Validating the Disconnectome Symptom Discoverer Model for Predicting Long-Term Cognitive Outcomes After Stroke

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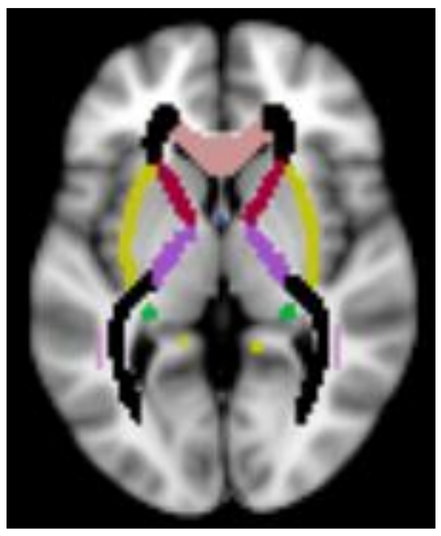
Introduction

20 - 80% of stroke survivors develop post-stroke cognitive impairment (PSCI)[1].
Early identification of those at risk for developing PSCI through effective prediction models could guide care and intervention planning as well as support patient-family communication.

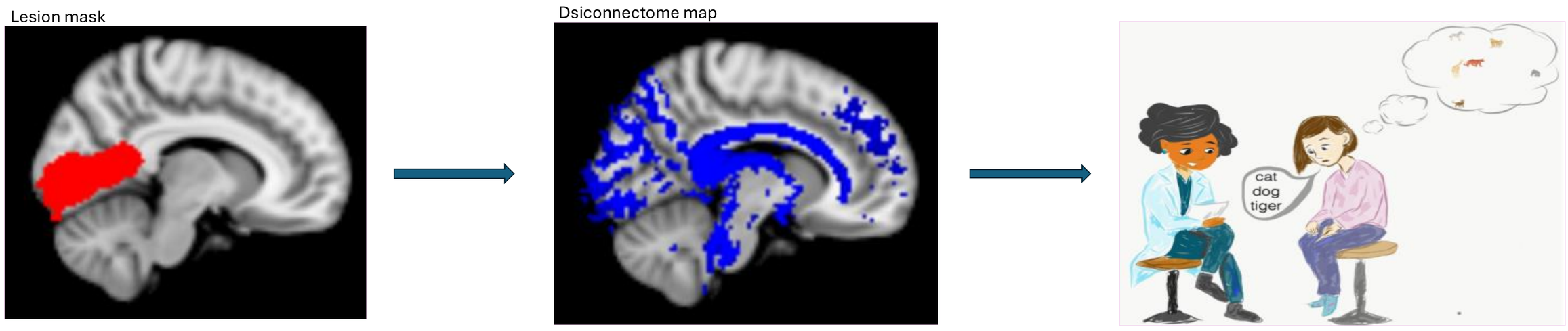


The disconnectome symptom discoverer (DSD) [2] offers a promising, publicly available model to predict cognition after stroke from lesion masks based on the likelihood of white matter disconnections.

Previous studies on the DSD examined MRI-derived lesions,[2 3] but it is important to establish whether CT scans can be used for accurate prediction by independent researchers for wider clinical applicability.

Methods

The dataset consisted of 70 stroke survivors obtained from the OX-CHRONIC [4] dataset evaluated 2 - 9.38 years after stroke.
CT scan lesions were delineated, binarised and normalised into MNI152 2mm space.
Lesions were processed through the brain connectivity and behaviour toolkit [5] to create disconnectome maps - representing the likelihood of each white matter connection being disrupted according to diffusion weighted images from 178 healthy controls.

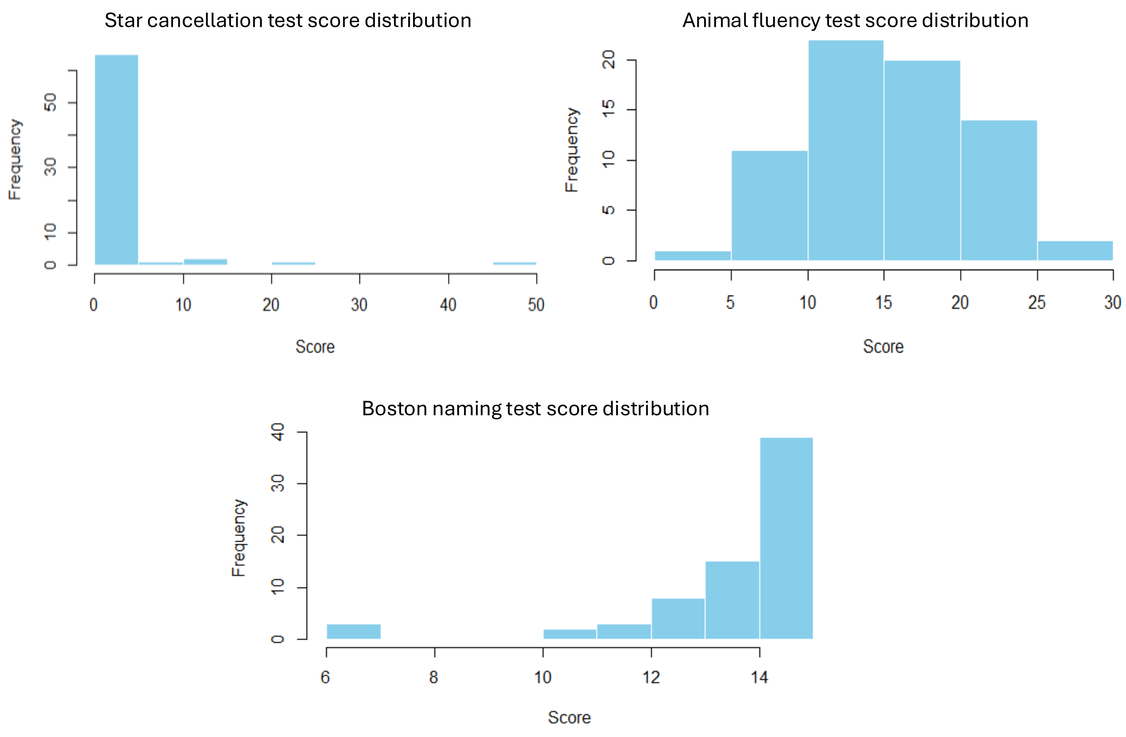


Disconnectome maps were inputted to the DSD to produce predicted scores for language and visuospatial cognitive domains
The goodness of fit test (R^2) was used to compare the observed and predicted scores.

Results

Average lesion volume was 345328.1 cm^3 (SD = 954202.6).
Average age at stroke onset was 68.01 years old (SD =11.79)

The average time of observed cognitive outcome after stroke was 4.56 years (SD = 2.19) for our dataset as opposed to 1.08 years (SD = 0.15) in the original DSD dataset.



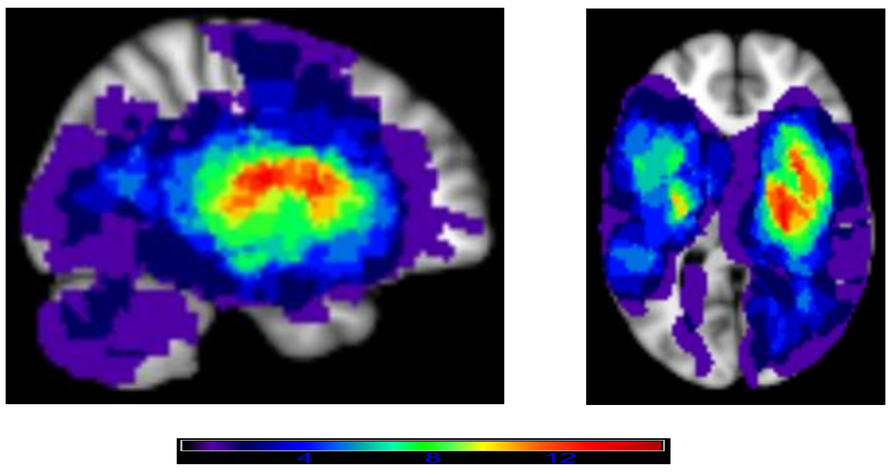
The goodness of fit test showed a lack of predictive value of the DSD for any of the neuropsychological tests analysed.

Test	Score mean ± SD	OX-CHRONIC R^2	Original data R^2
Animal fluency test	16.29 ± 5.54	0.00	0.17
Boston naming test	13.94 ± 1.92	0.00	0.12
Star cancellation test	2.04 ± 6.40	0.00	0.26

Discussion

- The DSD does not generalise to predict cognitive scores long-term after stroke in our external dataset.
- Although our study is limited by a relatively low sample size, similarly powered validation datasets have been used to previously test the DSD.[2]
- A previous study established a similar lack of predictive value for long-term datasets with MRI[3]. These results suggest that the DSD may only apply to acute cognitive predictions around 1 year after stroke and does not apply to long term data.
- The next steps will be to compare the predictive value of the DSD on acute data to test this theory using CT scans.

Lesion overlay distribution OX- CHRONIC



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