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# Original contribution

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## Neuropsychological profile of a group of older adults diagnosed with mild cognitive impairment

Neuropsychological profile of a group of older adults diagnosed with mild cognitive impairment

### Abstract

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**INTRODUCTION:** Mild cognitive impairment (MCI) is a clinical condition between normal aging and a probable dementia process such as Alzheimer's disease (AD), which manifests itself as a loss of memory greater than expected for age, without meeting the diagnostic criteria Established for AD. This disease occurs in people with advanced ages. It is expected that by 2050 life expectancy in Colombia will exceed 79 years and with more than 20% of the population over 60 years.

**OBJECTIVE:** To describe the neuropsychological profile of a group of older adults with MCI.

**METHODS:** The sample consisted of 69 elderly adults with an average age of 71.79 years. Mini-Mental State Examination and Neuropsychological Assessment (Grover and Buschke Verbal Memory and Cognitive Cerad) were used.

**RESULTS:** In all, 49% of older adults assessed had a predominance of MCI-type amnesic multiple domains, 35% had non-amnesic MCI multiple domains and 8% met criteria for MCI-type amnesic single domain and non-amnesic single domain.

**CONCLUSION:** When comparing the results of other investigations and taking into account that the present study does not estimate prevalence, it is necessary to recognize the similarity in the results and the usefulness of the case study to make more accurate diagnoses.

### Keywords

*mild cognitive impairment,  
dementia, executive functions,  
attention, memory.*

# Resumen

**INTRODUCCIÓN:** El deterioro cognitivo leve (DCL) es una condición clínica entre el envejecimiento normal y un probable proceso demencial como la enfermedad de Alzheimer (EA), que se manifiesta por pérdida de memoria mayor a la esperada para la edad, sin cumplir con los criterios diagnósticos establecidos para la EA. Dicha enfermedad se presenta en personas con edades avanzadas. Se espera que para el 2050 la esperanza de vida en Colombia sea superior a 79 años y con más del 20% de la población por encima de los 60 años.

**OBJETIVO:** Describir el perfil neuropsicológico de un grupo de adultos mayores con DCL.

**MÉTODOS:** La muestra fue conformada por 69 adultos mayores con una edad promedio de 71.79 años. Se utilizaron instrumentos de tamizaje (Mini-Mental State Examination, Escalas de memoria, depresión y actividades de la vida diaria) y de evaluación neuropsicológica (Memoria Verbal de Grober and Buschke y el Cerad Cognitivo).

**RESULTADOS:** El 49% de los adultos mayores valorados presenta un predominio de DCL tipo amnésico múltiples dominios, el 35% presenta DCL tipo no amnésico múltiples dominios y el 8% cumple los criterios para DCL tipo amnésico único dominio y no amnésico único dominio.

**CONCLUSIONES:** Al comparar los resultados de otras investigaciones y teniendo en cuenta que en el presente estudio no se estima prevalencia, es necesario reconocer la similitud en los resultados arrojados y la utilidad que presenta el estudio de caso para realizar diagnósticos más acertados.

## Palabras clave

*deterioro cognitivo leve, demencia, funciones ejecutivas, atención, memoria.*

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## Introduction

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Mild cognitive impairment (MCI) is a clinical condition between normal aging and Alzheimer's disease (AD), which is manifested by memory loss greater than expected for the age, without complying with the diagnostic criteria established for AD.<sup>1</sup> MCI is associated with an increased risk of developing dementia; additionally, neuropsychological deficits are more common and clinically important in intervention and rehabilitation processes.<sup>2</sup>

The increase in life expectancy represents one of the most relevant aspects of our current society, resulting from a series of factors such as disease control, better nutritional conditions, hygiene, birth control, and decrease of mortality. According to the last census performed in Colombia, 6.3% of the population is over 65 years of age, corresponding to 2,612,508 inhabitants. The general population increased by an average of 1.9% per year (in the period 1990-2003), while the population aged over 80 grew at a rate of 4%.<sup>3</sup>

It is expected that by 2050, life expectancy in Colombia will exceed 79 years, and more than 20% of the population will be over 60 years old.<sup>4</sup> These figures suggest that, as the population ages, diseases of this age such as dementia will also increase. Taking into account that senescence involves a series of changes, especially at the cognitive level, it is necessary to analyze these changes because not all of them are particular to old age. When it comes to alterations in cognitive functions with a predominance of important changes in memory, language, perception, and attention, some are due to the appearance of dementia.<sup>5,6</sup> However, there is interindividual variability due to external factors such as educational level, gender, socioeconomic status, and eating habits.<sup>7</sup>

Considering the aforementioned, and due to the lack of clarity about recognizing a pre-dementia process that begins with MCI, Petersen *et al.*<sup>8</sup> proposed diagnostic criteria to identify cognitive impairments that do not affect daily life activities

and suggest that MCI should be designated as a transition state between normal aging and dementia.<sup>9-12</sup>

This article presents the neuropsychological profile of a group of older adults with MCI at the Memory Clinic of the city of Neiva, Colombia. The objective of this clinic is to develop integral rehabilitation programs in mental health and offer a complementary treatment to the pharmacological, within the framework of investigative processes, led by a group at the Surcolombiana University. This approach includes the recovery or optimization of cognitive, occupational, social, and physical abilities, and is aimed at patients with cognitive disorders secondary to neurodegenerative diseases, vascular diseases, or sequelae of cranioencephalic trauma, and their families.

## Methods

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### Participants

The sample consisted of 69 older adults with an average age of 71.79 years (SD=7.88) and 2.76 years of schooling (SD=1.04). The group consisted of 78% females and 22% males. Out of these participants, 74% presented medical history of risk of arterial hypertension (54%), diabetes (11%), cardiopathies (7%), and cerebrovascular disease (1%), and a family medical history of dementia (18%), Parkinson's disease (7%), psychiatric background (3%), and other neurodegenerative conditions (2%). This sample of patients arises from the diagnostic process performed on 573 elderly people, of which 48% (275) did not present cognitive impairment, and 52% (298) were assessed in depth due to the suspicion of dementia in process. Of this remaining population (298), 23% were diagnosed with MCI according to the classification proposed by Petersen *et al.*<sup>8</sup> The research protocol and

informed consent were approved by the Research Ethics Committee of the Faculty of Health of the Surcolombiana University.

## Instruments

### Screening Instruments

Mini-Mental State Examination (MMSE).<sup>13</sup> A cut-off point between 23 and 24 was used, with a sensitivity and specificity of 87% and 82%, respectively.

Subjective Memory Complaints Questionnaire.<sup>14</sup> It is applied to one of the relatives and/or caregiver (who must be in permanent contact with the participant). The cut-off point is 19 and the maximum score is 45.

Lawton and Brody Scale. It evaluates the subject's ability to lead an independent life, and studies the patient's performance in order to correlate it with the cognitive skills he uses to access the context in which he is developing.<sup>15</sup>

Yesavage Geriatric Depression Scale. Allows a differential diagnosis with pseudodementia.<sup>16</sup>

### Complementary neuropsychological evaluation tests

Grober-Buschke Test. Test of explicit verbal memory with controlled coding that allows to register free recall and cued recall, phonological and semantic, in the short and long term.<sup>17</sup>

Cognitive CERAD.<sup>18</sup> Standardized in the Colombian population by the Neuroscience Research Group at the University of Antioquia.<sup>19</sup> It evaluates the following cognitive domains:

Language. It utilizes the 64 figures of the Boston Naming Test.<sup>20</sup> The subject must name objects, and the errors are classified into six categories: visual, semantic, visual-semantic, phonological, descriptive, and others.

Semantic fluency. It explores the generation of

active search strategies for information and word production from an established category.

Sustained attention. Search and visual tracking from the Trail Making Test (TMT) Part A, which allows to obtain the number of correct sequences in a maximum execution time of 120 seconds.<sup>21</sup>

Constructional apraxia and visual-spatial skills. Determined by the Rey-Osterrieth Complex Figure Test,<sup>22</sup> which allows to evaluate the execution and to assess the capacity to generate planning strategies and imitative capacity.

Executive functions. Categorization, conceptualization, planning, organization, and abstraction are evaluated with tests such as the Wisconsin, Raven, and WAIS (Wechsler Adult Intelligence Scale) subtests.

## Procedures

A screening process was initially performed to obtain the participants' cognitive processes baseline. Once this was completed, if there was a suspected cognitive impairment in a participant (value less than  $2 \pm SD$  in each of the tests), we proceeded to a complementary neuropsychological evaluation with a protocol standardized by the Neuroscience group of the University of Antioquia,<sup>23</sup> which was used in a study of the prevalence of dementia in Neiva's population over 60 years of age.<sup>24</sup>

After the complementary neuropsychological assessment, all the cases were submitted to study by an interdisciplinary team (neurologist, psychiatrist, and neuropsychologist), whose purpose was to establish a diagnosis with the support of MCI international criteria.<sup>25</sup>

## Results

First, the sociodemographic characteristics of the participants are described. Next, the scores obtained in the neuropsychological tests are evaluated, and the performance of the subjects is established with respect to the MCI subtype in which they are located. Finally, an inter- and intra-group comparison is performed for MCI subtypes in order to establish significant differences in the performance of the cognitive spheres evaluated.

### Neuropsychological profile

To determine the state of the cognitive functions of the participants, a descriptive analysis was performed for each of the cognitive domains evaluated.

The classification of optimal and low performance was based on a conversion of the gross scores in each of the tests that constitute the protocol used, taking into consideration the age, schooling, and the standardized scales for the Colombian population proposed by the research group of the University of Antioquia.<sup>19</sup> The direct scores that were below average for the age and schooling were considered low performance, and those that were above the mean were considered optimal performance. **Table 1** presents the performance of the participants in the cognitive domains.

### Language

It was found that 56.8% of the evaluated subjects exhibited low performance in the tasks of denomination, semantic fluency, and phonological fluency, with only 43.2% presenting optimal performance.

### Memory

In the memory of constructional praxis, 64.9% of the evaluated subjects presented low performance; likewise, 70.3% obtained low performance in the Rey complex figure test. Meanwhile, 97.3%

displayed optimal performance in the recognition of a list of words.

### Attention

In the Trail Making Test (TMT), 62.2% of those evaluated had low performance, and 86.5% used more time than expected for their age and schooling in the execution of the task, just as 78.4% did in the visual execution test.

### Constructional abilities

Though 62.2% had an optimal performance, the time spent for the execution of the test in the majority of the subjects was high, which is to say, there is a slowing down in this process.

### Executive functions

The 78.4% of the subjects obtained low performance in tests of calculation (WAIS) and the Wisconsin (64.9%); similarly, 62.2% of the population did not reach the number of categories indicated for age and schooling, and 59.5% had a low performance in the initial category index.

### Functional status assessment

The results of the functional status scales complement the diagnostic criteria for MCI proposed by Petersen et al.<sup>8</sup> Participants must be totally independent in their basic activities of daily living.

In the functional status assessment, 81.1% of the population shows no signs of depression, 64.9% of those evaluated are at level two of the functional state, and in relation to the other tests it is evident that the basic functions of daily life are not altered (100% of the population presents absence of disability), which is why they're considered MCI.

### Typifying the subtypes of MCI

Taking into consideration the analysis of the cognitive domains and the description of the

sample studied, participants were classified into subtypes of MCI. This was done through a rigorous review of the case and the standardized scales for the Colombian population, in order to verify the correspondence in 1.5 standard deviations of the expected mean for age and schooling in each of the tests, placing each subject in one of the sub-types to carry out an intragroup characterization with respect to age, schooling, origin, and gender. The distribution of the participants according to the classification of the subtypes of MCI is presented in **Figure 1**.

According to the classification with respect to MCI subtypes, we found in the evaluated sample a predominance of amnesic multiple domains with 49% belonging to this sub-type; the percentage for non-amnesic multiple domains was 35%, and 8% met the criteria for amnesic single domain as well as non-amnesic single domain.

In the amnesic single domain group, the most common age was that of 66.7% of participants, which were older than 70 years, and the remainder of the group's age range was from 60 to 69 years old; the participants included in the amnesic multiple domains sub-type were 55.6% aged between 60 and 69 years, and 44.4% were over 70 years; within the non-amnesic single domain group, 33.3% were aged 60 to 69 years and 66.7% older than 70; with regards to non-amnesic multiple domains, the majority of the participants (76.69%) were over 70 years and the minority (23.1%) were in the range of 60 to 69 years of age.

One hundred percent of the participants in the amnesic single domain group had basic primary schooling. In the group for amnesic multiple domains, 88.9% had basic primary schooling and 11.1% had some middle school. In the non-amnesic single domain group, the whole group had basic primary schooling. In the non-amnesic multiple domains group, 69.2% had basic primary and 30.8% had some middle school.

Intra- and inter-group comparison of neuropsychological characteristics (MCI subtypes) The statistical calculation was performed to know

the compliance with normality parameters; the calculated p value was  $p > 0.05$  according to the Shapiro-Wilk and the ANOVA statistic was applied. **Table 2** shows the comparison of intragroup neuropsychological characteristics.

The ANOVA shows that there is a statistically significant difference between the groups in the tests that evaluate the field of visual execution and praxis; with  $p=0.001$  in the recollection of constructional praxis,  $p=0.016$  in the execution of constructional praxis, and  $p=0.027$  in the execution of the Rey figure test, the significant difference clearly shows that the dependent variable is directly related to the independent variables in the study. With respect to the remaining tests, there are no significant differences between groups.

## Discussion

The human being, from the perspective of the life cycle, transits through different stages. In later adulthood, there are changes that relate to these stages, among which is the slowing down of cognitive processes such as attention, memory, visuoconstruction abilities, and executive functions. These changes can become significant and generate cognitive alterations that affect the older adult's general performance. Experts in the subject have named these subtle changes MCI, which is characterized by a clinical picture consisting of the decrease of one or more cognitive functions without affectation in the activities of daily living.<sup>26</sup>

Petersen *et al.*<sup>8</sup> propose as criteria for MCI diagnosis that there should be a cognitive concern on the part of the patient or an informant, a decline in cognitive functions, intact daily life activities, and no pathological, neurological, or psychiatric alteration to explain the deterioration. Furthermore, they classify MCI into four sub-types taking into consideration the cognitive domain: amnesic single domain MCI, amnesic multiple

Table 1. Cognitive profile.

	Test applied	Performance	Percentage
Language	Denomination	Low	56.80%
		Optimal	43.20%
	Semantic Fluency	Low	56.80%
		Optimal	43.20%
	Phonological Fluency	Low	56.80%
		Optimal	43.20%
Memory	Memory of a list of words	Low	40.50%
		Optimal	59.50%
	Total Intrusions of the Word Listing	Low	48.60%
		Optimal	51.40%
	Recognition of the correct words list	Low	35.10%
		Optimal	64.90%
	Recognition of the incorrect words list	Low	2.70%
		Optimal	97.30%
	Recollection of constructional praxis	Low	64.90%
		Optimal	35.10%
Attention	Rey-Osterrieth complex figure test (Total score)	Low	70.30%
		Optimal	29.70%
	Trail Making Test (Correct Answers)	Low	62.20%
		Optimal	37.80%
	Trail Making Test (Time)	Low	86.50%
		Optimal	13.50%
	Visual Execution Test (Correct Answers)	Low	32.40%
		Optimal	67.60%
	Visual Execution Test (Omissions)	Low	32.40%
		Optimal	67.60%
	Visual Execution Test (Time)	Low	78.40%
		Optimal	21.60%
Visuoconstruction abilities	Constructional Praxis	Low	37.80%
		Optimal	62.20%
	Rey-Osterrieth complex figure test (Time)	Low	64.90%
		Optimal	35.10%
	Rey-Osterrieth complex figure test (Total score)	Low	32.40%
		Optimal	67.60%

	Test applied	Performance	Percentage
Executive Functions	Raven-A	Low	40.50%
		Optimal	59.50%
	WAIS Arithmetic	Low	78.40%
		Optimal	21.60%
	Wisconsin correct hits	Low	64.90%
		Optimal	35.10%
	Wisconsin errors	Low	45.90%
		Optimal	54.10%
	Wisconsin categories	Low	62.20%
		Optimal	37.80%
	Wisconsin perseverative responses	Low	32.40%
		Optimal	67.60%
	Wisconsin Initial Conceptualization Index	Low	59.50%
		Optimal	40.50%
	Wisconsin Total Attempts	Complete	83.80%
		Incomplete	16.20%

**Table 2.** ANOVA statistical values for the comparison of neuropsychological characteristics between the groups (MCI subtypes).

Test	F	Sig.
Mini-Mental	0.571	0.638
Denomination	2.019	0.13
Memory of list of words	1.373	0.268
Constructional Praxis	3.97	0.016
Recollection of list of words	0.467	0.707
Recollection of constructional praxis	7.461	0.001
Trail Making Test (Time)	0.973	0.417
Visual Execution Test (Time)	2.445	0.081
Rey-Osterrieth complex figure test (Time)	0.356	0.785
Rey-Osterrieth complex figure test (Total score)	3.46	0.027
Semantic Fluency	0.451	0.719
Phonological Fluency	1.232	0.314
Raven-A	1.399	0.26
WAIS Arithmetic	1.478	0.238
Wisconsin correct hits	2.431	0.083
Wisconsin errors	1.626	0.202
Wisconsin perseverative responses	0.811	0.497

F = Statistical Value

Sig. = Statistical Significance

domains MCI, non-amnestic single domain MCI, and non-amnestic multiple domains MCI.<sup>27</sup>

The participants classified in the non-amnestic single domain MCI group had low grades in tests of denomination, semantic fluency, phonological fluency, and visuoconstruction execution, evidencing predominantly cognitive affectation of language. The group classified in the subtype non-amnestic multiple domains presented low performance in denomination tests, sustained attention, executive functions, and visuoconstruction execution, which indicate more than one altered cognitive sphere.

In the analysis performed with ANOVA at the inter- and intra-group level, we verified significant differences between the groups in the execution of constructional praxis tests as much in memory as in copying, and in the elaboration of the complex Rey figure; this shows that the dependent variable meets the criterion of being directly influenced by the independent variables present in the study. This verifies that the initial classification, product of case studies, gives an important value to the clinical findings and helps establish a clear diagnostic criterion.<sup>28</sup>

In Colombia, research has shown how, over the years, cognitive processes deteriorate and may become clinically significant.<sup>29,30</sup> In these studies, the cognitive profile of a group of older adults was established and it was concluded that, at an older age, performance declines in attention, language, memory, and executive functions; similarly, the neuropsychological evaluation showed that the participants presented a decline in cognitive spheres, such as language, with low performance in the denomination, phonological fluency, and semantics tests.

With regards to memory, the remarkably inferior performance was presented at the recollection of constructional praxis and the complex Rey figure; as for attention, low results were found in the performance of the trail making test, the visual execution test (time), and the complex Rey figure test. With respect to the executive functions, a low

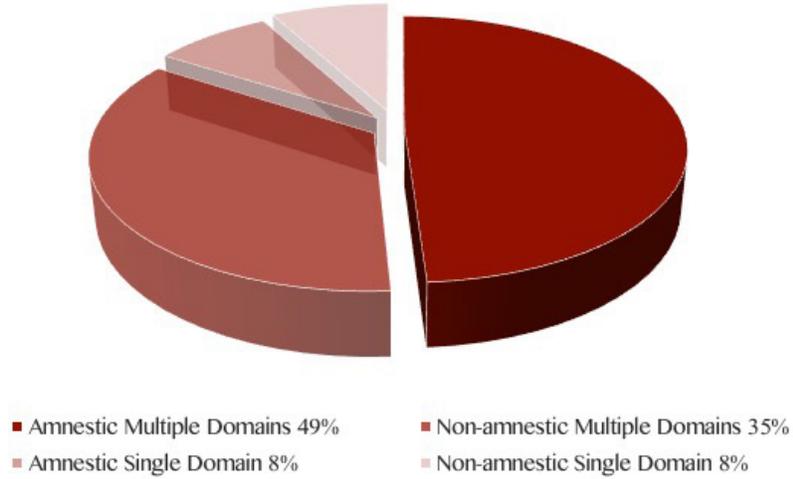
performance was evident in the WAIS arithmetic and the Wisconsin card classification tests.

In different studies, it was found that patients with amnestic MCI had poor performance in memory tests (episodic predominance), while non-amnestic multiple domains had more difficulty with language tasks.<sup>31-33</sup> These findings are similar to the present study because the evaluated subjects exhibited low performance in tests related with semantic and phonological fluency; in the amnestic multiple domains group, they had low performance in language, memory, and attention.

Regarding schooling as a variable to be analyzed regarding cognitive decline, many studies show that the higher the schooling, the lower the impairment in cognitive performance.<sup>11,33,34</sup> This is corroborated in the present investigation because the range of schooling is low, having been considered a risk factor and a trigger of this clinical picture.

The affected areas in the participants in multiple domains MCI show decline in memory, attention, language, and visuoconstructional abilities, among others. These processes are also affected in the amnestic multiple domains MCI with a greater decline in amnestic processes. When comparing the aforementioned figures, and taking into account that the present study does not estimate prevalence, it is necessary to recognize the similarity in the results obtained and the usefulness of the case study to make more accurate diagnoses.<sup>28</sup>

Figure 1. Population distribution according to the classification of the MCI subtypes.



### Conflict of interest statement

The authors declare there are no relevant conflicts of interest in this study.

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