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# **Screening for cognitive impairment among patients with neuromyelitis optica using touchscreen cognitive testing in routine clinical care**

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Dear Sirs,

Neuromyelitis optica (NMO) is a rare autoimmune disease associated with inflammation of the optic nerves, spinal cord and brainstem [1]. In addition to physical and visual problems, cognitive dysfunction is also common among people with NMO (pwNMO) [2], but is potentially under-recognised and incompletely evaluated in routine clinical care. We aimed to investigate the spectrum of cognitive impairment in pwNMO presenting to a specialist clinic using a brief cognitive battery administered on a touchscreen tablet computer.

All pwNMO attending the Anne Rowling Regenerative Neurology Clinic, University of Edinburgh, between February 2014 and February 2015 were offered the opportunity to complete the cognitive tasks as part of their routine holistic clinical assessment. Three tests from the Cambridge Neuropsychological Test Automated Battery (CANTAB) (assessing five different domains of cognition) were administered using a touchscreen tablet computer (iPad Air, Apple Inc.):

1. Match to Sample (MTS): assesses processing speed and attention
2. Paired Associates Learning (PAL): assesses visuospatial episodic memory
3. Spatial Working Memory (SWM): assesses working memory and executive function

These took approximately 15 minutes to complete. Each task incorporated an automated computer voiceover providing instructions to patients and required no prior neuropsychological training for administration. Patients were also screened for depression using a touchscreen version of the 15-item Geriatric Depression Scale [3], which has high diagnostic sensitivity and specificity in the general adult population [4]. Upon completion, raw scores for each cognitive domain were processed by the software to create z-scores standardised for age, sex and education status using data from an inbuilt normative database collected from healthy adults aged 18-90 years. Based on these z-scores, cognitive performance levels were categorised from 'superior' (z-score > 1.5) to 'very poor' (z-score < -2), though 'average' (z-score  $\geq$  -1) was the highest possible category for some tests. Patients scoring 'poor' or 'very poor' (z-score < -1.5) in a cognitive domain were considered to be impaired relative to their age, sex and education-matched peers.

Sixteen pwNMO (62.5% female) completed the CANTAB assessments (mean age  $48.6 \pm 17$  years, range: 18 - 83 years). Cognitive impairment was detected in at least one cognitive domain in seven patients (43.8% of the sample). Two patients (12.5% of the sample) exhibited impairment in two cognitive domains. Across the sample, impairments were observed on

measures of working memory (12.5%), episodic memory (18.8%) and executive function (25%). None of the patients exhibited impairments in processing speed or attention. Clinically significant depressive symptoms were reported in 43.8% of patients, but were not associated with the presence of cognitive impairment.

These results confirm that cognitive impairment is common and occurs across a range of domains among pwNMO. These findings also further corroborate reports that suggest that the effects of NMO may extend beyond the optic nerve and spinal cord and into the brain [2, 5, 6]. The overall proportion of individuals exhibiting impairment was similar to another recent study conducted at the same clinic in patients with multiple sclerosis, though the profile of impairment differed slightly between disorders [7]. The absence of impairments in processing speed or attention in this NMO sample is interesting as it conflicts with previous findings [2], but also suggests that the impairments observed in other aspects of cognition were not attributable to visual or motor problems, or to potential sedating effects of pain medications [8]. Collectively, these results support recent calls for the use of routine cognitive screening in NMO [1], and demonstrate that computerised cognitive assessments could offer a practical solution to the lack of time, specialist resources and expertise typically required to administer, score and interpret paper-and-pencil based measures in everyday clinical practice.

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**Ethics statement:** The authors declare that they complied with ethical standards and the study was in accord with the Declaration of Helsinki.

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