Evaluating Predictors of MCI – A Meta-Analysis

Lauren Leis, Alejandra Ortega, & Robert Dyer
Dr. Dorota Kossowska-Kuhn

Introduction

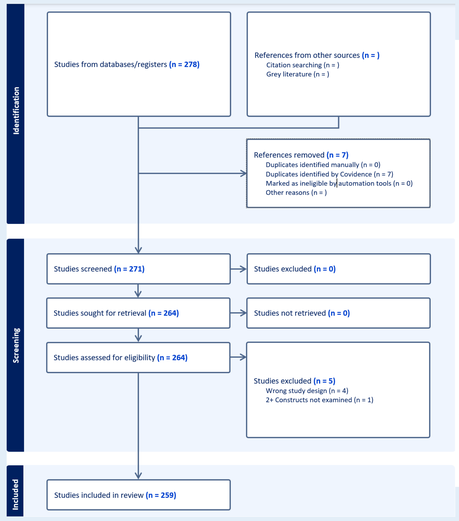
- Mild Cognitive Impairment (MCI) is a transitional phase between normal aging and Alzheimer's Disease (AD). An estimated 12–18% of adults over 60 meet criteria for MCI, and 10–15% of those with MCI progress to dementia, including AD, each year. By 2060, roughly 13.8 million people in the United States are expected to be living with AD. Current research also shows that specific cognitive deficits, like memory and spatial navigation, may predict this progression. Further, neuroimaging studies prove that structural brain changes correlate with cognitive decline and therefore may help to predict AD.
- Current research has been limited by things like small sample sizes and limited cognitive measures studied. A lot of studies analyze just one specific brain region's correlation with the onset of MCI, making it difficult to find the strongest predictors. Also, many of these studies fail to follow up with participants afterward, rendering it harder to understand the timeline of cognitive decline.
- The reason our meta-analysis addresses these gaps is that it combines all these types of data, which are often limited in and of themselves, to create a stronger and more broad research study of which cognitive impairments best predict AD. The purpose of this study is to determine which cognitive skills, in deficit, best predict the onset of Alzheimer's disease in individuals with MCI.
- We would like to clarify which cognitive measures are most useful for physicians to consider—and doing so would enable earlier diagnoses, which often proves vital for families and their ability to either prepare to combat the disease or even treat it with a higher likelihood of success. We hypothesized that spatial navigation will emerge as the strongest predictor.

Methods

- Our meta-analysis used studies examining older individuals diagnosed with MCI (typically 50-85 years old). Subgroups like amnestic MCI (aMCI) and naMCI (non-amnestic MCI) individuals were also extracted. These individuals went through cognitive diagnostic assessments like MOCA and MMSE.
- Global composite scores were excluded from our study, affirming that our data was focused on specific skills like attention and memory. We coded data from tests that examined multiple cognitive functions like memory, executive function, visuospatial skills, etc.
- We compared MCI individuals with age-matched HC (healthy controls) for each test that we coded for, extracting sample sizes, mean, and standard deviation results for this comparison.
- Relevant studies were identified through database searches and were subsequently screened. Criteria like number of participants and language of the article were examined as we decided which articles to include.
- At least 2 researchers examined each article; when there were disagreements about its relevance, a third mediator would resolve the conflict.

Results & Discussion

- Our preliminary findings have indicated that individuals with MCI consistently perform worse on memory, attention, visuospatial and other cognitive tasks than age-matched healthy controls. By comparing mean and standard deviation of both groups, we can begin to see the connection between MCI and performing poorly on cognitive assessments as we ensure that all of our findings are statistically significant. While we can begin to see a correlation between cognitive deficits, we cannot conclusively define results yet as this study is still ongoing.
- When we are finished though, we will have procured a study that has pooled information from over 200 studies. By effectively synthesizing data on our topic into one study, we will strengthen our ability to draw real associations. By combining many samples, we will also be able to more accurately estimate how strongly each indicator relates to MCI. What makes our study unique is that we are compiling so many different cognitive skills into one meta-analysis instead of only focusing on one skill.
- Some slight limitations in our study may be due to the studies in which we extracted data from. Some studies had noticeably small sample sizes and unclear diagnostic criteria. This may hinder our findings slightly, but as more studies are coded into our meta-analysis, the overall estimates are likely to become more stable.



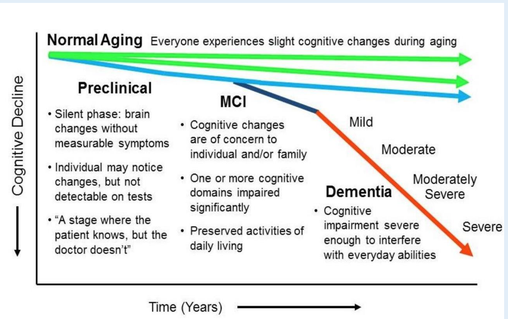


Figure 1 is a PRISMA chart generated by Covidence that displays the number of studies initially identified, screened, and later included. It also presents the number of studies excluded, and by what criteria

Figure 2 presents the timeline of cognitive decline with stages such as "Preclinical", "MCI", and "Dementia." It also describes the symptoms that are expected at each stage.

Future Application

- These findings suggest that cognitive impairment in MCI extends beyond memory alone and shows more broad disruptions in cognitive functioning associated with early Alzheimer's disease-related neural changes.
- In the future, these models could serve as low-cost, non-invasive screening tools to help identify individuals at risk and guide decisions about further neuroimaging research and clinical evaluation.
- Early identification can also benefit individuals and their families by allowing more time for planning, accessing support services, making informed care decisions, and reducing uncertainty surrounding diagnosis and diseases progression. Catching AD early significantly increases success in combatting it.

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References