



Examining the prevalence of cognitive impairment alongside depression and anxiety symptomatology in Multiple Sclerosis: A systematic review and meta-analysis.

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Introduction

Cognitive impairment is prevalent, common feature among 40-70% of Multiple Sclerosis (MS) patients, limiting their capacity in routine task management and social engagement. The most common cognitive domains impaired are executive function, memory, attention and information processing speed.

MS disability progression increases risk of psychiatric comorbidity, lengthening patient recovery and therapy adherence. Processing speed deficits are associated with higher anxiety symptoms that interrupt objective-oriented behaviours and increases response periods. MS patients with major depressive disorder possessed constricted working memory capacities when attempting to complete cognitive-demanding objectives.

As neurological symptoms are a precursor for psychiatric challenges, greater collaboration between neurologists and mental health professionals is required in treating and minimising the emergence of neurological and psychiatric complications. Both clinical specialities may benefit from developing a diagnostic apparatus which incorporates neurological and psychiatric properties in distinguishing intact against disrupted cognitive functions alongside emerging psychiatric complications.

Examining studies investigating cognitive impairment in MS patients using a validated cognitive battery may assist in identifying domain dysfunction prevalence which promotes clinical instability, using the data in constructing a sensitive diagnostic apparatus appropriate for all MS stages. A systematic review and meta-analysis shall evaluate the impact upon executive function, memory, attention and processing speed among MS patients, alongside evaluating the degree to which depression and anxiety symptoms are present.

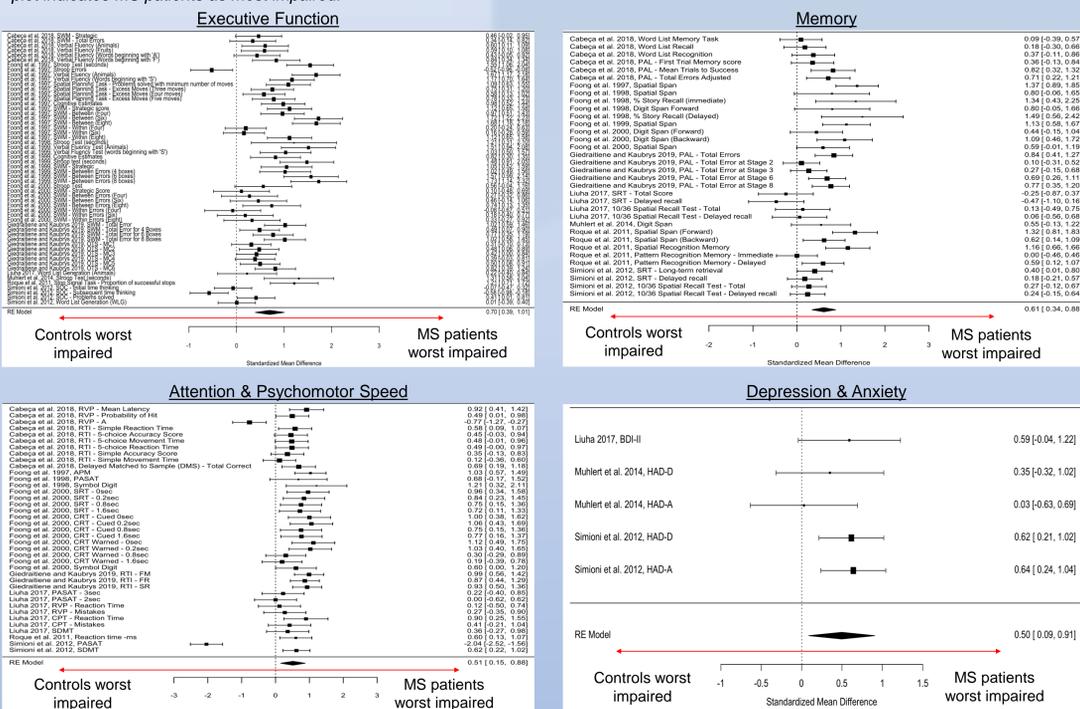
Results

Qualitative synthesis:

Thirteen included studies established a pattern of inferior MS patient performance within cognitive tests, having longer response periods, longer manoeuvre planning and execution, reduced memory transfer capacity during immediate and delayed recall and shorter attention spans. MS patients reported more depression and anxiety symptom occurrence than controls, with depression being the most common within the domain.

Quantitative synthesis:

Figure 1. Four forest plots representing a domain as indicated by title. Left of forest plot indicates that controls are most impaired; Right of forest plot indicates MS patients as most impaired.



Ten studies consisting of 369 patients and 291 control participants underwent meta-analysis, with 134 data outcomes across four domains. Significant difference between MS patients and controls across the four domains were present as outlined by the mixed meta-analysis (SMD = 0.66, 95% CI = 0.43, 0.88, $p < .001$).

Meta-analysis was reported for each of the four reported domains: executive function (SMD = 0.70, 95% CI = 0.39, 1.01, $p < .001$); memory (SMD = 0.61, 95% CI = 0.34, 0.88, $p < .001$); attention & psychomotor speed (SMD = 0.51, 95% CI = 0.15, 0.88, $p = .007$); depression & anxiety (SMD = 0.50, 95% CI = 0.09, 0.91, $p = .028$).

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Methodology

20 research articles retrieved from the Cambridge Cognition database utilised the Cambridge Neuropsychological Test Automated Battery (CANTAB). Studies were included if they compared MS patients against control participants and were not intervention-based studies. Restrictions on participant gender, study geographical location, MS phase, education attainment and a maximum age limit were not applied.

Outcomes measures included: executive function; memory; attention & psychomotor speed; social & emotional cognition; and depression & anxiety. None of the retrieved studies reported on social & emotional cognition. Attention and information processing speed were combined under a single domain in accordance with CANTAB.

Qualitative Synthesis:

Descriptive data on participant performance within cognitive tests was reported, along with and depression and anxiety symptom occurrence and severity between conditions.

Quantitative Synthesis:

The meta-analysis was performed using the R metafor package, adjusting for test score direction to identify poorer performance ('1' designated to lower scores indicating impairment; '-1' designated to higher score indicating impairment).

Mixed-effects model accounted for variations between and within included studies, with a standardised mean difference accounting for different assessments between included studies measuring the same variable. Continuous data was extracted from CANTAB tests and supplementary cognitive tests and psychiatric measures providing mean and standard deviations of MS patient and control participant performance associated with each domain.

Cohen's (1988) effect size rule was applied in interpreting meta-analysis results per domain: 0.2 (small); 0.5 (medium); 0.8 (large). Domains producing a effect size range not passing the 0 mark and a main significant effect ($p < .05$) indicated a significant main effect.

Discussion

There is clear indication of impairment being most prevalent among MS patients, with a medium to large effect size present in executive function and memory domain, highlighting the impact of these two domain operation capacity when completing cognitive-demanding objectives. Both domains may become primary sections when constructing a diagnostic assessment, focusing on the level of impairment within problem solving, inhibitory capacities, information encoding and storage.

Medium effect sizes were produced within the attention & psychomotor speed and depression & anxiety domains, with MS patients being the most impaired condition. Attention and processing speed measurements identifying significant impairment among MS patients may indicate cortical lesion volumes and lesion extent among patients based on their inferior test performance. Greater depression and anxiety symptoms among MS patients, being impaired by their occurrence, supports earlier findings that symptoms associated with these psychiatric states are widespread among MS patients than the general populace.

CANTAB and supplementary cognitive test performance highlights significant and recurring differences between MS patients and control conditions, with higher cognitive deficits, depression and anxiety symptomatology frequency among MS patients.

Conclusions

Future research developing a neuropsychological assessment centred upon these domains may use efficient elements from CANTAB, bolstering early diagnosis. Standardised assessments may provide clinical profiles outlining direction of neurocognitive deficits in patients and demyelination extent among brain areas as correlated with test type performance.