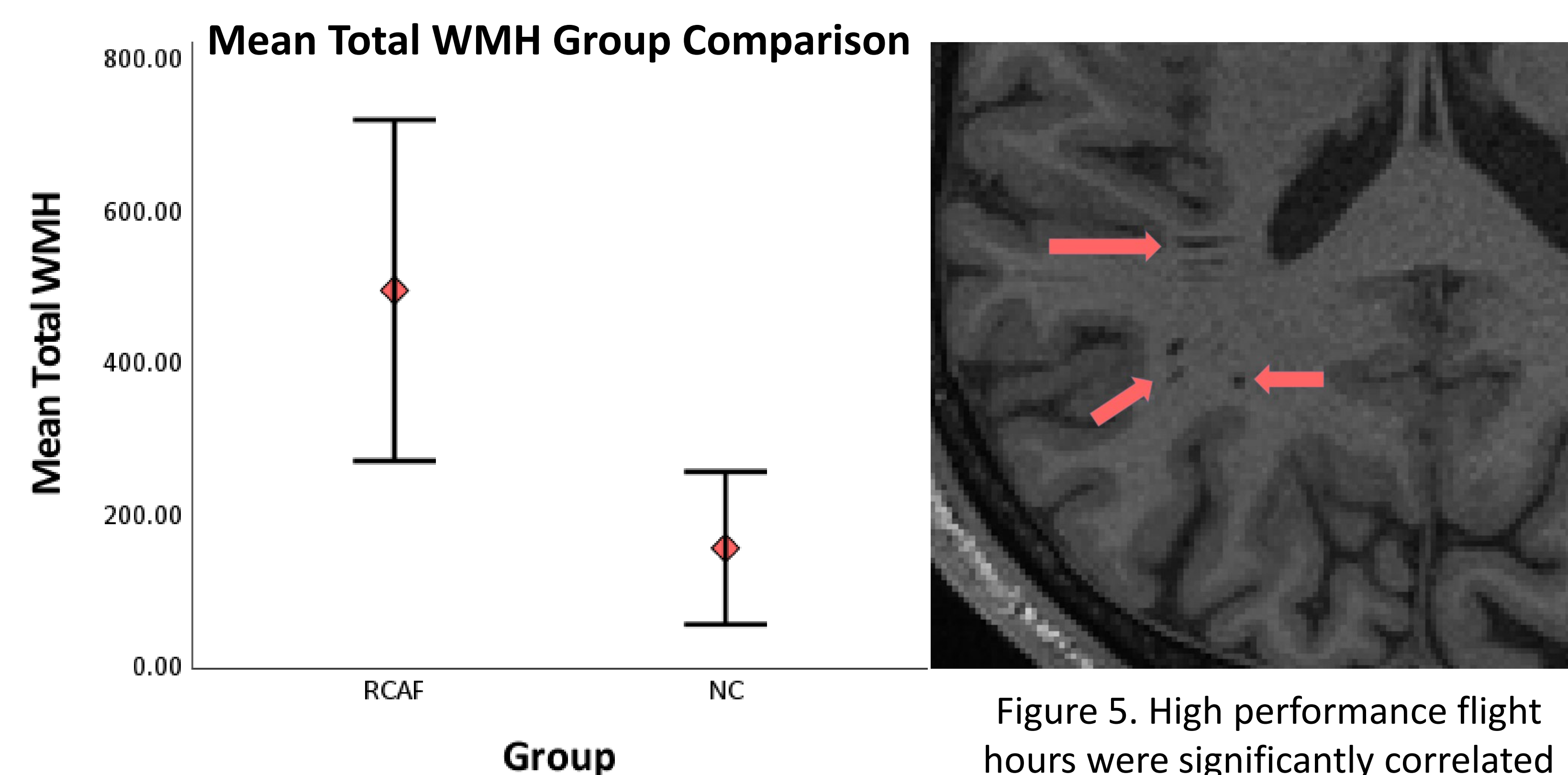


Figure 4. RCAF vs normal control mean total WMH with 95% confidence interval whiskers

Figure 5. High performance flight hours were significantly correlated with PVS volumes: r=0.352, p=0.022. T1 MRI with red arrows pointing to enlarged PVS

Discussion

RCAF pilots and aircrew were found to have a higher burden of WMH than normal controls

High performance aircraft flight time was correlated with enlarged PVS volume

WMH burden in RCAF personnel was associated with subtle neurocognitive impairment

Future Directions

- Investigate potential extreme flight factors influencing WMH/PVS progression
- Address RCAF personnel health and safety with large cohort, longitudinal designs and robust exposure assessments³

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Contact: vincent.marraffino@hotmail.com



References

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Regression models revealing negative associations between corrected WMH volume and neurocognition

Neurocognitive Test	Cognitive Ability	Regression Direction	Result
Shipley-2 Vocabulary	Crystallized Intelligence	↓	$\beta=-0.307$ $p=0.012$
Delayed Matching-to-Sample	Short-Term Visual Memory	↓	$\beta=-0.406$ $P=0.001$
N-Back Task	Working Memory Updating	↓	$\beta=-0.320$ $p=0.008$