

# Cognitive and Motor Reserve in Mild Cognitive Impairment: The Role of a Cognitively Stimulating Lifestyle and Physical Activity in Preserving Cognitive Function

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**Objectives:** The pathological changes underlying Alzheimer's disease can begin long before noticeable symptoms appear, positioning **Mild Cognitive Impairment (MCI)** as a crucial stage for early detection and potential intervention. In individuals with MCI, **Cognitive Reserve (CR)**, reflecting the cumulative effect of cognitively stimulating activities across the lifespan, has been shown to mitigate the clinical impact of brain pathology [1]. People with similar neurological damage but higher CR often exhibit milder cognitive deficits and slower progression toward dementia. Previous neuroimaging studies from our group [2] identified the left insula as a neural hub supporting the scaffolding of CR in MCI. A parallel concept, **Motor Reserve (MR)**, has been proposed in relation to motor function, attributed to lifelong physical activity; however, its relevance to cognitive performance remains poorly understood. This study investigates the respective contributions of CR and MR to cognitive outcomes in individuals with MCI.

**Materials and Methods:** We analyzed data from 88 individuals diagnosed with MCI (mean age = 75.97 ± 4.90 years; 43 males and 45 females), who underwent a comprehensive neuropsychological evaluation covering global cognition, memory, language, executive function, visuoconstructional abilities, and working memory. CR was quantified using the **Cognitive Reserve Index questionnaire (CRIq)**, whereas MR was assessed through two tools: the **Motor Reserve Index questionnaire (MRIq)** and the **Current Physical Activity questionnaire (CPAq)**. Multiple linear regression analyses were conducted to examine how well CR and MR scores predicted performance in different cognitive domains, with age included as a covariate.

Figure 1. Correlogram showing the associations between reserve indices and neuropsychological tests. [CRIq, Cognitive Reserve Index questionnaire; MRIq, Motor Reserve Index questionnaire; CPAq, Current Physical Activity questionnaire; MMSE, Mini Mental State Examination; RAVLT, Rey-Auditory Verbal Learning Test; CPM, Coloured Progressive Matrices; ROCF, Rey-Osterrieth complex figure].

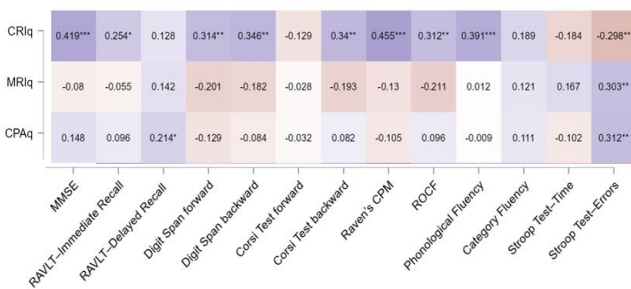
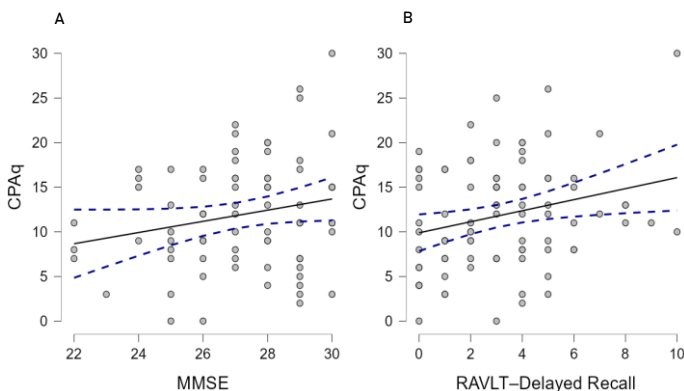


Figure 2. Scatterplots showing the association between CPAq and MMSE (Panel A) and RAVLT - Delayed Recall (Panel B). [CPAq, Current Physical Activity questionnaire; MMSE, Mini Mental State Examination; RAVLT, Rey-Auditory Verbal Learning Test].



## Results:

- Higher CR scores were consistently linked with better performance across a range of cognitive tasks (all p-values < 0.05).
- Current physical activity (CPA) was also positively associated with global cognition, measured by the MMSE ( $\beta = 0.09$ ,  $p = 0.014$ ), and episodic memory, particularly performance on delayed recall in the Rey Auditory Verbal Learning Test ( $\beta = 0.10$ ,  $p = 0.029$ ).
- MR as evaluated by MRIq did not significantly predict cognitive outcomes in any domain.

**Discussion and Conclusions:** Our findings underscore the critical role of CR in supporting cognitive function among individuals with MCI. Additionally, the observed benefits of CPA suggest that **lifestyle factors**, especially those involving **current physical engagement**, may contribute to **cognitive health**, potentially through **neuroplastic mechanisms** [3]. These results emphasize the importance of both lifelong intellectual stimulation and sustained physical activity in fostering cognitive resilience during the early stages of neurodegenerative disease.

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- [2] Cipriani, M. C., Di Tella, S., Anzuino, I., Scopetani Testa, C., Cocciolillo, F., Clemente, E., Liperoti, R., & Silveri, C. (2024). Abstracts of the 54th Annual Conference of the Italian Society of Neurology. *Neurological Sciences*, 45(Suppl 1), 1-582. <https://doi.org/10.1007/s10072-024-07787-z>
- [3] Pucci, V., Guerra, C., Barsi, A., Nucci, M., & Mondini, S. (2024). How long have you exercised in your life? The effect of motor reserve and current physical activity on cognitive performance. *Journal of the International Neuropsychological Society*, 30(1), 11-17. <https://doi.org/10.1017/S153561772300022X>