Article

Examining Memory Performance in Senior Adults: A Comparative Cross-Sectional Study

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Featured Application: Development of screening tools and assessment protocols to identify individuals at risk of cognitive decline and depression, allowing for early intervention and support. Ultimately, enhance the quality of life and cognitive health for older adults by guiding the development of targeted interventions and support strategies.

Abstract: This study investigates memory performance among 73 adults over 60 years old, utilising Memory Impairment Screening (MIS) and self-reported memory failures assessed by the Memory Failures in Everyday questionnaire (MFE-28). Participants were divided into four groups: individuals with depressive symptoms, healthy individuals, individuals with depressive symptoms and mild cognitive impairment, and individuals with mild cognitive impairment only. Groups were organised according to their Montreal Cognitive Assessment (MoCA) and the 15-item Geriatric Depression Scale (GDS-15) scores. The study aims to analyse MIS scores and self-reported memory failures across these groups as measured with the 28-item Memory Failures Everyday (MFE-28) scale. Correlation analyses were conducted for the complete sample, while variance analyses were carried out for the four classification groups above. Bivariate linear regression analysis was carried out to explore how the combination of cognitive and depressive symptoms status influenced memory performance. Results show that subjective memory complaints and memory performance are related to depressive symptoms, and the latter is associated with worse cognitive performance. Lastly, our study highlights that individuals with mild cognitive impairment and depressive symptoms exhibit worse performance in recall tasks and report more subjective memory complaints compared to those with mild cognitive impairment alone.

Keywords: depression; mild cognitive impairment; memory; elderly; free recall; subjective memory complaints

1. Introduction

According to the World Health Organisation, depression is a common illness worldwide, affecting an estimated 3.8% of the population, including 5% of young adults and 5.7% of adults over 60 years of age. Worldwide, approximately 280 million people have depression. In Spain, the incidence among those 25 to 64 years old is 6.7% of the population, and 12.8% in those over 65 years of age. In Spain alone, by mid-2021, 2.1 million people were suffering from depression, according to the European Health Survey, whose data were released by the National Statistics Institute in 2022.

Depression commonly occurs among people with mild cognitive impairment and has been found in 30% to 45% of patients with mild cognitive impairment. More than 20% of patients with mild cognitive impairment develop into dementia within three years [1].

Multiple studies evidence how depressive symptomatology contributes to further cognitive impairment [2,3] and that depression in elders is associated with cognitive deficits and increased risk for cognitive decline [4]. It has been evidenced that patients with depression and mild cognitive impairment show poorer cognitive function than non-depressed patients with mild cognitive impairment in some cognitive domains, and that improvement in depression is related to the improvement or prevention of deterioration in cognitive measures [5]. It is also evident that cognitive function should be taken into consideration in evaluation and treatment, as mental health-related quality of life is significantly impacted not only by the severity of depressive symptoms but also by the cognitive impairment observed in them. Consequently, there has been a notable shift in clinical research toward including cognitive improvements as primary endpoints for future trials [6].

Subjective memory complaints and performance, and their relationship with depressive symptoms have also been extensively studied. A study carried out with 63 individuals aged between 61 and 86 years (38 women and 25 men) who reported memory concerns [7] showed that subjects diagnosed with medical depression (MDD) had the most memory complaints, whereas the worst objective memory performance was experienced by subjects with mild cognitive impairment (MCI). The level of awareness in relation to memory performance was a discriminating indicator between MDD and MCI ($p < 0.05$) but not between MDD and clinical controls ($p > 0.05$). MDD subjects tended to underestimate their memory functioning as compared to controls ($p < 0.05$). On the other hand, a longitudinal analysis from the Berlin Ageing Study showed that there is little evidence for links between memory complaints and memory performance in very old age [8]. Another study [9] evidenced a consistent relationship between how people perceived their memory capabilities, their actual memory performance, and their level of depressive symptoms. When looking at individual changes over time, occasions where someone performed better on memory tests or reported fewer depressive symptoms than usual were associated with higher subjective memory ratings. This suggests that people tend to rate their memory abilities higher when they are feeling better mentally and when their memory performance is better. Furthermore, individuals who had functional limitations were more sensitive to changes in their memory performance and depressive symptoms over time, which could evidence that changes in memory performance and depressive symptoms have a bigger impact on how memory capabilities are perceived. Overall, the results indicate that changes in how people perceive their memory over time are influenced by both changes in their actual memory performance and changes in their mood. Indeed, older people with subjective memory concerns and objective short-term verbal memory decline do not fully overlap [10]. Memory complaints may reflect early cognitive impairment or normal ageing, but they are also included among the depressive symptoms used for diagnosis [11]. In fact, memory complaints frequently have stronger associations with depressive symptoms than with objective cognition [12]. These results were also confirmed by Wang et al. [13] in a study that evidenced that subjective memory complaints were associated with poorer objective memory performance, even after controlling the effect of depression and demographic data, but they did not predict faster cognitive decline or dementia over 3 years.

The main objective of this study is to analyse the relationships and differences in Memory Index Score (MIS) values and self-reported memory failures, taking into account MCI and depressive symptoms in people over 60 years of age, and to investigate the existence of relationships or differences according to gender, educational level, residence, and marital status. Thus, the research question (RQ) addressed by this study is as follows:

RQ: How do memory performance vary with MCI and depressive symptoms in individuals over 60 years of age, and what are the relationships or differences according to socio-demographic status?

MIS is a standard tool used to evaluate memory function as part of a broader cognitive assessment, typically administered by healthcare professionals. MIS focuses specifically on memory function to identify potential memory-related issues. It provides a standardised measure of memory function, allowing healthcare professionals to identify potential mem-
ory impairments or changes over time. This information is valuable in diagnosing cognitive disorders, tracking disease progression, and evaluating the effectiveness of interventions or treatments.

2. Materials and Methods

An overview of the study’s design is discussed below, including a detailed description of the study participants, as well as the criteria for participant inclusion and exclusion. In order to ensure the validity and reliability of the findings, rigorous criteria were employed to determine the eligibility of individuals for participation in the study. Additionally, a thorough description of the study sample is provided, offering insight into the demographic characteristics, medical history, and other relevant factors pertaining to the participants involved in the research. Finally, the measurement instruments utilised and the statistical analysis approach are briefly discussed.

2.1. Sample Description

A total of 73 people participated. Thirty participants were recruited in two day centres in Vigo, namely, Parque Castrelos and Os Cortizos. An additional recruitment campaign was implemented in the same area through the presentation of informative material, which made possible the inclusion of 43 volunteers not affiliated with these day centres. All participants gave their informed consent prior to their participation in the study, the protocol having been previously approved by the Ethics Committee of Galicia (2023/503), thus ensuring compliance with the respective ethical regulations and the protection of the participants’ privacy. The geographical area where participants were enrolled does not possess unique demographic, cultural, or socio-economic characteristics that distinguish it from other urban–rural areas in Western Europe. However, its applicability to other regions worldwide remains uncertain. Nonetheless, the sample reasonably reflects the male and female distribution within the general population of that age group (60 to 99 years) in Western Europe.

This study was designed as a cross-sectional study in which all participants were assessed in one session by means of the Memory Failures in Everyday questionnaire (MFE-28 [14]), the Lawton and Brody scale [15], MoCA and 15-item Yesavage geriatric depression scale (GDS-15). The individual sessions lasted approximately 30 min. Data collection began in February 2024 and was carried out until the end of March 2024. Participants who did not provide clinical diagnosis details were evaluated by a psychologist with specific training in psychogerontology.

Participants ranged in age from 60 to 99 years (mean = 75.78 ± 9.161). Of the participants, 30% (22) were male and 69.9% (51) female. The percentage of participants with depressive symptomatology and MCI was 28.8% (21), the percentage of people suffering from depressive symptoms without MCI was 13.7% (10), and the group of people with MCI represented 17.8% of the sample (13 participants), while 39.7% (29) were healthy people with neither MCI nor depressive symptoms. The participants’ distribution in study groups and the description of the sociodemographic variables are collected in Tables 1 and 2.

Table 1. Participants’ sociodemographic characteristics.

<table>
<thead>
<tr>
<th></th>
<th>D+MCI+ n = 21</th>
<th>D+MCI− n = 10</th>
<th>D−MCI+ n = 13</th>
<th>D−MCI− n = 29</th>
<th>n = 73</th>
<th>p</th>
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<tbody>
<tr>
<td>Educational level</td>
<td></td>
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<tr>
<td>&lt;12</td>
<td>95.2% (20)</td>
<td>80% (8)</td>
<td>69.2% (9)</td>
<td>44.8% (13)</td>
<td>50</td>
<td>0.002</td>
</tr>
<tr>
<td>&gt;12</td>
<td>4.8% (1)</td>
<td>20% (2)</td>
<td>30.8% (4)</td>
<td>55.2% (16)</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Household</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>LA</td>
<td>33.3% (7)</td>
<td>20% (2)</td>
<td>15.4% (2)</td>
<td>31% (9)</td>
<td>20</td>
<td>0.624</td>
</tr>
<tr>
<td>LWO</td>
<td>66.7% (14)</td>
<td>80% (8)</td>
<td>84.6% (11)</td>
<td>69% (20)</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>
Table 1. Cont.

<table>
<thead>
<tr>
<th></th>
<th>D+MCI+ n = 21</th>
<th>D+MCI− n = 10</th>
<th>D−MCI+ n = 13</th>
<th>D−MCI− n = 29</th>
<th>n = 73</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>Marital status</td>
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<tr>
<td>Married</td>
<td>23.8% (5)</td>
<td>50% (5)</td>
<td>46.2% (6)</td>
<td>44.8% (13)</td>
<td>29</td>
<td>0.835</td>
</tr>
<tr>
<td>Single</td>
<td>14.3% (3)</td>
<td>–</td>
<td>–</td>
<td>6.9% (2)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td>61.9% (13)</td>
<td>50% (5)</td>
<td>46.2% (6)</td>
<td>27.6% (8)</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>–</td>
<td>–</td>
<td>7.7% (1)</td>
<td>20.7% (6)</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28.6% (6)</td>
<td>30% (3)</td>
<td>46.2% (6)</td>
<td>24% (7)</td>
<td>22</td>
<td>0.001</td>
</tr>
<tr>
<td>Female</td>
<td>71.4% (15)</td>
<td>70% (7)</td>
<td>53% (7)</td>
<td>75.9% (22)</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>Age (Mean)</td>
<td>75.78 ± 9.161</td>
<td>81.90 ± 9.08</td>
<td>74.00 ± 8.08</td>
<td>76.46 ± 9.15</td>
<td>71.66 ± 7.26</td>
<td></td>
</tr>
</tbody>
</table>

1 LA: living alone. LWO: living with others; p: Kruskal–Wallis p-values.

Table 2. Means and standard deviations on tests by classification group.

<table>
<thead>
<tr>
<th></th>
<th>D+MCI+ n = 21</th>
<th>D+MCI− n = 10</th>
<th>D−MCI+ n = 13</th>
<th>D−MCI− n = 29</th>
<th>n = 73</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoCA (0–30)</td>
<td>13 ± 4.7</td>
<td>21.4 ± 5</td>
<td>16.3 ± 3.71</td>
<td>24 ± 3.5</td>
<td>19 ± 6.3</td>
<td>0.000</td>
</tr>
<tr>
<td>GDS-15 (0–15)</td>
<td>7 ± 3.60</td>
<td>6.9 ± 2.6</td>
<td>2.3 ± 2.5</td>
<td>1.4 ± 1.4</td>
<td>4 ± 3.66</td>
<td>0.000</td>
</tr>
<tr>
<td>MFE-28 (0–56)</td>
<td>25.3 ± 15.7</td>
<td>15 ± 9</td>
<td>13 ± 9</td>
<td>10.3 ± 6.9</td>
<td>15.82 ± 12.33</td>
<td>0.002</td>
</tr>
<tr>
<td>Lawton &amp; Brody (0–8)</td>
<td>4 ± 2.8</td>
<td>6 ± 2.6</td>
<td>5.6 ± 2.4</td>
<td>7.7 ± 0.6</td>
<td>6.11 ± 2.55</td>
<td>0.000</td>
</tr>
<tr>
<td>Free Recall (0–5)</td>
<td>0.38 ± 0.7</td>
<td>1.6 ± 1.34</td>
<td>1.3 ± 1.1</td>
<td>2.1 ± 1.64</td>
<td>1.41 ± 1.47</td>
<td>0.000</td>
</tr>
<tr>
<td>Categorical cue (0–5)</td>
<td>0.9 ± 0.9</td>
<td>1.2 ± 1.39</td>
<td>0.9 ± 0.7</td>
<td>0.68 ± 0.84</td>
<td>0.86 ± 0.94</td>
<td>0.628</td>
</tr>
<tr>
<td>Recognition cue (0–5)</td>
<td>1.8 ± 1.2</td>
<td>1.6 ± 1.6</td>
<td>1.7 ± 1.36</td>
<td>1.55 ± 1.27</td>
<td>1.67 ± 1.31</td>
<td>0.836</td>
</tr>
<tr>
<td>Total MIS (0–15)</td>
<td>4.76 ± 3.38</td>
<td>8.8 ± 3.9</td>
<td>6.9 ± 2.6</td>
<td>9.3 ± 3.9</td>
<td>7.52 ± 4.02</td>
<td>0.001</td>
</tr>
</tbody>
</table>

p: Kruskal–Wallis p-values.

2.2. Inclusion and Exclusion Criteria

The inclusion factors utilised to select the participants in this study are enumerated below. These criteria served also as a reference to define the groups under study.

D+MCI+ Persons with depressive symptoms and MCI. Individuals with a diagnosis of depression (MDD) reported by a health professional or previous clinical history; Yesavage Geriatric Depression Scale (GDS-15) score greater than 5 (indicative of depression); MoCA score 1.5 deviations below the population mean according to age and educational level (i.e., level 3 in Reisberg’s Global Deterioration Scale, GDS).

D+MCI− Persons with depressive symptoms without MCI. Individuals with MDD reported by a health professional or previous clinical history; GDS-15 score greater than 5; MoCA score in the parameters of normality according to age and educational level (i.e., GDS 1).

D−MCI+ Individuals with no depressive symptoms but experiencing MCI. No diagnosis of depression; GDS-15 score less than or equal to 5; MoCA score 1.5 deviations below the mean.

D−MCI− Healthy group control. Persons without depressive symptoms or MCI. No diagnosis of depression; GDS-15 score less than 5; MoCA score between 1.5 deviations below the population mean (Reisberg’s GDS 3).

All participants were 60 years of age or older and were located in the Vigo area, Spain. The exclusion factors are enumerated below:

- Patients with psychiatric diagnosis, different from the inclusion criteria for D+MCI+ and D−MCI+ groups.
- Dementia diagnosis.
- Hearing or vocal disability.
- People incapable of consenting to the study.

Subjects enrolled in daycare centres for the elderly (cf. Section 2.1 below) provided the needed clinical diagnosis details for their classification. However, participants external to
the day centres were classified according to the cut-off points of the GDS-15 and MoCA scales. In the latter case, a more accurate cut-off point was utilised, according to the normative data in [16].

Note that only subjects meeting the inclusion criteria were invited to participate. Participants in daycare centres were pre-selected in coordination with their caretakers as pointed out above, and only attendees satisfying the inclusion criteria were considered. External healthy controls responded to a call for participation published at the participating daycare centres and senior associations. The call explicitly stated the inclusion criteria, and all respondents met them.

2.3. Measurement Instruments

The Geriatric Depression Scale, commonly known as the GDS, is a tool used to assess the presence and severity of depressive symptoms in older adults. It does not provide a definitive diagnosis but can be a valuable tool for identifying individuals who may require further assessment or treatment. Developed by psychiatrist Jerome Yesavage [17], GDS has become one of the most widely used tools in the assessment of depression in older adults because of its simplicity and effectiveness. The original scale consists of 30 dichotomous (yes/no) questions designed to assess depressive symptoms common in the geriatric population. The questionnaire has been adapted over time in different versions, including a short version of 15 questions and other shorter versions. In this study, the short 15-item version was utilised. The test lasts about 5–7 min.

The MoCA (Montreal Cognitive Assessment, MoCA Test, Inc., Québec, Canada) was designed as a screening instrument for cognitive impairment. It assesses various cognitive domains such as visuospatial/executive skills, attention, memory, orientation, language, abstraction, and delayed recall. The test can be completed in approximately 10 min and has a maximum score of 30 points. The cut-off point in the Hispanic context is 20/21 to discriminate between normality and MCI, while scores of 17/18 are the differential point between MCI and dementia [18]. As pointed out above, in the present study, the normative data collected in [16] would be used. A score below 1.5 standard deviations in relation to age and educational level will be considered an indication of cognitive impairment.

The Memory Index Score (MIS) is a subscore of MoCA that assesses memory recall and provides clinical information about the nature of memory deficits. For memory deficits due to retrieval failures, performance may improve with a cue, while for those deficits due to encoding failures, performance does not improve with cues. MIS is divided into three components, namely, recall without a cue, recall with a categorical cue, and recall with a multiple-choice cue. In the first, the score is obtained by multiplying the number of hits by 3. In the second, the score is obtained by multiplying the hits by 2. Finally, in the multiple choice cue, the score is just the addition of the score of the individual items. The total score is calculated by adding the scores obtained in each of these components, with the maximum possible being 15 points.

MFE-28 is a self-administered questionnaire used to evaluate metamemory, that is, the subjective assessment that participants make about their own memory. It was developed in 1983 [19] and had 35 items. Subsequently, the 28-item version was developed, which is currently the most widely used and has been adapted for the Spanish population [20]. The categories of forgetfulness included are “speaking, reading and writing”, “names and faces”, “actions” and “learning new things”. In this study, it was administered using a 3-option Likert scale [21].

The Lawton and Brody scale is used to evaluate the capacity to carry out instrumental activities of daily living; its maximum score is 8, indicating total independence.

2.4. Statistical Analysis

Statistical analysis was carried out using IBM SPSS Statistics 24 software. Descriptive statistics were obtained for each of the sociodemographic variables included in the study. Correlations were examined by means of the Pearson’s correlation coefficient between
cognitive and functional assessment tests, including the Lawton and Brody questionnaire, MFE-28, GDS-15, MoCA, memories without cue, memories with categorical cue and with multiple-choice cue, as well as MIS total score across the entire sample, without subgroup distinctions. In addition, the internal consistency of GDS-15 and MoCA was assessed using Cronbach’s alpha coefficient ($\alpha_C$).

Normality analyses were performed using the Kolmogorov–Smirnov test to assess the distribution of the data. Since the data did not follow a normal distribution, nonparametric tests were chosen to test the hypotheses. The Kruskal–Wallis and Mann–Whitney U tests were used to examine differences in means across all groups, aiming to observe disparities concerning MIS and its internal scores (free recall, categorical cue, and recognition) Lawton scale and MFE-28.

Multivariate regression analysis was carried out to study the relation between the MoCA and GDS-15 test scores utilised to define the study groups (i.e., independent variables) on MFE-28, MIS and Lawson and Brody scores (i.e., dependent variables), and to understand whether they individually and collectively have a significant impact on MFE-28, MIS and Lawson and Brody scores.

3. Results

Table 1 shows the descriptive analyses of the sociodemographic variables included in this study. Table 2 collects the mean values and standard deviations for each of the tests used.

With respect to the dataset’s internal consistency, the calculated value of Cronbach’s alpha coefficient for the MoCA test was $\alpha_C = 0.84$ and that of GDS-15 was $\alpha_C = 0.845$, suggesting a high degree of internal consistency in both tests [22].

The existence of correlations between GDS-15 score, MFE-28 and types of memory recall was tested for the entire sample, revealing negative correlations between uncued recall and both tests ($p < 0.001$). In addition, there exist significant correlations between the MIS total score, and MFE-28 and GDS-15 ($p < 0.001$). No significant correlations were found in the recall scores with categorical cue and multiple-choice recall. Specifically, in cue-free recall, there are significantly moderate correlations with MFE-28 ($r = -0.382, p < 0.001$) and GDS-15 ($r = -0.307, p = .008$). These correlations indicate that lower uncued recall is associated with a higher number of subjective memory complaints and more pronounced symptoms of geriatric depression.

As for total MIS scores, correlations are found with MFE-28 ($r = -0.451, p < 0.001$) and GDS-15 ($r = -0.331, p = 0.004$). These correlations suggest that a lower MIS score is associated with a higher number of subjective memory complaints and more pronounced symptoms of geriatric depression. MFE-28 shows a moderately strong significant correlation with GDS-15 ($r = 0.496, p < 0.001$) and a significantly inverse strong correlation with the MoCA ($r = -0.540, p < 0.001$). This indicates that a higher number of subjective memory complaints is associated with more pronounced symptoms of geriatric depression and worse performance on cognitive evaluation. Finally, GDS-15 shows a significant correlation with MoCA ($r = -0.409, p < 0.001$). This suggests that more pronounced symptoms of geriatric depression are associated with worse performance on cognitive assessment.

As for sociodemographic variables, there is a significant negative correlation between age and MoCA ($r = -0.667, p < 0.001$) indicating that as age increases, MoCA scores tend to decrease. On the other hand, age correlates positively with MFE-28 ($r = 0.422, p < 0.001$), that is, as age increases, subjective memory complaints also increase. There is also a significantly positive correlation between educational level and MoCA ($r = 0.505, p < 0.001$), while there is a significantly negative correlation with GDS-15 ($r = -0.359, p < 0.001$), suggesting that the higher the educational level, the less depressive symptomatology is reported (cf. Table 3). No correlations were found for marital status or for whether participants live alone or accompanied.
Table 3. Study correlations. Pearson coefficients and significance. Correlations were computed for the whole sample. Age (60 to 99) and educational level (5 to 20 years) were taken into account to estimate the MCI cut-off point for the 43 external users of the healthy control group, but some subjects provided scores below the ones expected, or exhibited depressive symptomatology.

<table>
<thead>
<tr>
<th></th>
<th>MFE-28</th>
<th>GDS-15</th>
<th>MoCa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Recall (0–5)</td>
<td>-0.382 (p = 0.001)</td>
<td>-0.307 (p = 0.008)</td>
<td>-</td>
</tr>
<tr>
<td>Total MIS (0–15)</td>
<td>-0.451 (p = 0.000)</td>
<td>-0.331 (p = 0.004)</td>
<td>-</td>
</tr>
<tr>
<td>MFE-28</td>
<td>-</td>
<td>0.496 (p = 0.000)</td>
<td>-0.540 (p = 0.000)</td>
</tr>
<tr>
<td>GDS-15</td>
<td>-</td>
<td>-</td>
<td>-0.409 (p = 0.000)</td>
</tr>
<tr>
<td>Age</td>
<td>0.422 (p = 0.000)</td>
<td>-</td>
<td>-0.667 (p = 0.000)</td>
</tr>
<tr>
<td>Educational level</td>
<td>-</td>
<td>-0.359 (p = 0.002)</td>
<td>0.505 (p = 0.000)</td>
</tr>
</tbody>
</table>

A normality analysis was also performed by means of the Kolmogorov–Smirnov test, to check the type of distribution of the variables analysed. The variables analysed had a non-normal distribution, so non-parametric statistical tests were utilised for hypothesis testing.

Contrast tests for analysis of variance were carried out by studying the difference in means between study groups for the results of MIS, types of recall and scores obtained in MFE-28. The means of these two tests are represented for each of the study groups in Figure 1. Significant differences between the four groups were found using the Kruskal Wallis test for independent samples on the variables in the case of recall without cue (p = 0.000), MIS (p = 0.001), MFE-28 (p = 0.002), and Lawton (p = 0.000). Recall with categorical cues and multiple choice did not differ significantly among groups.

![Figure 1](image1.png)

**Figure 1.** (a) Differences among groups on MFE-28 and MIS performance. (b) Scores on types of memories measured with MIS.

In order to identify the groups in which means differed significantly, the Mann–Whitney U test for two independent samples was applied between the combinations of the four groups (cf. Figure 2). The most significant differences were evident between the MCI+ individuals with depressive symptoms (D+) and without depressive symptoms (D−) in terms of recall without cues (p = 0.008) and MFE-28 scores (p = 0.024). Individuals with depressive symptoms and MCI showed poorer performance on recall without cues (M = 0.38) and reported higher subjective memory complaints (M = 25.3) compared to those without depressive symptoms and MCI.

Moreover, there were differences between the D+/MCI+ and D−/MCI− groups, with higher complaint scores observed in MFE-28 (p = 0.000) and increased dependency noted in Lawton and Brody scores (p = 0.000), among individuals with depressive symptoms and MCI. Additionally, variations in Lawton scale scores (p = 0.006) were noted for the D−/MCI+ group when compared to healthy individuals.
Figure 2. Significant differences among the study groups.

Additionally, a bivariate regression analysis was carried out to study the individual effects of the variables used for classification (i.e., MoCa and GDS-15 scores) on the MFE-28, MIS and Lawton and Brody scores. In other words, the analysis served to explore how the combination of MCI and depressive symptoms status influenced memory performance. Table 4 collects the regression parameters and t-values obtained.

Table 4. Bivariate regression analysis parameters.

<table>
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<tr>
<th></th>
<th>$\beta_0$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$R^2$</th>
<th>$\epsilon$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total MIS (0–15)</td>
<td>$-1.222 \pm 1.323$</td>
<td>$0.463 \pm 0.056$</td>
<td>$-0.037 \pm 0.096$</td>
<td>0.549</td>
<td>2.73759</td>
</tr>
<tr>
<td></td>
<td>($t = -0.924$)</td>
<td>($t = 8.266$)</td>
<td>($t = -0.387$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFE-28</td>
<td>$26.595 \pm 4.747$</td>
<td>$-0.793 \pm 0.201$</td>
<td>$1.109 \pm 0.346$</td>
<td>0.383</td>
<td>9.825</td>
</tr>
<tr>
<td></td>
<td>($t = 5.603$)</td>
<td>($t = -3.943$)</td>
<td>($t = 3.206$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lawton &amp; Brody</td>
<td>$0.485 \pm 0.822$</td>
<td>$0.299 \pm 0.035$</td>
<td>$-0.028 \pm 0.060$</td>
<td>0.570</td>
<td>1.702</td>
</tr>
<tr>
<td></td>
<td>($t = 0.590$)</td>
<td>($t = -3.943$)</td>
<td>($t = -0.475$)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$s = \beta_0 + \beta_1 \cdot \text{MoCa} + \beta_2 \cdot \text{GDS15} + \epsilon$, with $s \in \{\text{MFE28, MIS, Lawton&Brody}\}$.

In the case of MIS scores, the obtained correlation factor $R = 0.741$ indicates a strong correlation between the predictor variables and the dependent variable (MIT total score). $R^2 = 0.549$ shows that 54.9% of the variability in MIS total score can be explained by the predictor variables. We can also observe that, according to the t-values obtained, MoCa is a significant predictor variable for the MIS total score, and GDS-15 is not a significant predictor variable for that score.

When analysing the adjusted plane for MFE-28, we see that $R = 0.619$ indicates a moderate correlation between the predictor variables and this score, while 38.3% of the variability in this score can be explained by the predictor variables. Both GDS-15 and MOCA are significant predictor variables for MFE-28, with GDS-15 having a positive effect and MoCa a negative one. The constant term ($\beta_0 = 26.595$, $p < 0.001$) is statistically significant, suggesting that when MOCA and GDS-15 are held at zero, the baseline level of MFE-28 is significantly different from zero.

With respect to the Lawton scores, we also observe a strong correlation between the predictor variables and Lawton’s, and 57% of the variability Lawton scores can be explained by the predictor variables. Again, only the MoCA score is a significant predictor in this case.
4. Discussion

The internal consistency of MoCA ($\alpha = 0.84$) agrees with the values reported by other authors [23–25]. On the other hand, the GDS-15 value obtained was $\alpha = 0.845$ but the internal consistency of this scale usually has values between 0.70 and 0.80 [26–28].

The study by Dillon et al. [29] involving 5000 people over nine years highlights how people with depression tend to have worse memory for positive events, enhanced memory for negative events, and generalised memory impairment [30]. The results obtained in this study reflect that poorer uncued recall is linked to more pronounced symptoms of geriatric depression and a greater number of subjective memory complaints. This suggests that the ability to recall information unaided is related to individuals’ perception of their own memory and emotional state. Furthermore, we observed that a lower MIS score is associated with a higher number of subjective memory complaints and more pronounced symptoms of geriatric depression.

Some studies suggest that people suffering from depression tend to have lower hippocampal volume or insufficient dopamine compared to healthy subjects and, consequently, problems in recall. Stress is a common trigger of initial depressive episodes, and chronic stress can suppress hippocampal neurogenesis and inhibit dopaminergic neurons [31,32]. Our results reflect that more pronounced symptoms of geriatric depression are associated with worse performance on cognitive assessment and a higher number of subjective memory complaints. On the other hand, complaints are also negatively related to cognitive performance, suggesting a bidirectional relationship between mental health and cognitive functioning in this population [9]. Our results follow the line of other studies in which perceived memory decline predicted future depressive symptoms [11,33], which evidence how depression and memory complaints are strongly associated in the presence of cognitive impairment [31], suggesting that subjective memory complaints are associated with sub-syndromal depression and anxiety in cognitively healthy older adults.

Similar to the study by Yoon S et al. involving 161 patients divided into depressive and non-depressive groups [5], the results obtained in this research suggest that people with depressive symptoms and MCI present worse performance in recall and cognitive functions compared to people with MCI but no depressive symptoms. In our study, we found significant differences in the performance of the free recall test between individuals with MCI who also have depressive symptoms and those without depressive symptoms. The performance of individuals with depressive symptoms (D+/MCI+) was significantly worse compared to those without depressive symptoms (D−/MCI+). Moreover, individuals diagnosed with both MCI and depressive symptoms exhibited a higher prevalence of subjective memory complaints compared to those diagnosed solely with MCI. Various studies indicated a positive correlation between depression and subjective memory complaints, suggesting that depressive symptoms may contribute to an altered perception of memory function, leading to heightened negative attributions [34]. In this line, it is interesting to note that the D+/MCI+ group reports significantly higher subjective memory complaints than the healthy group. However, when comparing the healthy group with the MCI+ group without depressive symptoms, we do not observe the same level of significance.

Regarding memory complaints, there is some evidence that the level of awareness of memory deficits is useful in discriminating between MCI and major depressive disorder. In a study with 63 participants [7], it was observed that individuals diagnosed with MDD reported the highest frequency of memory complaints, whereas those diagnosed with MCI exhibited the poorest performance on objective memory tests. Interestingly, the level of consciousness emerged as a discriminating factor between individuals with MDD and those with MCI ($p < 0.05$). Furthermore, participants with MDD tended to underestimate their memory abilities compared to control subjects ($p < 0.05$). While our results do not reflect significant differences among groups, average values show a tendency for depressive individuals to report more memory complaints than those with MCI only and the healthy group. It should be taken into consideration that the inclusion diagnostic criteria were not
as strict as in the article referenced above (i.e., MDD diagnosis), in addition to having a small sample in each classified group ($N = 10$ and $N = 13$).

Additionally, the correlations observed between the educational level and GDS-15 scores suggest that as educational level increases, depressive symptoms decrease. This may indicate that educational level could serve as a possible protective factor against depression as indicated by some studies [35].

The linear regression analysis revealed some insights into the relationship between the independent variables and the dependent variables MFE-28, MIS, and Lawton and Brody scores. In the case of MFE-28, a statistically significant constant term suggests that the baseline level of MFE-28 is significantly different from zero. The positive relationship between independent and dependent variables evidences that higher scores on GDS-15 are significantly associated with higher scores on MFE as mentioned above. The significant t-value reinforces the importance of this variable as a predictor. The MoCA coefficient ($\beta_1$) has a negative relationship, suggesting that higher MoCA scores, indicative of better cognitive performance, are significantly associated with lower scores on MFE-28. The highly significant t-value emphasises the strong inverse relationship between cognitive performance and subjective memory complaints, underscoring the protective effect of cognitive and emotional health on subjective memory perceptions. MoCA also shows a strong positive relation with MIS, suggesting that higher MoCA scores, which reflect better cognitive performance, are significantly associated with better memory performance.

Lastly, the significant positive coefficient for MoCA in the Lawton and Brody scale suggests that cognitive performance is a crucial factor in determining functional independence. As individuals score higher on MoCA, their ability to perform daily activities independently increases. Interventions aimed at improving cognitive function could have positive effects on the functional independence of elderly populations.

While this study provides valuable insights into the relationships between cognitive and depressive symptoms and functional outcomes in older adults, it exhibits some limitations that highlight the need for cautious interpretation of the results. The sample size of 73 participants may not provide sufficient statistical power to detect subtle effects, and may increase the likelihood of some relationships not being detected. The findings may not be generalizable to the broader population due to the limited sample size and regional focus. Additionally, cross-sectional studies like this capture data at a single point in time, making it difficult to infer causal relationships or the direction of associations between variables (e.g., whether depressive symptoms actually influence cognitive scores or vice versa). Finally, the interactions between MoCA and GDS-15 scores, and other potential covariates, may not be fully explored.

Although our findings suggest a connection between cognitive ability, memory, and depressive symptoms, to gain a thorough understanding of these relationships, additional factors should be considered that could influence the outcomes of future studies. Variables such as medication use, the specific type of medication, the type and severity of the depression, duration since diagnosis and types of MCI were not addressed in our study but are important for analysis. Additionally, increasing the sample size of the study cohorts and employing diverse psychological assessments would enhance the reliability of the findings.

Understanding the relationships and differences between depression and MCI in older adults would help in achieving an earlier and more accurate diagnosis. By differentiating between the cognitive symptoms that are specific to MCI and those that may be attributed to depression, healthcare professionals can tailor their diagnostic and treatment approaches more effectively. Additionally, recognising how these conditions interact can inform better clinical practices, leading to improved management and support for older adults experiencing these issues.

5. Conclusions

Our study reveals several key findings regarding the relationship between depressive symptoms, cognitive impairment, and subjective memory complaints in older adults.
Specifically, we addressed the following research question: **How does memory performance vary with MCI and depressive symptoms in individuals over 60 years of age, and what are the relationships or differences according to socio-demographic status?**

With respect to memory performance and depressive symptoms, this study shows that individuals exhibiting symptoms of geriatric depression tend to display poorer memory performance as evidenced by lower scores on the Memory Index Score (MIS). This particularly indicates reduced uncued recall abilities. There is a significant association between memory, cognitive function, and emotional state. Individuals with depressive symptoms exhibit worse cognitive performance.

When analysing participants’ subjective memory complaints, individuals reporting depressive symptoms also tend to report more frequent memory lapses. Additionally, diminished cognitive function, indicated by lower scores on the Montreal Cognitive Assessment (MoCA), is observed in individuals reporting higher frequencies of memory failures.

There is a negative correlation between educational level and GDS-15 scores, suggesting that achieving higher levels of education may serve as a protective factor against depression. However, further exploration of some socio-demographic factors (i.e., gender, residence, and marital status) is necessary to fully understand their impact on memory performance, but initial findings suggest these socio-demographic variables may play a role in moderating the impact of cognitive impairment and depressive symptoms.

Individuals with mild cognitive impairment (MCI) who also exhibit depressive symptoms demonstrate poorer performance in recall tasks and report more subjective memory complaints compared to those with MCI but without depressive symptoms. There appears to be a bidirectional relationship between depressive symptoms and memory performance, highlighting the complex interplay between mental health and cognitive functioning in this population, but additional research is needed to confirm this aspect.

Our findings underscore the importance of considering both mental health and cognitive functioning in the assessment and management of older adults’ well-being, which motivates future research targeted to further explore the mechanisms underlying these relationships, and to support the development of targeted interventions to mitigate the adverse effects of depression and cognitive impairment in this population.

Inspired by the results of this study, our ongoing research investigates the interactions between social media and elders with MCI or depressive symptoms, examining how social networks are perceived and how perceptions change over time. Additional research addresses the analysis of the elder’s support network, life satisfaction, physical activity, and self-perception, and how these variables influence their perception and memory performance. A deeper analysis of MCI and its evolution in the target population, considering various types of MCI and depression, as well as the influence of depression medication on memory performance, is also planned.

By addressing these areas, we aim to provide a comprehensive understanding of how memory performance varies with MCI and depressive symptoms, and the role of socio-demographic factors in this process.


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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Research Ethics Committee of Galicia, Spain (protocol code 2023/503), approved on 23 January 2024.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The raw data utilised in this study are available upon request to the corresponding author.

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Abbreviations
The following abbreviations are used in this manuscript:

GDS  Global Deterioration Scale
MCI  Mild Cognitive Impairment
MDD  Major Depressive Disorder
MFE  Memory Failures in Everyday
MIS  Memory Index Score
MoCA  Montreal’s Cognitive Assessment test
SPSS  Statistical Package for the Social Sciences
GDS-15  Yesavage Geriatric Depression Scale

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