



# Underdiagnosis of mild cognitive impairment in Ecuador: reflections on a case study.

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## Summary

**Introduction:** Mild cognitive impairment (MCI) in Ecuador may be underdiagnosed because of the official recommendation to use the Mini-Mental State Examination. The Mini-Mental State Examination (MMSE) was used exclusively to assess cognitive function in older adults. This article highlights the need for more sensitive diagnostic protocols to enable early detection of mild cognitive impairment (MCI).

**Case report:** An 85-year-old woman with hypertension and hearing loss, a low educational level, and subjective complaints of progressive memory loss for the past 2 years maintained functional autonomy, which family members corroborated.

**Diagnostic workshop:** The MMSE was normal; the Neuropsychi test revealed alterations in memory and executive functions, compatible with undome aMCI.

**Evolution:** Slow symptoms, without loss of autonomy; contrasted results reflect the risk of underdiagnosis owing to the exclusive use of screening.

**Conclusion:** The need to complement the screenings recommended by the regulations with neuropsychological assessments is indicated to detect MCI and intervene early, preventing progression to major neurocognitive disorders.

## Keywords:

Mild cognitive impairment, neuropsychological assessment, older adult, Mini-Mental State Examination (MMSE).

## Abbreviations

MMSE: Mini-Mental State Examination.

## Supplementary information

No supplementary materials are declared.

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## Authors' contributions

**Mateo Beltrán Zhindón**, conceptualization, research, original draft writing, resources, software, supervision.

**Alexandra Bueno** Methodology, Data Curation, Formal Analysis, Fundraising, Project Management, Validation, Visualization, Writing, Review and Editing.

**Fernando Estévez**: conceptualization, research, original draft, resources, software, supervision.

**Felipe Webster**, conceptualization, research, original draft writing, resources, software, supervision.

All the authors read and approved the final version of the manuscript.

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## Availability of data and materials

The datasets used and analyzed during this study are available to the corresponding author upon reasonable request.

## Introduction

Mild cognitive impairment (MCI) is a degenerative process that frequently precedes major neurocognitive disorders. Its diagnosis is based on five main criteria: 1) the presence of subjective complaints of memory difficulties by the patient, corroborated by external informants; 2) objective memory impairment that is at least 1.5 standard deviations below the mean of their normative group according to age and educational level; 3) relative preservation of general cognitive functioning; 4) preservation of the ability to perform basic and instrumental activities of daily living; and 5) the absence of diagnostic criteria for a major neurocognitive disorder or dementia [1, 2]. While the progression of MCI was previously associated primarily with Alzheimer's disease, owing to the predominance of amnesic impairment, two main subtypes are now recognized: amnesic MCI and nonamnesic MCI. Furthermore, it is classified according to the number of cognitive functions affected, distinguishing between the *unidome*, in which only one function is compromised, and the *multidomain*, in which multiple cognitive areas are compromised [3].

In this context, neuropsychology plays a key role in studying the relationships between the brain and behavior in both healthy individuals and those with brain damage. Neuropsychological assessment, in particular, allows for the analysis of specific cognitive functions through their behavioral expression and potential brain dysfunction. This assessment uses tools such as standardized scales, interviews, and clinical observations adapted to the needs of each patient. Unlike a conventional psychological examination, a neuropsychological evaluation is characterized by its personalized approach, making it an essential strategy for detecting cognitive dysfunctions and evaluating their impact on the quality of life and autonomy of older adults. Although the line separating normal from pathological cognitive aging is not entirely clear, the use of complementary tests, such as neuroimaging and anxiety and depression questionnaires, helps to refine the diagnosis [4].

The process of proper neuropsychological evaluation begins with cognitive screening tailored to the patient's needs. Among the available tools are the Addenbrooke's Cognitive Examination III (ACE-III), the Montreal Cognitive Assessment (MoCA), and the Frontal Assessment Battery (FAB), the INECO Frontal Screening (IFS), and the Mini-Mental State Examination (MMSE). Although the choice of these tools depends on the characteristics of the patient, both the ACE-III and the MoCA have demonstrated greater sensitivity and specificity than the MMSE, IFS, and FAB, consolidating

themselves as reference instruments for the early detection of cognitive disorders [4].

The reason why it is essential to present this case lies mainly in the fact that it highlights the risk of underdiagnosis of MCI when only screening tests recommended in Ecuadorian regulations are used, rather than the greater sensitivity of specific neuropsychological assessments that would contribute to practice by optimizing public policy with more sensitive clinical assessment protocols.

## Case report

### Medical records

An 85-year-old woman presented with a history of hypertension, which was treated pharmacologically, and bilateral hearing loss, which was treated with hearing aids in both ears. The patient has a low level of education and has not yet completed primary school, as did her parents. She lives independently in a housing complex shared with her granddaughter and her family.

Currently, patients report subjective complaints of memory loss that began approximately two years ago. The forgetfulness has progressively increased, particularly the difficulty in remembering the names of acquaintances with whom she frequently interacts. Despite this, she can perform basic and instrumental activities of daily living independently. These symptoms cause frustration for the patient and concern her family, who corroborate her complaints.

Following neuropsychological evaluation, clinical symptoms consistent with mild cognitive impairment (MCI) were observed. This conclusion was based on observations, interviews, and the application of neuropsychological assessment instruments. The patient presented a significant decline in memory function, exceeding the expected variations for her age and educational level. Despite this impairment, the patient retains the ability to function adequately in her daily activities, ruling out a major neurocognitive disorder.

### Diagnostic workshop

In the particular case of the examinee, a cognitive screening, such as the Mini-Mental State Examination (MMSE), and a neuropsychological assessment instrument, such as the Neuropsi Attention and Memory, second edition, were used.

The MMSE results indicated normal overall performance after adjusting for age and education. A detailed analysis of the protocol revealed that she scored perfectly in all areas except for time orientation (4/5 points) and attention

and calculation (3/5 points). The main results of the assessment of the older adults via Neuropsi Attention and Memory 2 are presented in [Table 1](#).

The neuropsychological report indicates that the patient is oriented to a person and place; however, her orientation to

time is partial. In the attention and concentration area, the scores fall within the "normal" range, with a slight alteration observed on the successive series test, which evaluates explicitly attention and concentration.

**Table 1.** Neuropsi Attention and Memory Scores

| Total scores                                 | Normalized Score | Diagnostic Category    |                     |
|----------------------------------------------|------------------|------------------------|---------------------|
| Total Attention and Executive Functions      | 90               | Normal                 |                     |
| Total memory                                 | 76               | Mild alteration        |                     |
| Full attention and memory                    | 79               | Mild alteration        |                     |
| Attention and Executive Functions Sub-scales | Natural Score    | Maximum subscale score | Diagnostic Category |
| Orientation                                  | 6                | 7                      | Normal              |
| Digit progression                            | 5                | 9                      | Normal              |
| Cubes progression                            | 5                | 9                      | Normal              |
| Visual detection                             | 14               | 24                     | Normal              |
| Digit detection                              | 10               | 10                     | Normal              |
| successive series                            | 0                | 3                      | Mild alteration     |
| Category Formation                           | 9                | 25                     | Normal              |
| Semantic verbal fluency                      | 1                | 4                      | Normal              |
| Phonological verbal fluency                  | 2                | 4                      | Normal              |
| Nonverbal fluency                            | 1                | 4                      | Mild alteration     |
| Motor functions                              | 16               | 20                     | Mild alteration     |
| Stroop time                                  | 2                | 4                      | Normal              |
| Stroop hits                                  | 2                | 4                      | Normal              |
| Memory subscales                             | Natural Score    | Maximum subscale score | Diagnostic Category |
| Digit regression                             | 4                | 8                      | Normal              |
| Regression cubes                             | 4                | 8                      | Normal              |
| Encoding memory curve                        | 4                | 12                     | Normal              |
| Associated pairs encoding                    | 0                | 12                     | Severe Disorder     |
| Logical memory stories encoding              | 9                | 16                     | Normal              |
| Logical memory topics coding                 | 4                | 5                      | Normal              |
| Semicomplex figure encoding                  | 11               | 12                     | Normal              |
| Faces coding                                 | 2                | 4                      | Mild alteration     |
| Spontaneous verbal memory                    | 1                | 12                     | Normal              |
| Verbal memory by cues                        | 2                | 12                     | Normal              |
| Verbal recognition memory                    | 0                | 12                     | Mild alteration     |
| Associated pairs evocation                   | 2                | 12                     | Mild alteration     |
| Logical memory, stories, evocation           | 4                | 16                     | Normal              |
| Logical memory, themes, recall               | 4                | 5                      | Normal              |
| Semicomplex figure evocation                 | 8                | 12                     | Normal High         |
| Evocation of names                           | 8                | 8                      | Normal              |
| Facial recognition                           | 2                | 2                      | Normal              |

The results of the executive function assessments were mainly within the "normal" range. However, mild impairments were detected in nonverbal fluency and motor functions.

The examinee exhibited significant difficulties in memory, with scores suggesting moderate to severe impairments in both visual and verbal memory. Notably, in additional tests that also assess these skills, the results range from normal to mild impairments. In particular, high scores

are observed in visual memory, as shown by the semicomplex figure test.

The most significant difficulty was evident in verbal recognition memory, which was primarily affected by intrusions that invalidated the scores. Throughout the Neuropsi tests, a consistent pattern of perseverative and intrusive errors was identified.

Based on evidence gathered through behavioral observation, interviews, and neuropsychological assessments, and considering a prior neurological evaluation, the findings are consistent with a diagnosis of amnesic single-domain mild cognitive impairment. The diagnostic criteria supporting this conclusion include the following:

- Subjective memory complaints corroborated by family members.
- Objective impairments in memory, especially in the verbal and visual areas.
- Preservation of general cognitive functioning.
- Ability to independently perform basic and instrumental activities of daily living.
- The absence of diagnostic criteria for a major neurocognitive disorder or dementia.

## Evolution

The patient and her family reported that her subjective memory complaints began approximately two years ago, manifesting primarily as sporadic forgetting of names and information from recent conversations. As time passed, the frequency of these lapses increased, prompting concern among her family. Despite the aforementioned progression of difficulties, the patient has maintained independence in basic and instrumental activities of daily living. Furthermore, during this period, no episodes of disorientation or significant behavioral changes were observed beyond the patient's own frustration upon realizing her inability to retrieve information from memory.

Currently, the symptoms remain stable, with a mild impact on daily life, which is consistent with the findings of the neuropsychological evaluation. These findings reveal a profile compatible with mild aMCI. Initially, based solely on the screening test, the patient's overall performance was within normal limits, ruling out impairment. However, given the presence of subjective memory complaints, a more comprehensive assessment was undertaken. This revealed a different profile when the Neuropsi Attention and Memory 2 test was applied. This evolution between the screening and neuropsychological evaluation phases reflects the risk of

underdiagnosis when only brief tests recommended by Ecuadorian guidelines are used.

## Discussion

The Mini-Mental State Examination (MMSE) is described as a valuable tool for the cognitive assessment of patients, obtaining results related to the mental functions of patients in a short period of time; however, it should be taken into consideration that, like any other assessment instrument, it does not by itself provide a diagnosis but must be complemented with a good clinical history, physical examination, complementary tests and even evolutionary monitoring of the patients to obtain a specific diagnosis of mild cognitive impairment, major neurocognitive disorder, or another [5].

The MMSE consists of 5 sections that aim to briefly assess orientation, fixation, calculation, attention, memory, and language and praxis; it should be noted that each section has a specific score, and the sum of these scores reflects the examinee's performance in the aforementioned cognitive functions. Notably, the MMSE corrects for the age and educational level of patients to obtain a score that takes into account the individual differences of the examinees; the MMSE is a widely used instrument around the world because of its brevity in administration and scoring, and even in Ecuador, it is one of the primary assessment instruments for elderly patients by the Ministry of Economic and Social Inclusion (MIES), which has used it to assess cognitive impairment since 2019 [5, 6].

The Neuropsi Attention and Memory, Second Edition, is presented as a neuropsychological assessment tool for evaluating cognitive performance in healthy, psychiatric, neurological, and other patients with various medical conditions. It is a brief instrument developed by Ostrosky, Ardila, and Roselli in 1994. Specifically, it assesses different aspects of cognitive performance, including orientation, attention, concentration, memory, language, visuospatial skills, executive functions, and reading [7-9]. The instrument allows for objective, simple scoring: 1 point for correct answers and 0 for incorrect, with a maximum score of 130. The score determines the performance levels: normal, mild, moderate, or severe. Among the advantages of Neuropsi is its broad applicability, as it has norms for four age groups (16-85 years) and educational levels (none to 14 years) [7-9].

The Neuropsi neuropsychological assessment tool is presented as a valid option in the field of dementia, as it has a solid Cronbach's alpha of .89 to .95 in its original version, as assessed via the test-retest method. In some adaptations to the

Latin American context, it reached .86, as occurred in neighboring Peru. Although it has not yet been validated in Ecuador, its Spanish version has been used in numerous studies evaluating cognitive performance in young people, adults, and older adults [7]. The instrument consists of 29 subtests that allow for the determination of a degree or level of impairment in cognitive functions; these levels are classified as high normal, regular, mild to moderate, and severe. Finally, its scoring system can provide quantitative and qualitative data easily in approximately 60 minutes [9].

This article has demonstrated the advantages of a formal, specific neuropsychological assessment over screening scales, such as the MMSE, especially in older adults presenting with subjective memory complaints. In this case, when the patient is assessed with the Mini-Mental State Examination (MMSE), she obtains normal and age-appropriate scores. In contrast, when evaluated with the Neuropsi 2 in attention and memory, scores indicate mild, moderate, and even severe impairments in some cognitive abilities [6, 10]. Timely neuropsychological assessment data could benefit both the patient and the healthcare system, allowing for the early initiation of cognitive training that prevents the progression of cognitive decline to a major neurocognitive disorder, especially when signs such as subjective memory complaints reported by patients or their families are already present [6, 10].

In Ecuador, public health policy often leads professionals to use brief and nonspecific cognitive assessment tools in older adults, which carry a high risk of underdiagnosis. This means that some older adults, because they do not show significant impairment in multiple cognitive functions resulting in scores consistent with a major neurocognitive disorder, are mistakenly considered to have normal cognitive performance and do not require intervention [11]. This article demonstrated the usefulness of a comprehensive neuropsychological assessment to identify mild cognitive impairment in a patient whose cognitive function was initially considered normal based on brief tests. This more specific assessment enabled avoidance of potential underdiagnosis and the initiation of cognitive training to prevent a more severe neurocognitive disorder. Therefore, valuing neuropsychological assessments in the early stages of mild cognitive impairment should guide Ecuadorian public health policy.

As previously stated, the differential diagnosis of mild cognitive impairment should be considered, particularly in the presence of confusional syndrome or a major neurocognitive disorder. The main reason for excluding confusional syndrome was that no evidence of impaired

attention or consciousness was found in the patient, and her memory impairment was not recent but rather dated back approximately two years. A major neurocognitive disorder is also ruled out, as the cognitive deficits do not interfere with the patient's independence; she performs basic and instrumental activities of daily living perfectly well [12].

Subjective memory complaints are often the first changes to appear in mild cognitive impairment (MCI) and are even considered warning signs for possible diagnoses of Alzheimer's disease. These complaints are particularly prevalent in older adults when they occur during activities of daily living. Research has shown that subjective memory complaints are associated with an objective decline in episodic memory in approximately 65% of cases and, in 56% of cases, are also linked to executive functions and various types of attention.

To better understand the origin of subjective memory complaints, the role of executive functions (EFs) must be described as the way in which other functions, such as memory, attention, motor functions and others, are regulated; once this has been described, the evidence that indicates that the alteration of EFs, especially planning and working memory, results in perseverative errors should be mentioned [14-16].

Furthermore, executive functions are related to skills for inhibiting automatic responses, for behaving according to previously agreed-upon rules, and for adapting behavioral goals to the context. When deterioration in prefrontal areas is associated with the aging process or the presence of a major neurocognitive disorder, the ability to inhibit the automatic processing of familiar stimuli that are incompatible with the task being performed is compromised, leading to intrusions. This consequence usually occurs when the inhibitory mechanisms of attention are weakened, leading to reduced capacity for comprehension and memory [13, 17].

The advantages of neuropsychological assessment are numerous, as it includes instruments that can evaluate specific cognitive functions, such as executive functions. This study aims to analyze the potential to optimize the diagnostic, therapeutic, and research resources of public health systems, which generally neglect comprehensive neuropsychological assessments and instead propose, in their biological and psychological evaluation of older adults, only screening tests for cognitive impairment, such as the Folstein Mini-Mental State Examination. This approach may overlook valuable information for diagnosing and intervening on cognitive impairments, which are only treated when their symptoms suggest moderate to severe cognitive impairment or a major neurocognitive disorder [6, 10].



While the rationale for using screening tools in older adults might be their speed of administration and interpretation, these tools can only document a patient's cognitive performance superficially and with low sensitivity, as they are not suitable for diagnosing dementia. This is primarily due to the risk of underdiagnosis in mild cases and, consequently, the poor selection of suspected cases of major neurocognitive disorders [18, 19]. Neuropsychological assessments, on the other hand, base their suspicions on clinical grounds, beginning with interviews with patients, family members, and caregivers to identify recent changes. A specific evaluation is then conducted based on this information, and there are assessment tools that provide valid, brief, and appropriate results regarding a person's cognitive performance, including options that offer remote modalities for patients who have difficulty accessing a clinic [18, 20].

## Conclusions

This clinical case demonstrates that brief screening instruments, such as the MMSE, are insufficient to detect mild cognitive impairment (MCI), thereby increasing the risk of underdiagnosis in patients with subjective memory complaints. Unlike screening tests, a comprehensive neuropsychological assessment (e.g., Neuropsi) can identify subtle alterations in episodic memory and executive functions that would otherwise go unnoticed. Early detection is fundamental for implementing timely interventions, such as cognitive training, that delay progression to a more severe neurocognitive disorder. Therefore, it is recommended that the Ecuadorian public health system prioritize transitioning from basic screening to comprehensive neuropsychological assessments in older adults, thereby ensuring preventive health policy, accurate differential diagnoses, and clinical management appropriate to the patient's functional reality.

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# Underdiagnosis of mild cognitive impairment in Ecuador: reflections from a case study.

## Abstract

**Introduction:** Mild cognitive impairment (MCI) in Ecuador may be underdiagnosed because official regulations recommend the Mini-Mental State Examination (MMSE) for evaluating cognitive function in older adults. This article highlights the need for more sensitive diagnostic protocols to enable early detection of MCI.

**Case report:** An 85-year-old woman with hypertension and hearing loss, a low educational level, and subjective complaints of progressive memory loss for 2 years maintained functional autonomy, as corroborated by relatives.

**Diagnostic workshop:** The MMSE was normal; Neuropsi showed alterations in memory and executive functions, compatible with single-domain amnesic MCI.

**Evolution:** Slow symptoms, without loss of autonomy, contrast results reflect the risk of underdiagnosis owing to the exclusive use of screening.

**Conclusion:** The need to complement the screenings recommended by the regulations with neuropsychological evaluations to detect MCI and intervene early, avoiding progression to major neurocognitive disorders, is indicated.

**Keywords:** Mild Cognitive Impairment, Neuropsychological Evaluation, Older Adult, Minimental State Examination (MMSE).

## Statements

### Ethics committee approval and consent to participate

This method is not required for clinical cases.

### Publication consent

The authors obtained the patients' written consent for the publication of images, radiographs, and specific studies.

### Conflicts of interest

The research has no financial interests or conflicts of interest.

### Use of generative AI

The authors declare that they did not use generative AI.

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