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Recognition memory in individuals with mild cognitive impairment and Alzheimer's dementia: a systematic review

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ABSTRACT

Background: Episodic memory impairment is a hallmark of Alzheimer's disease (AD) and is already present in its prodromal stage. While recall deficits are well established as predictors of memory performance, the role of recognition memory—particularly the dissociation between familiarity and recollection—remains less explored.

Objective: This systematic review aims to synthesize current evidence on recognition memory performance in healthy controls (HC), individuals with mild cognitive impairment (MCI), and those with AD, with a focus on the distinct contributions of familiarity and recollection processes.

Methods: We searched PubMed (MEDLINE), Science Direct, PubPsych, and TRIP Medical databases for studies published until November 2025, which investigated recognition memory performance in individuals with MCI and AD including validated memory tools (such as scales, indices, scores, tests, and assessments). Forty-six studies (n = 3996) met the criteria and were included. Methodological quality was evaluated using the Newcastle-Ottawa scale. This study is registered with PROSPERO, CRD42022343750.

Results: Most studies were cross-sectional and conducted in memory clinics or research centers, with considerable heterogeneity in sample size and assessment tools. The majority utilized experimental paradigms to differentiate familiarity and recollection, though traditional memory tests remain prevalent. Across studies, recollection was consistently impaired in MCI and AD, while familiarity showed a more variable pattern—often preserved in early MCI but impaired in advanced stages and AD. Structural and functional neuroimaging studies revealed that hippocampal atrophy is closely linked to recollection deficits, while alterations in entorhinal and parahippocampal cortices are associated with familiarity impairment. Combined deficits in recall and recognition, especially when recognition impairment reflects encoding failure, robustly predict conversion to dementia.

Conclusions: Recognition memory assessment, particularly the dissociation between familiarity and recollection, provides valuable information for early detection and prognosis in the AD continuum. Incorporating nuanced recognition memory measures into clinical practice may improve diagnostic specificity and facilitate timely interventions. Further longitudinal research is needed to validate recognition memory as a predictor of dementia progression and to standardize its assessment in diverse populations.

KEYWORDS

Alzheimer's disease; dementia; familiarity; mild cognitive impairment; recognition memory; recollection

Introduction

Episodic memory impairment is a central and early feature in the continuum of Alzheimer's disease (AD), which is already present in the early stages known as amnestic mild cognitive impairment (a-MCI) (Albert et al., 2011; Jack et al., 2024; Petersen et al., 1999, 2001). Thus, episodic memory assessment is fundamental for diagnosis and disease staging. However, recent studies indicate that while current clinical diagnostic criteria are sensitive (including the use of AD biomarkers), they lack specificity in predicting the risk of conversion to dementia (Jack et al., 2024; Lerch et al., 2024; McGuinness et al., 2015; Rossini et al., 2022). This limitation may reflect substantial clinical heterogeneity even with apparently homogeneous groups like a-MCI and underscores the need for more specific early diagnostic and prognostic tools (Lee et al., 2024).

The combined impairment of recall and recognition memory in a-MCI patients is a robust predictor of conversion to dementia, particularly AD (Gainotti et al., 2014; Goldstein et al., 2019; Russo et al., 2017). Longitudinal studies have shown that deficits in both modalities reflect alterations in hippocampal and posteromedial cortical networks associated with early neurodegenerative processes (Irish et al., 2014; Rémy et al., 2015). Several studies suggest that

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Table 1. Study characteristics of included studies.

Study	Country	Type of study	Purpose/Objective	Target population (n)				Sample source
				HC	MCI	AD	Other conditions	
Algarabel et al. (2009)	Spain	Experimental, cross-sectional study	To investigate the possible existence of deficits in familiarity in five samples of participants spanning a broad range of ages and cognitive states.	32	32	16	0	Memory clinics
Algarabel et al. (2012)	Spain	Experimental, cross-sectional study	To shed light on the pattern of responding in recollection and familiarity in MCI.	33	40	8	0	Memory clinics
Ally et al. (2009)	USA	Experimental, cross-sectional study	To use a depth of encoding manipulation and ROC procedures to estimate recollection and familiarity for word stimuli in healthy older adults, patients with a-MCI, and patients with mild AD.	12	11	10	0	Memory clinics, research center
Anderson et al. (2008)	Canada	Experimental, cross-sectional study	To explore recollection and familiarity in healthy young adults, healthy older adults, and individuals with aMCI.	72	17	0	0	Memory clinics, research center
Bastin el at. (2013)	Belgium	Experimental, cross-sectional study	To examine whether recognition memory performance can be improved in AD when the use of familiarity is facilitated by the salience of processing fluency due to an earlier encounter with the information.	16	0	15	0	Memory clinics
Bastin et al. (2021)	Belgium	Experimental, longitudinal study (4 years)	To analyze recollection and familiarity performance in aMCI patients as a function of the clinical outcome at the end of a 4-year neurological and neuropsychological follow-up.	26	45	0	0	Memory clinics
Bennett et al. (2006)	USA	Observational, cross-sectional study	To assess episodic memory performance in a relatively small sample of amnestic MCI using a combination of free recall, yes/no recognition, and forced-choice recognition.	30	21	0	0	Memory clinics, research center
Budson et al. (2000)	USA	Experimental, cross-sectional study	To examine false recognition of semantic associates in patients with probable AD, older adults, and young adults using a paradigm that provided rates of false recognition after single and multiple exposures to word lists.	28	0	12	0	Memory clinics
Caruso et al. (2020)	Italy	Experimental, cross-sectional study	To clarify the cognitive processes involved in recall and recognition in patients with dementia.	45	0	28	22	Memory clinics
Chang et al. (2022)	Taiwan	Experimental, cross-sectional study	To evaluate sex-specific differences in older adults with and without aMCI in item and associative verbal memory by using an associative memory task with immediate and delayed recognition conditions.	55	49	0	0	Memory clinics
Clement et al. (2012)	Canada	Experimental, cross-sectional study	To conducte an fMRI memory study measuring brain activation related to old/new (item recognition) and intact/rearranged (associative recognition) word-pair recognition paradigms in 26 persons with mild cognitive impairment (MCI) and 14 healthy older adults.	14	26	0	0	Memory clinics
Clark et al. (2012)	USA	Observational, cross-sectional study	To examine patterns of recognition memory deficits in individuals with AD and MCI.	35	37	37	0	Research center
De Simone et al. (2024)	Italy	Experimental, longitudinal study (3 years)	To investigate the rate of forgetting of the familiarity and recollection components of recognition in patients at the onset of medial temporal lobe pathology and destined to convert to AD.	15	13	0	0	Memory clinics
De Simone et al. (2018)	Italy	Observational, longitudinal study (3 years)	To evaluate whether different memory performances on two procedures commonly used for the neuropsychological assessment of episodic memory might be a key in predicting a-MCI patients' subsequent progression to AD.	62	80	0	0	Memory clinics
Delhaye et al. (2019)	Belgium	Experimental, cross-sectional study	To assess whether mild AD patients' associative memory could be improved when the to-be-learnt associations could be anchored within preserved prior-knowledge, similar to amnesia or healthy aging.	21	0	21	0	Memory clinics
Embree et al. (2012)	USA	Experimental, cross-sectional study	To obtain estimates of familiarity and recollection for pictures and words in patients with aMCI and healthy older controls.	16	16	0	0	Memory clinics
Arias et al. (2023)	Canada	Observational, cross-sectional study	To assess how delayed recall and recognition evolve throughout the natural history of Alzheimer's disease from a PET-Braak perspective and to inspect brain areas where vulnerability to tau pathology adversely affects different aspects of auditory verbal memory.	144	39	29	0	Research center

(*Continued*)

Table 2. Continued.

Study	Country	Type of study	Purpose/Objective	Target population (n)				Sample source
				HC	MCI	AD	Other conditions	
Fine et al. (2008)	USA	Observational, cross-sectional study	To compare the performance of individuals with HD and AD on three types of CVLTII recognition discriminability indices (RDI): Source, Novel, and Total.	0	0	16	17	Research center
Gallo et al. (2004)	USA	Experimental, cross-sectional study	To compare patients with mild AD with age-matched control subjects on an associative recognition task. Subjects studied pairs of unrelated words and were later asked to distinguish between these same studied pairs (intact) and new pairs that contained either rearranged studied words (rearranged) or nonstudied words (nonstudied).	12	0	12	0	Memory clinics
Genon et al. (2013)	Belgium	Experimental, cross-sectional study	To examine whole brain regional activity during one core aspect of the recollection function: associative controlled episodic retrieval (CER), contrasted to item familiarity in AD patients.	17	0	32	0	Memory clinics
Graves et al. (2024)	USA	Observational, cross-sectional study	To examine performance on the CVLT-3 List A vs. List B RD index in individuals with HD or AD and mild or moderate dementia.	0	0	52	55	Research center
Graves et al. (2017)	USA	Observational, cross-sectional study	To evaluate the degree to which population differences in the index of total recognition discriminability may vary across applications of these nonparametric and parametric formulas in individuals with HD, individuals with AD, healthy middle-aged adults, and healthy older adults who were administered the CVLT-II.	103	0	33	65	Research center
Graves et al. (2018)	USA	Observational, cross-sectional study	To compare the performance of individuals with AD and HD in mild and moderate stages of dementia on CVLT-3 indices of Total RD and List A vs. Novel/Unrelated RD.	84	0	52	55	Research center
Graves et al. (2019)	USA	Observational, cross-sectional study	To examine the utility of CVLT-3 nonparametric and parametric Total RD indices in the assessment and comparison of yes/no recognition in individuals with HD and AD in mild and moderate stages of dementia.	0	0	52	55	Research center
Heun et al. (2007)	Germany	Experimental, cross-sectional study	To compare cerebral activation between subjects with and without MCI, and between remembered and non-remembered words.	28	20	0	0	Memory clinics
Hudon et al. (2009)	Canada	Experimental, cross-sectional study	To use the Remember/Know (R/K) procedure combined with signal detection analyses to assess recognition memory in 20 elders with aMCI, 10 patients with probable AD as well as matched healthy older adults.	23	20	10	0	Memory clinics
Lekeu et al. (2003)	Belgium	Experimental, cross-sectional study	To explore recognition memory performance for novel versus familiar words in AD patients and controls, using an adaptation of E. Tulving and N. Kroll's (1995) procedure.	16	0	16	0	Memory clinics
Lombardi et al. (2018)	Italy	Experimental, cross-sectional study	To investigate the forgetting rate of episodic memory in a group of patients with a-MCI using a modified version of Huppert and Piercy's procedure.	19	16	0	0	Memory clinics
O'Connor et al. (2010)	USA	Experimental, cross-sectional study	To understand the role of perceptual and conceptual fluency in the familiarity of pictures and words in patients with aMCI and AD.	16	16	16	0	Memory clinics
Putcha et al. (2022)	USA	Observational, cross-sectional study	To investigate performance on the (CVLT-II-SF in 23 amyloid-positive, tau-positive, and neurodegeneration-positive participants with atypical "non-amnestic" variants of AD and 14 amnestic AD participants.	0	0	37	0	Memory clinics
Rahmani et al. (2023)	Iran	Observational, cross-sectional study	To compare the recognition discriminability and response bias in the Shiraz verbal learning test (SVLT) between healthy elderly and those with amnestic MCI and AD.	59	60	61	0	Memory clinics
Ratcliff et al. (2022)	USA	Experimental, cross-sectional study	To examine the performance of memory disordered patients on lexical decision and item recognition tasks relative to control subjects.	57	76	29	0	Memory clinics
Rivas Fernandez et al. (2021)	Spain	Experimental, cross-sectional study	To characterize the performance and the brain activity changes related to episodic memory retrieval in adults with sdaMCI, relative to cognitively unimpaired adults.	24	24	0	0	Research center

(*Continued*)

Table 2. Continued.

Study	Country	Type of study	Purpose/Objective	Target population (n)				Sample source
				HC	MCI	AD	Other conditions	
Russo et al. (2017)	Argentina	Observational, longitudinal study (2 years)	To investigate whether recognition memory tasks in combination with delayed recall measure of episodic memory and CSF biomarkers can predict MCI to AD conversion at 24-month follow-up.	0	397	0	0	Research center
Russo et al. (2017)	Argentina	Observational, cross-sectional study	To evaluate the recognition memory performance by using a yes/no procedure to examine the effect of discriminability and response bias measures in a-MCI, AD dementia, and normal-aging subjects.	43	45	51	0	Memory clinics
Serra et al. (2010)	Italy	Experimental, cross-sectional study	To investigate whether, in patients with a-MCI, recognition deficits are mainly due to a selective impairment of recollection rather than familiarity.	19	23	0	0	Memory clinics
Simon et al. (2018)	Belgium	Experimental, cross-sectional study	To attenuate recognition memory deficits in AD by maximizing the salience of fluency cues in two conditions of a recognition memory task.	16	0	15	0	Memory clinics
Staffaroni et al. (2017)	USA	Observational, cross-sectional study	To conduct a cluster-based correlation analysis to assess the relationships between recency and recognition memory scores from the CERAD Word Learning Task and cortical metabolic activity measured using FDG-PET.	0	0	81	0	Memory clinics
Troyer et al. (2012)	Canada	Experimental, cross-sectional study	To examine associative and item memory in aMCI with a focus on the role of medial-temporal lobe regions and genetic risk for AD.	21	24	0	0	Memory clinics
Tse et al. (2010)	USA	Experimental, cross-sectional study	To explore the ability to control familiarity-based information in a memory exclusion paradigm in healthy young, older adults, and early-stage AD individuals.	105	0	48	0	Research center
Van Den Verg et al. (2020)	The Netherlands	Observational, cross-sectional study	To investigate differences in recognition memory performance between bvFTD and AD.	59	0	55	85	Research center
Weis et al. (2011)	UK	Experimental, cross-sectional study	To examine brain networks involved with sustaining memory encoding performance in healthy aging and in AD. Since different brain regions are affected by degradation in these two conditions, it might be conceivable that different compensation mechanisms occur to keep up memory performance in aging and in AD.	29	0	8	0	Memory clinics
Wolk et al. (2008)	USA	Experimental, cross-sectional study	To evaluate recognition memory in a-MCI in the framework of the dual process model.	21	16	0	0	Research center
Wolk et al. (2011)	USA	Experimental, cross-sectional study	To examine measures of recollection and familiarity in three groups (normal older adults, aMCI, AD) in which these memory measures and the relative integrity of MTL structures are variable, thus enhancing our power to detect MTL-memory relationships.	21	14	9	0	Research center
Wolk et al. (2013)	USA	Experimental, cross-sectional study	To record PRPs while a-MCI patients and cognitively normal age-matched adults performed a recognition memory task.	33	24	0	0	Research center
Wolk et al. (2013)	USA	Experimental, cross-sectional study	To describe findings of estimates of recollection and familiarity in young adults (YA, cognitively normal older adults (CN), and patients with amnestic-MCI (a-MCI). These measures in the CN and a-MCI patients were then related to a structural imaging biomarker of AD that has previously been demonstrated to be sensitive to preclinical and prodromal AD, the Cortical Signature of AD (ADsig).	67	32	0	0	Memory clinics, research center

AD: Alzheimer's disease; HC: healthy controls; MCI: mild cognitive impairment.

assessing both recognition and recall performance may help distinguish prognostic subtypes in aMCI, with particular emphasis on the distinction between encoding and retrieval deficits. Specifically, patients with impaired recognition-often interpreted as reflecting encoding deficits- appear to have a higher risk of progression to dementia compared to those with preserved recognition but impaired recall, typically associated with retrieval problems linked to fronto-subcortical circuits (Andrés et al., 2019; Putcha et al., 2022).

In this context, a detailed analysis of recognition memory offers a more nuanced characterization of memory dysfunction and may capture subtle cognitive changes that precede clinically overt dementia (Andrés et al., 2019; Wolk, Manning, et al., 2013). Recognition memory is supported by at least two partially dissociable processes: familiarity, a context-free sense that a stimulus has been encountered before, and recollection, the retrieval of qualitative contextual details associated with the prior encounter. Numerous theoretical models have been

developed to explain how these processes support recognition decisions. Single-process models (Dunn, 2004; Malmberg et al., 2004; McClelland & Chappell, 1998; Shiffrin & Steyvers, 1997) propose that recognition judgments are driven by a single memory-strength signal, typically formalized within a continuous signal-detection framework. Dual-process theories (Jacoby & Dallas, 1981; Tulving, 1985; Yonelinas, 1994), in contrast, posit that familiarity and recollection are qualitatively distinct, with familiarity varying along a strength continuum (Aggleton et al., 2005; Slotnick & Dodson, 2005; Wixted, 2007) and recollection operating in a threshold-like, all-or-none manner. Both perspectives assume a critical role of the medial temporal lobe (MTL) (Eichenbaum et al., 2007), but they differ in how they map familiarity and recollection onto specific MTL subregions. For example, some dual-process accounts associate recollection primarily with the hippocampus and familiarity with adjacent cortices (e.g., perirhinal and parahippocampal cortex) (Brown & Aggleton, 2001; Yonelinas, 2025), although this specialization remains a matter of debate (Smith et al., 2011).

Beyond this classic dichotomy, more recent approaches have proposed hybrid models (Wixted et al., 2010) that integrate elements of single- and dual-process theories, as well as continuous models in which recollection-like responses are interpreted as high-strength familiarity rather than a distinct process (Squire et al., 2007). Continuous signal-detection formulations and related frameworks argue that behavioral dissociations can sometimes be accommodated without assuming two qualitatively different processes, instead attributing differences to variations in strength, decision criteria, or task demands. Acknowledging these alternative perspectives is important, because different theoretical assumptions lead to different interpretations of recognition-memory performance in clinical populations, including MCI and AD (Russo et al., 2017). Nonetheless, the dual-process framework remains widely used in clinical neuropsychology due to its practical utility for designing paradigms that attempt to dissociate familiarity and recollection, and for linking these components to distinct neural substrates within the MTL.

From a clinical standpoint, recognition-memory measures have been proposed as potential tools to refine early diagnosis and prognosis in individuals at risk for AD. Standard clinical scales typically rely heavily on free recall, which is highly sensitive but may not be sufficiently specific to distinguish between different mechanisms of memory impairment or to predict differential risk of progression. Incorporating recognition paradigms that tap familiarity and recollection processes could improve characterization of memory profiles in a-MCI and early AD, facilitate differential diagnosis from normal aging and other dementias, and potentially serve as cognitive proxies for underlying pathological changes in hippocampal and extrahippocampal regions. Furthermore, a better understanding of how recognition components relate to structural and functional neuroimaging and to fluid biomarkers may help bridge cognitive models and biological frameworks of the disease.

Previous systematic reviews (Koen & Yonelinas, 2014; Schoemaker et al., 2014) have primarily focused on studies that explicitly distinguish recollection and familiarity within the dual-process theoretical framework. These reviews have yielded important insights into the relative vulnerability of recollection versus familiarity across healthy aging, MCI, and AD, but they have typically restricted their scope to paradigms that directly estimate both processes (e.g., remember/know judgments or process-dissociation procedures). In contrast, many clinical and experimental studies in MCI and AD employ global indices of recognition performance, often derived from signal-detection measures such as discrimination accuracy or response bias, which do not necessarily separate familiarity and recollection. As a result, the broader landscape of recognition-memory assessment—including tasks that do and do not dissociate processes—has not been comprehensively synthesized.

The present systematic review addresses this gap by adopting an inclusive approach to recognition memory in individuals with MCI and AD. Unlike prior reviews that focused exclusively on paradigms explicitly designed to separate familiarity and recollection, this work encompasses both dual-process and non-dissociative tasks, including those that provide global recognition indices derived from signal-detection theory (SDT). This strategy allows for a more complete overview of recognition-memory performance across the continuum from healthy aging to AD, capturing the range of experimental and clinical methodologies currently used in the field. In addition, the review integrates evidence from neuroimaging studies (structural MRI, functional MRI, and PET) that relate recognition-memory performance—and, when available, its familiarity and recollection components—to alterations in MTL structures and associated networks. By situating recognition-memory findings within contemporary biomarker-based frameworks of AD, this review aims to provide an updated and clinically relevant synthesis.

This systematic review therefore has a dual purpose: theoretical integration and practical guidance for clinical neuropsychology. Specifically, it aims to (1) identify the types of tasks used to evaluate recognition memory in healthy controls (HC), MCI, and AD—including stimuli, administration format, and procedures for measuring familiarity and/or recollection—across both dual-process and global recognition paradigms; (2) compare recognition-memory performance among HC, MCI, and AD, with particular attention to the pattern of recollection and familiarity deficits along the disease continuum; and (3) synthesize current knowledge regarding the neurobiological correlates of recognition-memory impairment, highlighting how structural, functional, and molecular markers relate to these processes. By integrating behavioral and neuroimaging evidence, and by covering both process-dissociative and non-dissociative tasks, this review seeks to inform test selection and interpretation in clinical settings, to clarify the potential of recognition measures for early detection and prognosis, and to identify directions for future research on recognition memory in the context of MCI and AD.

Methods

Search strategy and selection criteria

This systematic review followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

guidelines, adhering to the PRISMA 2020 checklist (Page et al., 2021). A research protocol for this systematic review was designed a priori and was registered in the PROSPERO database (registration number: CRD42022343750). The study design is consistent with the registration program.

The search was based on keywords using PubMed (MEDLINE), Science Direct, PubPsych, and TRIP Medical databases using the following MeSH terms: ((("mild cognitive impairment"[tiab] OR "mild cognitive impairments"[tiab] OR "MCI"[tiab] OR "mild neurocognitive disorder"[tiab] OR "mild neurocognitive disorders"[tiab] OR "mild neurocognitive impairment"[tiab]) AND ("Amnesia"[Mesh] OR amnesi*[tiab] OR "Memory"[Mesh:NoExp] OR memory[tiab] OR "Alzheimer Disease"[Mesh] OR Alzheimer*[tiab]) OR "AD"[tiab]) AND ("Recognition, Psychology"[Mesh] OR "recognition memory"[tiab])) NOT ("review"[Publication Type]). A total of 6320 records were initially identified up to November 25, 2025. Results from all databases were imported into Rayaan software (Ouzzani et al., 2016). Details about our search strategy are made available as supplementary material.

Inclusion and exclusion criteria

The screening was done by checking and verifying the fulfillment of the selected inclusion criteria: (1) Only human subjects were involved; (2) Articles written in the English language; (3) Any objective measurement of verbal recognition memory performance to assess cognitive performance using identified diagnostic criteria for either MCI or AD, including validated memory tools (such as scales, indices, scores, tests, and assessments); (4) Articles that include some measure of recognition memory based on the signal-detection model and/or the dual-process threshold/detection model; (5) Articles had to contribute previously unpublished findings (no review articles); and (6) Participants did not suffer from any other neurological or psychiatric condition. We excluded articles that did not have recognition memory or cognitive impairment as the outcome and that had no human or original data. We also excluded screening and case-report studies. Finally, additional records were added from external sources, and judged useful for the literature review conducted.

Screening and data extraction

Articles selection was conducted independently by MJR and RFA. Any difference was resolved by discussion until a consensus was reached. According to the screening steps, a total of 4698 records were assessed for eligibility. Among them, 46 studies met the inclusion criteria described below and formed the sample for our systematic review.

A draft data extraction form was developed, and discussed with and revised by the research supervisors (RFA, GES) until the final version was completed. The full-text review was conducted by the main author and data extraction was completed for the following: study characteristics (authors, year of publication, country, purpose of the study, target population and settings), participant characteristics (age, gender, education), characteristics of the recognition memory assessment (scores, indices, scales, tests), and study outcomes (main outcomes and other primary outcomes, main findings, and result reporting).

Quality assessment

The methodological quality of included studies was assessed independently by two reviewers (MJR and EL) using the Newcastle-Ottawa scale (NOS) (Stang, 2010). The NOS is a widely used tool for evaluating the quality of non-randomized studies in systematic reviews, consisting of eight items across three domains: selection (representativeness of the exposed cohort; selection of the non-exposed cohort; ascertainment of exposure; and demonstration that outcome of interest was not present at start of study), comparability (comparability of cohorts based on the design or analysis) and outcome (assessment of outcome; was follow-up long enough for outcomes to occur; and adequacy of follow-up of cohorts). A study meeting five or more NOS items was considered to have adequate methodological quality. NOS scores of 0-4 were classified as low-quality, 5-6 as moderate-quality, and 7-9 as high quality. Further details on scoring and criteria are provided in Supplementary Materials.

To ensure reliability, all reviewers underwent standardized training in using the NOS prior to formal assessment. Both reviewers rated studies independently, followed by a pilot phase in which they assessed a sample of papers, resolved initial disagreements through discussion, and developed calibrated interpretations for each item. Disagreements during the full assessment were resolved by consensus; a third reviewer was available if necessary. Substantial agreement was achieved overall, with disagreements arising in only 5 out of 46 papers—a disagreement rate of 10.9%. Inter-rater reliability for pilot ratings was quantified by the kappa statistic. In case of low agreement, interpretation guidelines were further refined before continuing.

It should be noted, consistent with previous methodological analyses (Lo et al., 2014; Stang, 2010), that the NOS was originally designed for observational research (e.g., cohort, case-control studies), and may not fully capture particular sources of bias in experimental or laboratory-based study designs. The potential limitations of using the NOS for experimental studies are discussed explicitly in the limitations section.

Results

Study selection and characteristics

The study selection process is summarized in the PRISMA 2020 flow diagram (Figure 1). A total of 6,332 records were identified, of which 1,622 were duplicates. After screening 4,698 titles and abstracts, 4,045 records were excluded based on the inclusion and exclusion criteria. Full texts of the remaining studies were assessed, leading to exclusion of 19 articles due to study design or publication type, 389 due to population characteristics, and 211 due to outcome type.

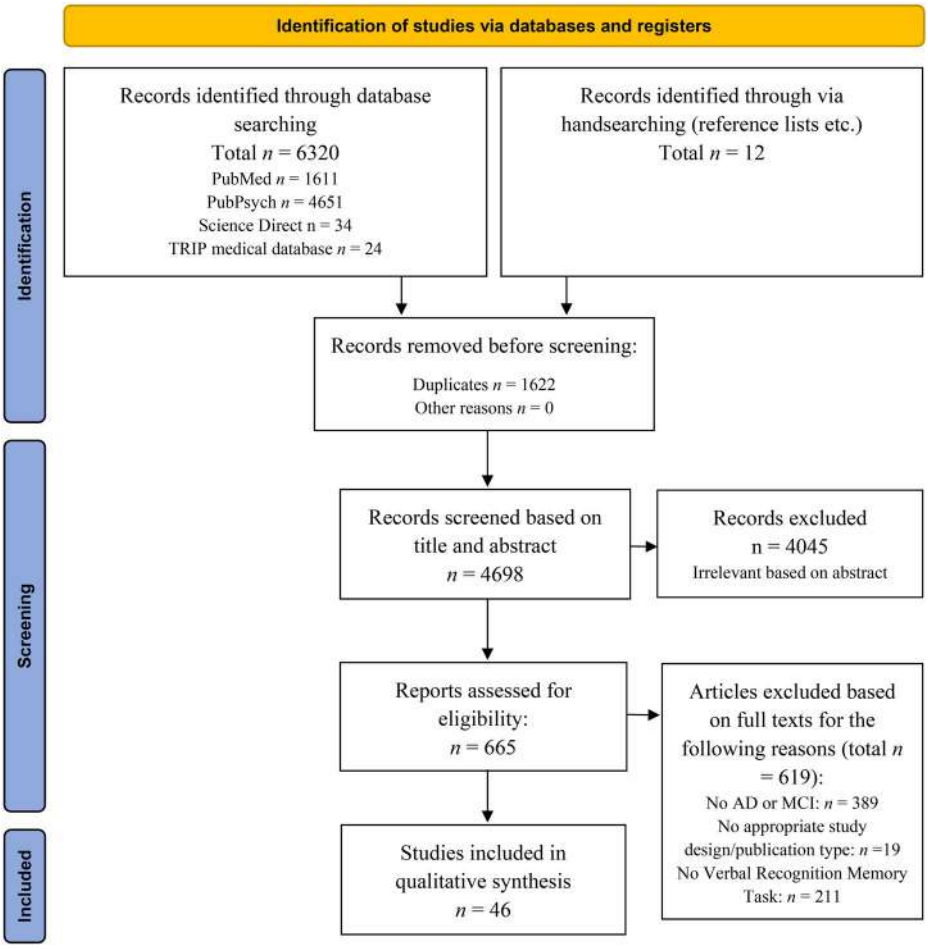

Figure 1. Search strategy and study selection process according to the PRISMA 2020 statement.

Forty-six studies met all criteria and were included in the qualitative synthesis.

Among the 46 studies, 4 were longitudinal cohort studies and 42 were cross-sectional. Samples were recruited primarily from memory clinics and research centers across multiple countries: Germany (1) (Heun et al., 2007), Iran (1) (Rahmani et al., 2023), Taiwan (1) (Chang & Moscovitch, 2022), The Netherlands (1) (Van Den Berg et al., 2020), UK (1) (Weis et al., 2011), Argentina (2) (Russo et al., 2017), Spain (3) (Algarabel et al., 2009, 2012; Rivas-Fernández et al., 2021), Italy (5) (Caruso et al., 2020; De Simone et al., 2019, 2024; Lombardi et al., 2018; Serra et al., 2010), Canada (5) (Anderson et al., 2008; Arias et al., 2023; Clément & Belleville, 2012; Hudon et al., 2009; Troyer et al., 2012), Belgium (6) (Bastin et al., 2013, 2021; Delhaye et al., 2019; Genon et al., 2013; Lekeu et al., 2003; Simon et al., 2018), and USA (20) (Ally et al., 2009; Bennett et al., 2006; Budson et al., 2006; Clark et al., 2012; Embree et al., 2012; Fine et al., 2008; Gallo et al., 2004; Graves et al., 2017, 2018, 2021, 2024; O'Connor & Ally, 2010; Putcha et al., 2022; Ratcliff et al., 2022; Staffaroni et al., 2017; Tse et al., 2010; Wolk et al., 2008, 2011; Wolk et al., 2013; Wolk, Manning, et al., 2013).

The combined sample included 3,996 participants (1,548 healthy controls, 1,233 individuals with MCI, 861 with AD, and 354 with other conditions), with individual study sample sizes ranging from 24 to 397. The mean age of older adult participants (with and without cognitive impairment) was 72.63 years, whereas younger comparison groups had a mean age of 31.63 years; on average, approximately 60% of participants were male (Table 1).

Diagnostic procedures and global cognitive status

Most studies diagnosed MCI and AD using National Institute on Aging–Alzheimer's Association (NIA/AA) criteria (Albert et al., 2011; Jack et al., 2011, 2024; McKhann et al., 2011; Sperling et al., 2011) and related MCI criteria (Petersen et al., 1999, 2001; Winblad et al., 2004), often complemented by structural MRI, PET imaging, CSF biomarkers, and/or APOE genotyping. Two studies (Rahmani et al., 2017; Weis et al., 2011) used DSM-IV or DSM-5 neurocognitive disorder criteria as the primary diagnostic framework (American Psychiatric Association, 2000, 2013). Global cognitive status was most frequently evaluated with the Mini-Mental State Examination (34/46 studies) (Algarabel et al., 2009, 2012; Ally et al., 2009; Anderson et al., 2008; Bastin et al., 2013; Bennett et al., 2006; Caruso et al., 2020; Chang & Moscovitch, 2022; Clément & Belleville, 2012; De Simone et al., 2019, 2024; Embree et al., 2012; Gallo et al., 2004; Heun et al., 2007; Hudon et al., 2009; Lekeu et al., 2003; Lombardi et al., 2018; O'Connor &

Ally, 2010; Rahmani et al., 2023; Ratcliff et al., 2022; Rivas-Fernández et al., 2021; Russo et al., 2017; Serra et al., 2010; Simon et al., 2018; Staffaroni et al., 2017; Troyer et al., 2012; Tse et al., 2010; Van Den Berg et al., 2020; Weis et al., 2011; Wolk et al., 2008, 2011; Wolk et al., 2013; Wolk, Manning, et al., 2013) and, in 12 studies, with the Dementia Rating Scale (Anderson et al., 2008; Bastin et al., 2013, 2021; Clark et al., 2012; Clément & Belleville, 2012; Delhaye et al., 2019; Fine et al., 2008; Genon et al., 2013; Graves et al., 2017, 2018, 2021, 2024; Simon et al., 2018). In some studies, Clinical Dementia Rating (Algarabel et al., 2009, 2012; Arias et al., 2023; Caruso et al., 2020; Chang & Moscovitch, 2022; De Simone et al., 2019, 2024; Fine et al., 2008; Putcha et al., 2022; Ratcliff et al., 2022; Serra et al., 2010; Tse et al., 2010), the Global Deterioration Scale (Algarabel et al., 2009, 2012; Ratcliff et al., 2022) or the Blessed Dementia Scale (Budson et al., 2000) were used as alternative diagnostic confirmation instruments (Table 2).

Global recognition versus process-based paradigms

To address the first aim—characterizing the tasks used to evaluate recognition memory across healthy controls, MCI, and AD—studies were stratified by whether they provided only global recognition indices or allowed explicit estimation of familiarity and recollection.

Thirty-one studies (67.4%) used experimental recognition paradigms (Algarabel et al., 2009, 2012; Ally et al., 2009; Anderson et al., 2008; Bastin et al., 2013, 2021; Budson et al., 2000; Caruso et al., 2020; Chang & Moscovitch, 2022; Clément & Belleville, 2012; De Simone et al., 2024; Delhaye et al., 2019; Embree et al., 2012; Gallo et al., 2004; Genon et al., 2013; Heun et al., 2007; Hudon et al., 2009; Lekeu et al., 2003; Lombardi et al., 2018; O'Connor & Ally, 2010; Ratcliff et al., 2022; Rivas-Fernández et al., 2021; Serra et al., 2010; Simon et al., 2018; Troyer et al., 2012; Tse et al., 2010; Weis et al., 2011; Wolk et al., 2008, 2011; Wolk et al., 2013; Wolk, Manning, et al., 2013), including yes/no recognition, old–new tasks with lures, associative recognition, forced-choice recognition, Remember/Know procedures, and Process Dissociation Procedures.

The remaining studies relied mainly on standardized episodic memory tests widely used in clinical practice, such as the California Verbal Learning Test (CVLT) and the Rey Auditory Verbal Learning Test (RAVLT), which provide global recall and recognition indices but do not directly separate familiarity and recollection. CVLT and its variants were used in 7 studies (Clark et al., 2012; Fine et al., 2008; Graves et al., 2017, 2018, 2021, 2024; Putcha et al., 2022), while RAVLT was used in 4 studies (Arias et al., 2023; Russo et al., 2017; Van Den Berg et al., 2020).

Item memory (single words or pseudowords) was examined in 36/46 studies, whereas associative memory (word pairs or face–name pairs) was examined in 10/46 studies, typically to enhance demands on recollection. All tasks, test conditions, and primary recognition measures are summarized in Table 3.

Quantification of familiarity and recollection

Signal-detection and dual-process metrics were heterogeneously applied. Across the 46 studies:

- The parametric sensitivity index d′ was reported in 31 studies as the primary discrimination measure (Algarabel et al., 2009; Arias et al., 2023; Bastin et al., 2013, 2021; Bennett et al., 2006; Caruso et al., 2020; Chang & Moscovitch, 2022; Clark et al., 2012; Clément & Belleville, 2012; De Simone et al., 2019, 2024; Delhaye et al., 2019; Fine et al., 2008; Graves et al., 2017, 2018, 2024; Heun et al., 2007; Lekeu et al., 2003; Putcha et al., 2022; Rahmani et al., 2023; Russo et al., 2017, 2017; Serra et al., 2010; Staffaroni et al., 2017; Tse et al., 2010; Weis et al., 2011; Wolk et al., 2008, 2011; Wolk et al., 2013; Wolk, Manning, et al., 2013).
- The nonparametric index A′ was used in 5 studies (Budson et al., 2000; Hudon et al., 2009; Rivas-Fernández et al., 2021; Simon et al., 2018; Van Den Berg et al., 2020).
- Two studies generated ROC curves from confidence-rating tasks (Ally et al., 2009; Embree et al., 2012), and several studies reported only hits and false alarms without computing formal discrimination indices (Algarabel et al., 2012; Gallo et al., 2004; Ratcliff et al., 2022).

Importantly, not all studies that reported recognition performance provided reliable process estimates. All included studies reported recognition outcomes, but only a subset implemented paradigms that allow separate quantification of recollection and familiarity.

- Twenty-two studies (47.8%) used explicit process-dissociation or Remember/Know methods to estimate recollection and familiarity (Anderson et al., 2008; Bastin et al., 2021; De Simone et al., 2024; Genon et al., 2013; Hudon et al., 2009; Lombardi et al., 2018; Serra et al., 2010; Troyer et al., 2012; Wolk et al., 2008, 2011; Wolk et al., 2013; Wolk, Manning, et al., 2013).
- Process Dissociation Procedures (PDP) were implemented in 8 studies (Anderson et al., 2008; Genon et al., 2013; Serra et al., 2010; Troyer et al., 2012; Wolk et al., 2008, 2011; Wolk et al., 2013; Wolk, Manning, et al., 2013), using inclusion–exclusion equations to derive recollection and familiarity parameters.
- Remember/Know paradigms were used in 7 studies (Bastin et al., 2021; De Simone et al., 2024; Hudon et al., 2009; Lombardi et al., 2018; Serra et al., 2010), with "remember" and "know" responses interpreted as proxies for recollection and familiarity.

This stratification is reflected in Table 3, where studies are labeled as global recognition only or dual-process/dissociation to distinguish paradigms/methods that truly estimate recollection and familiarity from those that provide only overall recognition performance.

Table 2. Summary of characteristics of study participants.

Study	n	Mean Age (years ± SD)	Gender (F)	Mean education level (length in years ± SD)	Severity measures	Memory tests
Algarabel et al. (2009)	80	HC: 70.38 (0.95), aMCImd: 73.06 (1.33), naMCImd: 75.44 (1.23), AD: 74.5 (2.10)	HC: 7, aMCImd: 7, naMCImd: 6, AD: 6	HC: 9.19 (0.53), aMCImd: 9.13 (0.83), naMCImd: 9.50 (0.81), AD: 10.13 (0.81)	MMSE, GDS, CDR	LM-WMS
Algarabel et al. (2012)	81	HC: 66.7 (8.4), MCI (young): 68.75 (4.6), MCI (older): 81.0 (2.9), AD: 80.3 (4.2)	HC:9, MCI (young): 10, MCI (older): 9, AD: 7	HC: 9.4 (2.3), MCI (young): 9.1 (3), MCI (older): 9.4 (2.3), AD: 8.5 (3.3)	MMSE, GDS, CDR	RAVLT
Ally et al. (2009)	33	HC: 77.3 (5.8), aMCI: 76.5 (7.8), AD: 77.1 (4.7)	NR	HC: 15.8 (3.5), aMCI: 16.0 (3.1), AD: 16.6 (4.1)	MMSE	CERAD-WLMT
Anderson et al. (2008)	89	Young HC: 22.3 (2.6), older HC: 74.2 (5.9), aMCI: 73.2 (6.0)	NR	Young HC: 16.4 (2.2), older HC: 15.6 (3.0), aMCI: 15.5 (2.5)	MMSE, DRS	CVLT
Bastin el at. (2013)	31	HC: 77.7 (5.2), AD: 76.8 (5.3)	HC: 12, mild AD: 11	HC: 9.4 (2.6), AD: 10.1 (2.4)	MMSE, DRS	NR
Bastin et al. (2021)	71	NR	HC: 18, aMCI: 41	NR	DRS	NR
Bennett et al. (2006)	51	HC: 78.9 (5.1), aMCI: 76.8 (4.9)	HC: 15, aMCI: 15	HC: 16.2 (2.9), aMCI: 15.2 (2.1)	MMSE	USC-REMT
Budson et al. (2000)	40	Young HC: 19.42 (18-21), older HC: 74.25 (63-90), AD: 71.58 (60-85)	NR	Young HC: 13.42 (12-15), older HC: 16.50 (12-20), AD: 15.25 (12-21)	Blessed Dementia Scale	NR
Caruso et al. (2020)	95	HC: 73.6 (4.9), AD: 73.9 (4.7), bvFTD: 71.7 (6.6)	HC: 26, AD: 23, bvFTD: 11	HC: 10.8 (4.1), AD: 10.3 (3.8), bvFTD: 11.9 (4.1)	MMSE, CDR	RAVLT
Chang et al. (2022)	104	HC (Female): 71.59 (4.59), HC (Male): 73.29 (5.28), MCI (Female): 73.84 (7.20), MCI (Male): 74.67 (5.98)	HC: 34, MCI: 25	HC (Female): 12.71 (2.30), HC (Male): 14.05 (2.27), MCI (Female): 12.28 (2.61), MCI (Male): 13.46 (3.38)	MMSE, CDR	CVLT-II
Clement et al. (2012)	40	HC: 67.21 (6.80), MCI (Higher cognition): 68.62 (10.30), MCI (Lower cognition): 67.08 (6.29)	HC: 8, MCI (Higher cognition): 8, MCI (Lower cognition): 7	HC:14.57 (3.76), MCI (Higher cognition): 15.31 (3.83), MCI (Lower cognition): 13.62 (3.91)	MMSE, DRS	FCSRT
Clark et al. (2012)	109	HC: 75.8 (8.8), aMCI: 77.7 (8.2), naMCI: 79.4 (8.0), AD: 77.1 (8.4)	HC: 16, aMCI: 6, naMCI: 9, AD: 11	HC: 16.1 (1.9), aMCI: 15.1 (2.6), naMCI: 15.1 (2.8), AD: 14.9 (2.7)	DRS	CVLT-II
De Simone et al. (2024)	28	HC: 71.9 (5.8), aMCI: 75.2 (5.5)	HC: 7, aMCI: 6	HC: 13.1 (3.5), aMCI: 12.0 (3.9)	MMSE, CDR	RAVLT
De Simone et al. (2018)	142	HC: 73.2 (7.3), sMCI: 70.6 (6.6), cMCI: 73.2 (5.5)	HC: 41, sMCI: 21, cMCI:16	HC: 11.6 (3.9), sMCI: 10.5 (4.5), cMCI: 10.2 (4.5)	MMSE, CDR	RAVLT
Delhaye et al. (2019)	42	HC: 76.95 (7.13), AD: 76.52 (7.31)	HC: 12, AD: 9	HC: 11.24 (3.33), AD: 11.14 (3.24)	DRS	NR
Embree et al. (2012)	32	HC: 74.1 (8.1), aMCI: 77.3 (7.3)	HC: 8, aMCI: 6	HC: 15.9 (2.7), aMCI: 16.4 (3.1)	MMSE	CERAD-WLMT
Arias et al. (2023)	212	HC: 71.7 (5.9), MCI: 72 (5), AD: 66.9 (8)	HC: 95, MCI: 26, AD: 17	HC: 15.4 (3.7), MCI: 15.7 (3.7), AD: 14.8 (3.1)	CDR	RAVLT
Fine et al. (2008)	33	AD: 73.6 (12.6), HD: 47.1 (15.4)	AD: 6, HD: 13	AD: 14.5 (2.8), HD: 13.7 (1.9)	CDR, DRS	CVLT-II
Gallo et al. (2004)	24	HC: 74.8 (63–85), AD: 74.1 (55–89)	HC: 7, AD: 5	HC: 15.9 (12–20), AD: 16.9 (12–24)	MMSE	NR
Genon et al. (2013)	49	HC: 68.6 (5.0), mild AD: 75.6 (7.1)	HC: 6, mild AD: 11	HC: 13.0 (2.9), mild AD: 12.4 (3.7)	DRS	NR
Graves et al. (2024)	107	HD-mild: 49.62 (11.55), HD-mod: 50.00 (12.22), AD-mild: 75.28 (4.84), AD-mod: 78.67 (5.02)	mild HD: 26, moderate HD: 9, mild AD: 10, moderate AD: 9	mild HD: 14.15 (2.32), moderate HD: 14.19 (2.29), mild AD: 15.44 (2.89), moderate AD: 15.22 (3.39)	DRS	CVLT-3
Graves et al. (2017)	201	Young HC: 43.63 (15.56), older HC: 75.80 (8.82), AD: 76.55 (8.60), HD: 48.03 (9.58)	Young HC: 32, older HC: 16, AD: 8, HD: 33	Young HC: 15.15 (2.17), Older HC: 16.06 (1.86), AD: 15.00 (2.69), HD: 14.33 (2.15)	DRS-2	CVLT-II
Graves et al. (2018)	191	Young HC: 48.90 (4.53), older HC: 74.57 (6.38), AD-mild: 75.28 (4.84), AD-mod: 78.67 (5.02), HD-mild: 49.87 (11.67), HD-mod: 49.38 (11.93)	Young HC: 18, older HC: 25, AD-mild: 10, AD-mod: 9, HD-mild: 26, HD-mod: 9	Young HC: 14.19 (1.97), older HC: 16.30 (2.09), AD-mild: 15.44 (2.89), AD-mod: 15.22 (3.39), HD-mild: 14.18 (2.33), HD-mod: 14.13 (2.28)	DRS-2	CVLT-3
Graves et al. (2019)	107	mild AD: 75.28 (4.84), and moderate AD: 78.67 (5.02), mild HD: 49.62 (11.55), moderate HD: 50.00 (12.22).	mild AD: 10, moderate AD: 9, mild HD: 26, moderate HD: 9.	mild HD: 14.15 (2.32), moderate HD: 14.19 (2.29), mild AD: 15.44 (2.89), moderate AD: 15.22 (3.39)	DRS, DRS-2	CVLT-3

(*Continued*)

Table 2. Continued.

Study	n	Mean Age (years ± SD)	Gender (F)	Mean education level (length in years ± SD)	Severity measures	Memory tests
Heun et al. (2007)	48	HC: 67.5 (5.4), MCI: 69.7 (7.1)	HC: 17, MCI: 11	NR	MMSE	VLMT
Hudon et al. (2009)	53	HC: 68.6 (8.2), aMCI: 66.1 (7.6), AD: 74.9 (7.0)	HC: 15, aMCI: 9, AD: 6	HC: 14.7 (4.1), aMCI: 14.6 (4.2), AD: 13.7 (3.9)	MMSE	RL/RI-16
Lekeu et al. (2003)	32	HC: 65.4 (7.1), AD: 70.1 (6.2)	HC: 4, AD: 9	NR	MMSE	NR
Lombardi et al. (2018)	35	HC: 68.3 (8.5), aMCI: 71.0 (7.0)	HC: 6, aMCI: 5	HC: 12.3 (3.5), aMCI: 12.3 (4.3)	MMSE	NR
O'Connor et al. (2010)	48	HC: 74.3 (4.3), aMCI: 72.5 (8.7), mild AD: 73.6 (9.7)	NR	HC: 15.8 (3.7), aMCI: 16.9 (3.6), mild AD: 15.1 (3.9)	MMSE	CERAD-WLMT
Putcha et al. (2022)	37	Amnestic AD: 61.2 (5.9), PCA: 70.3 (8.4), lvPPA: 71.2 (8.3)	Amnestic AD: 7, PCA: 9, lvPPA: 5	Amnestic AD: 16.9 (2.2), PCA: 16.8 (2.1), lvPPA: 14.9 (3.5)	CDR	CVLT-II-SF
Rahmani et al. (2023)	180	NR	NR	NR	MMSE	SVLT
Ratcliff et al. (2022)	162	HC: 68.9 (6.6), MCI: 72.0 (8.6), mild AD: 74.8 (7.0)	HC: 39, MCI: 34, mild AD: 13	NR	MMSE, CDR, GDS	CERAD-WLMT
Rivas Fernandez et al. (2021)	48	HC: 66 (9.1), sdaMCI: 67.96 (9.5)	HC: (9), sdaMCI: (9)	HC: 13.96 (6.0), sdaMCI: 10.88 (5.1)	MMSE	CVLT
Russo et al. (2017)	397	aMCI non-converters: 74.12 (7.1), aMCI converters: 74.3 (6.8)	aMCI non-converters: 97, aMCI converters: 44	aMCI non-converters: 15.7 (3.1), aMCI converters: 15.5 (2.9)	MMSE	RAVLT
Russo et al. (2017)	139	HC: 68.84 (8.04), aMCI: 71.14 (7.33), mild AD: 72.42 (7.74)	HC: 23, aMCI: 25, mild AD: 21	HC: 14.22 (4.95), aMCI: 13.80 (3.81), mild AD: 12.40 (4.70)	MMSE	RAVLT
Serra et al. (2010)	42	HC: 66.9 (10.3), aMCI: 71,9 (9.7)	HC: 11, aMCI: 9	HC: 12.9 (4.3), aMCI: 12.9 (4.3)	MMSE, CDR	RAVLT
Simon et al. (2018)	31	HC: 77.96 (6.48), mild AD: 78.53 (6.15)	HC: 11, mild AD: 10	HC: 10.06 (1.73), mild AD: 9.87 (2.33)	MMSE, DRS	NR
Staffaroni et al. (2017)	81	AD: 78.26 (7.63)	AD: 15	AD: 14.05 (3.72)	MMSE	CERAD-WLMT
Troyer et al. (2012)	45	HC: 72.9 (6.7), aMCI: 76.1(7.6)	HC: 12, aMCI: 15	HC: 14.3 (2.6), aMCI: 14.2 (2.5)	MMSE	HVLT-R
Tse et al. (2010)	153	HC: 74.65 (8.59), mild AD: 74.31 (8.61)	NR	HC: 15.10 (2.86), mild AD: 15.33 (2.67)	MMSE, CDR	SRT
Van Den Verg et al. (2020)	199	HC: 67.0 (6.8), AD: 68.1 (7.2), bvFTD: 62.0 (9.0)	HC: 24, AD: 23, bvFTD: 34	HC: 5 (5–6), AD: 5 (4–6), bvFTD: 5 (4–6)	MMSE, FAB	RAVLT
Weis et al. (2011)	37	HC: 67.8 (5.4), AD: 69.6 (6.6)	HC: 17, AD: 4	NR	MMSE	VLMT
Wolk et al. (2008)	37	HC: 71.2 (8.9), aMCI: 72.2 (6.6)	HC: 13, aMCI: 6	HC: 16.1 (3.2), aMCI: 16.9 (2.6)	MMSE	CERAD-WLMT
Wolk et al. (2011)	44	HC: 71.7 (9.1), aMCI: 71.2 (8.0), mild AD: 77.8 (4.4)	NR	HC: 16.7 (2.9), aMCI: 16.6 (3.1), mild AD: 15.0 (3.0)	MMSE	NR
Wolk et al. (2013)	57	HC: 72.1 (8.9), aMCI: 70.0 (8.3)	HC: 22, AD: 10	HC: 16.8 (3.0), aMCI: 17.1 (2.8	MMSE	CERAD-WLMT
Wolk et al. (2013)	99	Young HC: 23.9 (1.6), older HC: 71.2 (9.0), aMCI: 72.0 (6.9)	Young HC: 12, older HC: 29, aMCI: 17	Young HC: 16.5 (1.1), older HC: 16.2 (2.8), aMCI: 16.9 (2.3)	MMSE	CERAD-WLMT

AD: Alzheimer's disease; aMCImd: amnestic mild cognitive impairment multi-domain; bvFTD: behavioral variant frontotemporal dementia; CDR: Clinical Dementia Rating; CERAD-WLMT: Word List Memory Test; cMCI: converter mild cognitive impairment; CVLT: California Verbal Learning Test; CVLT-SF: California Verbal Learning Test - Short Form; DRS: Dementia Rating Scale; HC: healthy controls; FAB: Frontal Assessment Battery; FCSRT: Free and Cued Selective Reminding Test; GDS: Global Deterioration Scale; HD: Huntington's disease; HVLT: Hopkins Verbal Learning Test; LM-WMS: Logical Memory subtest of the Wechsler Memory Scale; MCI; lvPPA: logopenic variant primary progressive aphasia; mild cognitive impairment; MMSE: Mini Mental State Examination; naMCImd: non-amnestic mild cognitive impairment multi-domain; NR: not reported; PCA: posterior cortical atrophy; RAVLT: Rey Auditory Verbal Learning Test; RL/RI-16: L'épreuve de rappel libre/rappel indicé à 16 items; sMCI: stable mild cognitive impairment; SRT: Selective Reminding Test; SVLT: Shiraz Verbal Learning Test; USC-REMT: University of Southern California Repeatable Episodic Memory Test.

Overall recognition performance by diagnostic group

When considering all recognition tasks together (global tests and experimental paradigms), recognition performance showed a graded pattern across groups.

- MCI participants generally exhibited mild-to-moderate recognition impairment relative to healthy controls, with some studies reporting relatively preserved recognition compared to marked free-recall deficits.
- AD participants showed robust and widespread recognition impairment in nearly all paradigms, often paralleling or exceeding deficits observed in recall.

This pattern is consistent with the notion that cued or recognition-based facilitation partly compensates retrieval demands in early stages but becomes insufficient as disease progresses, likely reflecting both executive and medial temporal lobe contributions to retrieval.

Table 3. Outcomes and methodological characteristics.

Study	Format	Memory Instrument	Stimuli (words, pseudowords)	Total Words	Studied words	Distractor words	Individual items	Associated items	Test condition	Recognition Measure	Recognition Method	Experimental procedure
Algarabel et al. (2009)	Computer	Experimental task	Words	98	20	20	Y	Y	Perceptual fluency	d′, C	Global recognition paradigm	Forced-Choice Recognition Task
Algarabel et al. (2012)	Computer	Experimental task	Word pairs	100	30	30	N	Y	Perceptual fluency	Hits minus false alarms	Dual-process	Forced-Choice Recognition Task Associative recognition task
Ally et al. (2009)	Computer	Experimental task	Words	160	160	160	Y	N	Deep/shallow encoding	ROC	Dual-process	Old/New ROC
Anderson et al. (2008)	Computer	Experimental task	Words	288	144	144	Y	N	Repeated words at one of three lags (0, 3, or 12 intervening words)	R = P Inclusión−P Exclusión, F = 1 − R/P Exclusión	Dual-process	Continuous Recognition Task PDP
Bastin el at. (2013)	Printed	Experimental task	Words	120	60	60	Y	N	Perceptual fluency	d′, C	Global recognition paradigm	Yes/No
Bastin et al. (2021)	Computer	Experimental task	Word pairs	20	20	80	N	Y	Cue-target pairs	d′, R= (R old-R new)/(1/R new)	Dual-process	Forced-Choice Recognition Task R/N paradigm
Bennett et al. (2006)	Verbal	USC-REMT	Words	45	15	30	Y	Y	Studied/no studied words	d′, C, proportion of hits minus proportion of false alarms (Pr)	Global recognition paradigm	Yes/No, Forced-choice test
Budson et al. (2000)	Computer	Experimental task	Words	36	18	18	Y	N	Semantically related/unrelated word pairs	A′, B″	Dual-process	Old/New Associative recognition task
Caruso et al. (2020)	Verbal	Experimental task	Words	45	15	30	Y	N	Semantically unrelated concrete objects	d′, C, ISR ((Hits + Correct rejections proportion) − (Delayed recall proportion)/(1-Delayed recall proportion))	Dual-process	Yes/No Comparison with recall tasks
Chang et al. (2022)	Printed	Experimental task	Words	32	16	16	Y	Y	Semantically/phonologically/orthographically/recombined /novel pairs.	d′	Dual-process	Yes/No Associative recognition task
Clement et al. (2012)	Computer	Experimental task	Word pairs	144	72	72	N	Y	Studied/no studied pair words, Intact/rearranged pair words	d′	Dual-process	Old/New Associative recognition task
Clark et al. (2012)	Verbal	CVLT	Words	48	16	32	Y	Y	Studied/no studied words	d′	Global recognition paradigm	Yes/No, Forced-choice test
De Simone et al. (2024)	Computer	Experimental task	Words	240	120	120	Y	N	Encoding/learning context	d′, R= (R old-R new)/(1/R new)	Dual-process	Yes/No R/K paradigm
De Simone et al. (2018)	Verbal	Verbal episodic long-term memory (Carlesimo, 1996)	Words	15	15	45	Y	N	Studied/no studied words	d′, C, ISR ((Hits + Correct rejections proportion) − (Delayed recall proportion)/(1-Delayed recall proportion))	Global recognition paradigm	Yes/No

(*Continued*)

Table 3. Continued.

Study	Format	Memory Instrument	Stimuli (words, pseudowords)	Total Words	Studied words	Distractor words	Individual items	Associated items	Test condition	Recognition Measure	Recognition Method	Experimental procedure
Delhaye et al. (2019)	Computer	Experimental task	Words, word pairs	60	30	30	Y	Y	Semantically related/ unrelated word pairs	d′, C	Dual-process	Yes/No Associative recognition task
Embree et al. (2012)	Computer	Experimental task	Words	470	235	235	Y	N	Conceptual and perceptual fluency	ROC	Dual-process	ROC
Arias et al. (2023)	Verbal	RAVLT	Words	45	15	45	Y	N	Studied/no studied words	d′	Dual-process	Yes/No Comparison with recall tasks
Fine et al. (2008)	Verbal	CVLT-II	Words	48	16	32	Y	N	Studied/no studied words	d′	Global recognition paradigm	Yes/No
Gallo et al. (2004)	Computer	Experimental task	Word pairs	228	36	72	N	Y	Studied/no studied pair words, Intact/ rearranged pair words	Hits to intact pairs - false alarms to word pairs	Dual-process	Yes/No Associative recognition task, Response-Time Methods
Genon et al. (2013)	Computer	Experimental task	Word pairs	314	100	200	N	Y	Intact/rearranged word pairs	R = P Inclusion−P Exclusion, F = 1 − R/P Exclusion	Dual-process	Old/New PDP
Graves et al. (2024)	Verbal	CVLT-3	Words	48	16	32	Y	N	Studied/no studied words	d′	Global recognition paradigm	Yes/No
Graves et al. (2017)	Verbal	CVLT	Words	48	16	32	Y	N	Studied/no studied words	d′	Global recognition paradigm	Yes/No
Graves et al. (2018)	Verbal	CVLT-3	Words	48	16	32	Y	N	Studied/no studied words	d′	Global recognition paradigm	Yes/No
Graves et al. (2019)	Verbal	CVLT-3	Words	48	16	32	Y	N	Studied/no studied words	d′	Global recognition paradigm	Yes/No
Heun et al. (2007)	Computer	Experimental task	Words	360	180	180	Y	N	Studied/no studied words	d′, β	Global recognition paradigm	Yes/No
Hudon et al. (2009)	Computer	Experimental task	Words	60	30	30	Y	N	Encoding/learning context	A′, B″, F = Know/ (1 Remember)	Dual-process	Yes/No R/N paradigm
Lekeu et al. (2003)	Computer	Experimental task	Words	160	80	80	Y	N	Novel/familiar words	d′	Dual-process	Yes/No Response-time method
Lombardi et al. (2018)	Computer	Experimental task	Words	240	120	120	Y	N	Encoding/learning context	R= (R old-R new)/(1/R new)	Dual-process	Old/New R/N paradigm
O'Connor et al. (2010)	Computer	Experimental task	Words	100	50	50	Y	N	Conceptual and perceptual fluency	Pr [% hits - % false alarms], Br [% false alarms / 1 − Pr]	Global recognition paradigm	Yes/No
Putcha et al. (2022)	Verbal	CVLT-II-SF	Words	27	9	18	Y	N	Studied/no studied words	d′, C	Global recognition paradigm	Yes/No
Rahmani et al. (2023)	Verbal	SVLT	Words	48	16	32	Y	N	Studied/no studied words	d′, C	Global recognition paradigm	Yes/No
Ratcliff et al. (2022)	Computer	Experimental task	Words, pseudowords	192	96	96	Y	N	Studied/no studied words. Lexical Decision.	Hit and correct rejection rates	Global recognition paradigm	Yes/No
Rivas Fernandez et al. (2021)	Computer	Experimental task	Words	50	20	30	Y	N	Studied/no studied words	A′, B″	Global recognition paradigm	Old/New
Russo et al. (2017)	Verbal	RAVLT	Words	45	15	30	Y	N	Studied/no studied words	d′	Global recognition paradigm	Yes/No
Russo et al. (2017)	Verbal	RAVLT	Words	45	15	30	Y	N	Studied/no studied words	d′	Global recognition paradigm	Yes/No

(*Continued*)

Table 3. Continued.

Study	Format	Memory Instrument	Stimuli (words, pseudowords)	Total Words	Studied words	Distractor words	Individual items	Associated items	Test condition	Recognition Measure	Recognition Method	Experimental procedure
Serra et al. (2010)	Verbal, Printed	Experimental task	Words	75	55	25	Y	N	Encoding processing: repeating (word listened to) or reading aloud (word written in its correct form) the presented words or solving the visually presented anagrams.	d′, R = P Inclusión–P Exclusión, F = 1 – R/P Exclusión	Dual-process	Old/New PDP, R/K paradigm
Simon et al. (2018)	Printed	Experimental task	Words	50	25	25	Y	N	Whole-word, letter-level visual and phonetic fluency	Á, B″	Global recognition paradigm	Yes/No
Staffaroni et al. (2017)	Verbal	CERAD	Words	20	10	10	Y	N	Studied/no studied words	d′	Global recognition paradigm	Yes/No
Troyer et al. (2012)	Verbal	Experimental task	Word pairs	48	16	32	N	Y	Intact/rearranged/new pair words	R = P Inclusion–P Exclusion, F = 1 – R/P Exclusion	Dual-process	Yes/No PDP
Tse et al. (2010)	Computer	Experimental task	Words	96	48	48	Y	N	Semantically related/ unrelated word pairs	d′, C	Global recognition paradigm	Yes/No
Van Den Verg et al. (2020)	Verbal	RAVLT	Words	30	15	15	Y	N	Studied/no studied words	A′, B″	Global recognition paradigm	Yes/No
Weis et al. (2011)	Computer	Experimental task	Words	90	45	45	Y	N	Studied/no studied words	d′	Global recognition paradigm	Old/New
Wolk et al. (2008)	Computer	Experimental task	Word pairs	120	40	80	N	Y	Intact/rearranged word pairs	d′, R = P Inclusion–P Exclusion, F = 1 – R/P Exclusión	Dual-process	Old/New PDP
Wolk et al. (2011)	Computer	Experimental task	Word pairs	120	40	80	N	Y	Intact/rearranged word pairs	d′, R = P Inclusion–P Exclusión, F = 1 – R/P Exclusión	Dual-process	Old/New PDP
Wolk et al. (2013)	Computer	Experimental task	Word pairs	120	40	80	N	Y	Intact/rearranged word pairs	d′, R = P Inclusion–P Exclusion, F = 1 – R/P Exclusion	Dual-process	Old/New PDP
Wolk et al. (2013)	Computer	Experimental task	Word pairs	120	40	80	N	Y	Intact/rearranged word pairs	d′, R = P Inclusion–P Exclusion, F = 1 – R/P Exclusion	Dual-process	Old/New PDP

C: Criterion; CDR: Clinical Dementia Rating; CERAD-WLMT: Consortium to Establish a Registry for Alzheimer's Disease-Word List Memory Test; CVLT: California Verbal Learning Test; CVLT-SF: California Verbal Learning Test - Short Form; d′; discriminability index; DRS: Dementia Rating Scale; F: Familiarity; FAB: Frontal Assessment Battery; FCSRT: Free and Cued Selective Reminding Test; GDS: Global Deterioration Scale; HVLT: Hopkins Verbal Learning Test; ISR: V; LM-WMS: Logical Memory subtest of the Wechsler Memory Scale; MMSE: Mini Mental State Examination; N: no; NA: not applicable; NR: not reported; P: Probability; PDP: Process Dissociation Procedure; R: Recollection; R/N paradigm: Remember/Know paradigm; RAVLT: Rey Auditory Verbal Learning Test; RL/RI-16: L'épreuve de rappel libre/rappel indicé à 16 items; ROC: Receiver Operating Characteristics; SRT: Selective Reminding Test; SVLT: Shiraz Verbal Learning Test; USC-REMT: University of Southern California Repeatable Episodic Memory Test; Y: yes.

Process-based evidence: recollection and familiarity

Studies that provided reliable estimates of recollection and familiarity were analyzed separately. Figure 2 summarizes the distribution of studies reporting impaired, normal, or mixed performance for each process in MCI and AD relative to healthy controls.

MCI vs. Healthy controls

Recollection was impaired in almost all studies that estimated it (Algarabel et al., 2012; Ally et al., 2009; Anderson et al., 2008; Arias et al., 2023; Bastin et al., 2021; Chang & Moscovitch, 2022; Clément & Belleville, 2012; De Simone et al., 2024; Embree et al., 2012; Hudon et al., 2009; Lombardi et al., 2018; Serra et al., 2010; Troyer et al., 2012; Wolk et al., 2008, 2011; Wolk et al., 2013; Wolk, Manning, et al., 2013), including both item and associative paradigms. Familiarity results were more heterogeneous: some studies reported familiarity deficits in MCI (Algarabel et al., 2012; Ally et al., 2009; Arias et al., 2023; Bennett et al., 2006; Chang & Moscovitch, 2022; Embree et al., 2012; Heun et al., 2007; O'Connor & Ally, 2010; Rahmani et al., 2023; Ratcliff et al., 2022; Rivas-Fernández et al., 2021; Russo et al., 2017; Wolk et al., 2008, 2011; Wolk et al., 2013; Wolk, Manning, et al., 2013), particularly with demanding or associative tasks, whereas others found preserved familiarity (Algarabel et al., 2012; Bastin et al., 2021; Clark et al., 2012; Clément & Belleville, 2012; De Simone et al., 2019), especially in early or single-domain a-MCI. A minority of studies reported no significant familiarity differences between MCI and controls (Anderson et al., 2008; De Simone et al., 2024; Hudon et al., 2009; Lombardi et al., 2018; Serra et al., 2010; Troyer et al., 2012).

AD vs. Healthy controls

All studies that estimated recollection reported marked recollection impairment in AD (Algarabel et al., 2012; Ally et al., 2009; Arias et al., 2023; Budson et al., 2000; Caruso et al., 2020; Delhaye et al., 2019; Gallo et al., 2004; Genon et al., 2013; Hudon et al., 2009; Lekeu et al., 2003; Wolk et al., 2011). Most also found significant familiarity deficits (Algarabel et al., 2009, 2012; Arias et al., 2023; Bastin et al., 2013; Caruso et al., 2020; Clark et al., 2012; Delhaye et al., 2019; Gallo et al., 2004; Graves et al., 2017, 2018; Hudon et al., 2009; O'Connor & Ally, 2010; Rahmani et al., 2023; Ratcliff et al., 2022; Russo et al., 2017; Simon et al., 2018; Tse et al., 2010; Van Den Berg et al., 2020; Weis et al., 2011; Wolk et al., 2011), though a few studies suggested that familiarity may remain relatively preserved under specific task conditions or for certain stimulus types, highlighting potential test-dependency (Budson et al., 2000; Lekeu et al., 2003). Only one study reported that familiarity for individual items remained relatively preserved in patients with AD compared to HC (Genon et al., 2013).

Taken together, these findings indicate that recollection is consistently vulnerable across the MCI–AD continuum, whereas familiarity shows a more variable pattern, often preserved in early MCI but increasingly compromised in advanced stages and in AD.

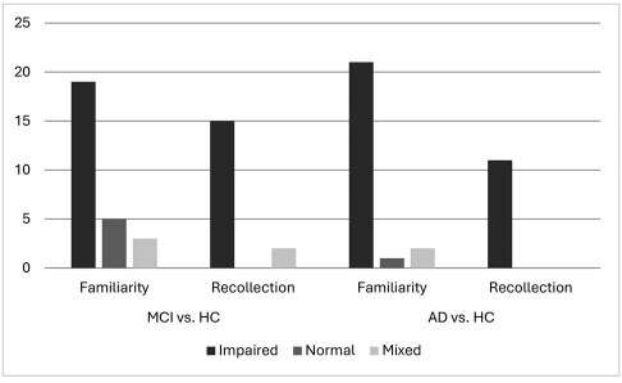

Figure 2. Distribution of studies reporting impaired, normal, or mixed performance for familiarity and recollection in comparisons between mild cognitive impairment (MCI) and healthy controls (HC), and Alzheimer's disease (AD) and HC.

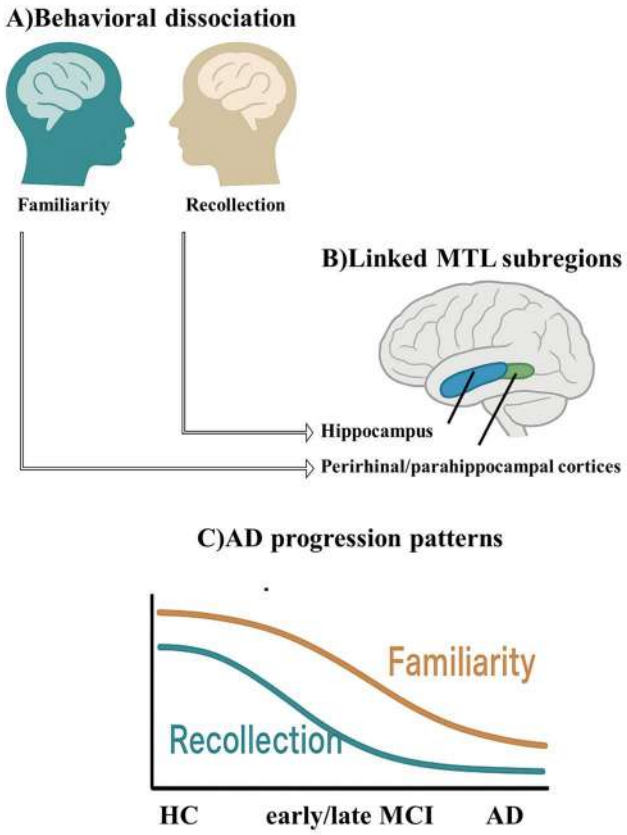

Figure 3. Schematic representation of the recollection–familiarity framework, its medial temporal lobe correlates, and its evolution along the Alzheimer's disease continuum. Recollection (left) involves context-rich, associative retrieval and is primarily supported by the hippocampus, whereas familiarity (right) reflects a graded sense of prior occurrence more closely linked to perirhinal and parahippocampal cortices. Across the progression from healthy aging to amnestic MCI and Alzheimer's dementia, recollection shows early and consistent decline, while familiarity is relatively preserved in early MCI and becomes increasingly impaired in later stages.
Note: The illustration was generated with the assistance of ChatGPT (OpenAI, 2025) and subsequently edited by the authors.

Longitudinal prediction of conversion to dementia

Four longitudinal studies (mean follow-up ≈ 3 years) examined whether recognition-based measures predict conversion from MCI to dementia (Bastin et al., 2021; De Simone et al., 2019, 2024; Russo et al., 2017). The overall conversion rate was approximately 25%, with some variability across samples.

Combined deficits in recall and recognition, particularly when recognition impairment reflected encoding failures rather than pure retrieval difficulties, were strong predictors of progression to AD (Bastin et al., 2021; De Simone et al., 2019, 2024; Russo et al., 2017).

In process-based paradigms, accelerated long-term forgetting of recollection—but not familiarity—was associated with higher conversion risk, whereas relatively stable familiarity-related memory traces characterized non-converters (De Simone et al., 2024).

These results support the clinical relevance of distinguishing recollection and familiarity processes when using recognition tasks to inform prognosis.

Neurobiological correlates of recognition memory

Structural MRI correlates

Four studies linked structural MRI findings to recognition performance across MCI and AD(Figure 3) . Reduced hippocampal volume was consistently associated with impaired recollection, particularly in associative recognition tasks, whereas entorhinal and parahippocampal atrophy was more closely related to familiarity deficits (Putcha et al., 2022; Wolk et al., 2011; Wolk et al., 2013). In amnestic AD (Troyer et al., 2012), anterior medial temporal atrophy was especially associated with poor recognition performance, while in non-amnestic variants recognition difficulty was more strongly related to posterior temporal and parietal involvement.

Functional MRI and network connectivity

Five studies examined functional activation and connectivity during recognition tasks (Clément & Belleville, 2012; Genon et al., 2013; Heun et al., 2007; Rivas-Fernández et al., 2021; Weis et al., 2011). MCI patients showed increased activation in prefrontal and inferior parietal regions during recognition, interpreted as compensatory recruitment to support memory performance. In contrast, a-MCI and AD participants exhibited hypoactivation in core default-mode regions and disrupted connectivity between the precuneus/posterior cingulate, hippocampus, and dorsolateral prefrontal cortex, consistent with default-mode network disruption in AD.

PET imaging findings

Staffaroni and cols. (Staffaroni et al., 2017) linked verbal recognition memory performance to metabolic activity in the left MTL and bilateral orbitofrontal cortex, using fluorodeoxyglucose-positron emission tomography (FDG-PET). The findings emphasize the distributed neural basis of recognition memory in AD patients. Another study (Lekeu et al., 2003) reported distinct clinic-metabolic associations: recognition of novel words correlated with metabolism in the right hippocampus, while familiar words engaged the left orbitofrontal gyrus.

Tau-PET work (Rivas-Fernández et al., 2021) mapped delayed recall and recognition decline onto Braak-like stages, with recall impairment emerging at earlier (anterior medial temporal) stages and recognition impairment at later stages involving posterior temporal and parietal cortices.

CSF biomarkers findings

CSF Aβ1–42, hippocampal atrophy, and recognition discriminability indices jointly predicted MCI-to-AD conversion in one study, supporting the value of combining cognitive and biomarker measures (Russo et al., 2017).

Apolipoprotein E (APOE) genotype

Regarding APOE, the ε4 allele was mainly associated with poorer associative/recollection performance (Troyer et al., 2012) and attentional control (Tse et al., 2010), whereas its presence did not consistently alter group-level recognition differences when included as a covariate (Arias et al., 2023; Russo et al., 2017).

Quality assessment

Methodological quality was evaluated with the NOS scale (Table 4). Fifteen studies (31%) were rated as moderate quality, while the remainder were predominantly high quality. The most frequent sources of lost points were lack of adjustment for demographic covariates (age, sex/gender, education) and incomplete reporting of non-response or follow-up adequacy. All studies achieved the maximum score for outcome assessment, as only investigations using specific recognition memory tasks were included.

Discussion

Summary of main findings

This systematic review synthesized 46 studies examining recognition memory in healthy older adults, individuals with MCI, and those with AD, with a particular focus on disentangling familiarity and recollection. Across paradigms, three main findings emerged. First, when recognition memory is assessed globally (e.g., CVLT, RAVLT, simple old–new tests), performance shows a graded pattern, with mild-to-moderate impairment in MCI and pronounced deficits in AD, often less severe than free-recall impairment in early stages (Algarabel et al., 2009; Clark et al., 2012; Fine et al., 2008; Graves et al., 2017, 2018, 2021, 2024; Russo et al., 2017; Van Den Berg et al., 2020). Second, in studies that explicitly estimated familiarity and recollection, recollection was consistently impaired in both MCI and AD, whereas familiarity showed a more heterogeneous pattern—frequently preserved in early or single-domain a-MCI but clearly impaired in advanced MCI and AD (Ally et al., 2009; Anderson et al., 2008; Arias et al., 2023; Bastin et al., 2013; Chang & Moscovitch, 2022; Clément & Belleville, 2012; De Simone et al., 2019; Hudon et al., 2009; Lombardi et al., 2018; Serra

Table 4. Newcastle-Ottawa scale for assessment of quality of included studies.

Citation (Author, year)	Selection				Comparability		Exposure/ Outcomes			Methodological quality
Algarabel et al., 2009	★	★	★	★	★		★	★		High quality
Algarabel et al., 2012	★	★	★	★	★		★	★		High quality
Ally, 2009	★	★	★	★	★		★	★		High quality
Anderson et al., 2008	★	★	★	★	★		★	★		High quality
Bastin, 2013	★	★	★	★			★	★		Moderate quality
Bennett, 2006	★	★	★	★	★	★	★	★		High quality
Budson, 2000	★	★	★	★	★		★			Moderate quality
Caruso et al., 2020	★	★	★	★	★	★	★	★		High quality
Chang, 2022	★	★	★	★	★	★	★	★		High quality
Clement, 2012	★	★	★	★	★		★	★	★	High quality
Clark et al., 2012	★		★	★	★	★	★	★		High quality
Delhaye et al., 2019	★	★	★	★	★	★	★			High quality
Embree, 2012	★	★	★	★	★		★			Moderate quality
Fernández Arias et al., 2023	★	★	★	★	★	★	★	★	★	High quality
Fine et al., 2008	★	★	★	★	★	★	★			High quality
Gallo et al., 2004	★	★	★	★	★		★			Moderate quality
Genon et al., 2013	★	★	★	★	★		★			Moderate quality
Graves, 2024	★	★	★	★			★			Moderate quality
Graves et al., 2017	★	★	★	★			★			Moderate quality
Graves et al., 2018	★	★	★	★			★			Moderate quality
Graves, 2019	★	★	★	★			★			Moderate quality
Heun et al., 2007	★	★	★		★		★	★	★	High quality
Hudon, 2009	★	★	★	★	★	★	★	★		High quality
Lekeu et al., 2003	★		★	★	★		★	★		Moderate quality
Lombardi et al., 2018	★	★	★	★	★	★	★	★		High quality
O'Connor, 2010	★	★	★	★	★		★			Moderate quality
Putcha et al., 2022	★	★	★	★	★	★	★		★	High quality
Rahmani et al., 2023	★	★	★	★			★	★		Moderate quality
Ratcliff, 2022	★	★	★	★	★		★			Moderate quality
Rivas Fernandez, 2021	★	★	★		★		★	★	★	High quality
Russo et al., 2017	★	★	★	★	★	★	★	★		High quality
Serra et al., 2010	★	★	★	★	★	★	★	★		High quality
Simon, 2018	★	★	★	★	★	★	★	★		High quality
Staffaroni et al., 2017	★	★	★		★		★			Moderate quality
Troyer et al., 2012	★	★	★	★	★	★	★		★	High quality
Tse et al., 2010	★	★	★	★	★		★			Moderate quality
Van Den Verg, 2020	★	★	★	★	★	★	★	★		High quality
Weis et al., 2011	★	★	★	★	★		★		★	High quality
Wolk, 2008	★	★	★	★	★	★	★	★		High quality
Wolk et al., 2011	★	★	★	★	★		★		★	High quality
Wolk et al., 2013	★	★	★	★	★	★	★			High quality
Wolk et al., 2013	★	★	★	★	★	★	★		★	High quality

Note. Each star represents whether the above-mentioned criterion within the subsection was fulfilled.

et al., 2010; Troyer et al., 2012; Wolk et al., 2008; Wolk et al., 2013; Wolk, Manning, et al., 2013; Wolk et al., 2011). Third, structural and functional neuroimaging and biomarker studies converged in linking recollection deficits to hippocampal and posteromedial network alterations, and familiarity impairment to entorhinal/parahippocampal involvement, with combined recall–recognition deficits and specific recognition indices predicting conversion from MCI to dementia (Genon et al., 2013; Lekeu et al., 2003; Putcha et al., 2022; Rivas-Fernández et al., 2021; Russo et al., 2017; Staffaroni et al., 2017; Wolk, Manning, et al., 2013; Wolk et al., 2011).

Global recognition measures and retrieval support

Considering all recognition tasks together provides insight into how cued retrieval and recognition support shape episodic memory performance in MCI and AD. Across standard clinical and experimental paradigms, MCI participants often performed relatively better on recognition than on free recall, especially in early stages, suggesting that external retrieval cues and reduced self-initiated search can partially compensate for impaired encoding and strategic retrieval (Clark et al., 2012; Fine et al., 2008; Graves et al., 2017, 2018; Putcha et al., 2022; Russo et al., 2017). However, in a substantial subset of studies—particularly those using more demanding or associative recognition tasks—recognition deficits in MCI approached those observed in recall, indicating that retrieval support is insufficient when underlying encoding or consolidation mechanisms are compromised (Arias et al., 2023; Bastin et al., 2013; De Simone et al., 2019; Troyer et al., 2012; Van Den Berg et al., 2020). In AD, recognition impairment was robust and widespread, typically paralleling or exceeding recall deficits, consistent with diffuse disruption of hippocampal–cortical networks and reduced benefit of external cues (Algarabel et al., 2009, 2012; Budson et al., 2000; Caruso et al., 2020; Delhaye et al., 2019; Gallo et al., 2004; Graves et al., 2017, 2018; Simon et al., 2018; Tse et al., 2010; Weis et al., 2011).

These findings align with models emphasizing the contribution of executive-mediated retrieval and strategic monitoring to recognition performance, especially under conditions of partial cueing or interference. From a clinical perspective, global recognition scores alone cannot be treated as pure

proxies of familiarity, as they reflect a mixture of recollection, familiarity, and executive control; nonetheless, patterns across recall, cued recall, and recognition can help differentiate predominantly retrieval-mediated difficulties from more fundamental encoding or consolidation failures (Bennett et al., 2006; Gallo et al., 2004; Ratcliff et al., 2022).

Dissociating recollection and familiarity

Focusing on studies that implemented process-dissociation or dual-process paradigms clarify how recollection and familiarity are differentially affected along the MCI–AD continuum. Nearly all such studies reported recollection impairment in MCI, including those using item-based and associative tasks, indicating that hippocampal-dependent, context-rich retrieval is particularly vulnerable even at prodromal stages (Ally et al., 2009; Anderson et al., 2008; Arias et al., 2023; Bastin et al., 2021; Chang & Moscovitch, 2022; Clément & Belleville, 2012; De Simone et al., 2024; Embree et al., 2012; Hudon et al., 2009; Lombardi et al., 2018; Serra et al., 2010; Troyer et al., 2012; Wolk et al., 2008; Wolk, Manning, et al., 2013; Wolk et al., 2011). Familiarity, in contrast, was often relatively preserved in early or single-domain a-MCI, especially when tasks minimized associative demands (Bastin et al., 2021; Clark et al., 2012; Clément & Belleville, 2012; De Simone et al., 2019), but became increasingly compromised with disease progression and in AD, where most studies found deficits in both processes (Algarabel et al., 2009, 2012; Bastin et al., 2013; Caruso et al., 2020; Delhaye et al., 2019; Gallo et al., 2004; Graves et al., 2017, 2018; Hudon et al., 2009; O'Connor & Ally, 2010; Rahmani et al., 2023; Russo et al., 2017; Simon et al., 2018; Tse et al., 2010; Van Den Berg et al., 2020; Weis et al., 2011). A small number of studies suggested that familiarity may remain relatively preserved under specific task conditions or for particular stimulus types (Bastin et al., 2013; Budson et al., 2000; Lekeu et al., 2003).

This pattern is broadly consistent with dual-process accounts positing greater susceptibility of recollection to early hippocampal dysfunction, with familiarity becoming affected as pathology extends to perirhinal and parahippocampal cortices (Yonelinas, 2025). At the same time, variability in familiarity findings underscores the influence of task characteristics, decision criteria, and underlying signal-detection properties, as emphasized by hybrid and continuous-strength models. The present synthesis therefore supports a nuanced view in which recollection emerges as a sensitive early marker of AD-related change, while familiarity provides additional diagnostic and prognostic value when assessed with carefully designed paradigms that control for response bias and associative load (Ally et al., 2009; Anderson et al., 2008; Embree et al., 2012; O'Connor & Ally, 2010).

Neurobiological correlates of recognition processes

Structural MRI

Across MRI studies, recollection deficits were closely associated with hippocampal atrophy and reduced volume in anterior medial temporal structures, particularly in tasks requiring associative binding (e.g., word or face–name pairs) (Bastin et al., 2013; Putcha et al., 2022; Troyer et al., 2012; Wolk et al., 2011). Familiarity impairment showed stronger links to entorhinal and parahippocampal thinning and, in some cases, posterior temporal and parietal atrophy, especially in non-amnestic presentations or more advanced disease (Lekeu et al., 2003; Putcha et al., 2022; Wolk, Manning, et al., 2013). These findings support the idea of partially distinct, though overlapping, medial temporal contributions to recollection and familiarity, while also highlighting that widespread cortical degeneration ultimately affects both processes.

Functional MRI and network connectivity

Functional imaging studies revealed compensatory and degenerative patterns across the continuum. In MCI, increased activation in prefrontal and inferior parietal regions during recognition tasks likely reflects compensatory recruitment of executive and attentional networks to support performance (Clément & Belleville, 2012; Heun et al., 2007). In contrast, a-MCI and AD participants showed hypoactivation in key default-mode regions and disrupted connectivity between the precuneus/posterior cingulate, hippocampus, and dorsolateral prefrontal cortex, consistent with default-mode network disruption as a core feature of AD (Bastin et al., 2013; Rivas-Fernández et al., 2021). These network-level changes parallel the behavioral shift from relatively preserved familiarity with impaired recollection in early stages to more global recognition failure in dementia.

PET, CSF biomarkers, and APOE

PET and CSF studies further situate recognition-memory changes within biomarker-based frameworks of AD. FDG-PET work linked poorer verbal recognition to reduced metabolism in the medial temporal lobe and orbitofrontal cortex, emphasizing the distributed neural underpinnings of recognition performance in AD (Lekeu et al., 2003; Staffaroni et al., 2017). Tau-PET work mapped delayed recall decline to earlier, anterior medial temporal tau deposition, whereas recognition impairment emerged later, in association with tau accumulation in posterior temporal and parietal cortices, suggesting partially distinct temporal trajectories for different episodic components (Arias et al., 2023). Lower CSF Aβ1–42 in combination with hippocampal atrophy and impaired recognition discriminability predicted conversion from MCI to AD, indicating that recognition indices may complement fluid and imaging biomarkers in risk stratification (Russo et al., 2017).

Regarding APOE, the ε4 allele was mainly associated with poorer associative/recollection performance and attentional control, particularly in tasks that require interference resolution or complex binding (Troyer et al., 2012; Tse et al., 2010). However, when included as a covariate, APOE genotype did not consistently modify group-level recognition differences, suggesting that its influence on recognition memory may be mediated by broader network and pathology burdens rather than by a simple direct effect (Arias et al., 2023; Russo et al., 2017).

Clinical implications and recommendations

The present findings have several implications for clinical neuropsychology and applied assessment. First, reliance on free recall alone is likely insufficient for characterizing memory mechanisms or predicting progression; combining recall, cued recall, and recognition measures can help distinguish retrieval-mediated difficulties from encoding-consolidation deficits and improve prognostic specificity in a-MCI (Bennett et al., 2006; Clark et al., 2012; De Simone et al., 2019; Russo et al., 2017). Second, within recognition testing, paradigms that allow at least partial dissociation of recollection and familiarity—such as associative recognition, Remember/Know judgments with clear instructions, or process-dissociation tasks adapted for clinical use—appear particularly informative for detecting early recollection impairment and tracking disease progression (Ally et al., 2009; Anderson et al., 2008; Bastin et al., 2021; Clément & Belleville, 2012; Troyer et al., 2012; Wolk et al., 2008; Wolk et al., 2011). Third, integrating recognition measures with structural MRI and tau/Aβ biomarkers may aid in constructing cognitive–biological profiles that distinguish prodromal AD from normal aging and other dementias, although routine implementation will require standardization of tasks and scoring across centers (Bastin et al., 2013; Putcha et al., 2022; Rivas-Fernández et al., 2021; Russo et al., 2017).

In practical terms, clinicians may consider incorporating: (1) a standardized list-learning test with both free-recall and recognition components, (2) at least one associative recognition paradigm when feasible, and (3) simple signal-detection-based indices (e.g., d′, A′, or corrected recognition) that reduce confounding by response bias (Budson et al., 2000; Hudon et al., 2009; Simon et al., 2018; Van Den Berg et al., 2020). Future work should also explore how sex/gender, education, and cultural factors modulate recognition profiles, as emerging evidence suggests that women may show distinct memory trajectories in prodromal AD, which could influence generalizability of current findings.

Methodological considerations and limitations

Several limitations should be acknowledged when interpreting this review. First, there was substantial heterogeneity in tasks, stimuli, outcome indices, and diagnostic criteria across studies, which limits direct quantitative synthesis and may contribute to variability in familiarity findings (Algarabel et al., 2009, 2012; Ratcliff et al., 2022). Although studies were stratified by paradigm type (global vs. process-based), differences in response formats, delay intervals, and analytic approaches still constrain cross-study comparability (Ally et al., 2009; Embree et al., 2012). Second, the NOS scale, while widely used for observational research, is not optimized for experimental or laboratory-based cognitive designs; some sources of bias specific to neuropsychological paradigms may therefore have been under-captured, and this should be considered when weighing the overall quality ratings (Lo et al., 2014; Stang, 2010).

Third, most included samples were recruited from specialized memory clinics or research centers in North America and Europe, with limited representation from other regions and from under-represented groups; consequently, the applicability of these findings to more diverse or community-based populations remains uncertain (Anderson et al., 2008; Bastin et al., 2013; Caruso et al., 2020; Rahmani et al., 2023). Fourth, only four longitudinal studies were available, with modest sample sizes and varying follow-up durations, which restricts firm conclusions about the predictive accuracy of recognition indices for conversion to dementia (Bastin et al., 2021; De Simone et al., 2019, 2024; Russo et al., 2017). Finally, although the search was updated through November 2024, rapid developments in biomarker criteria and experimental paradigms mean that subsequent work may further refine the relationship between recognition components and AD pathology.

Future directions

Future research should prioritize longitudinal, multimodal studies that combine carefully designed recognition paradigms with structural, functional, and molecular biomarkers across diverse cohorts. Standardizing recognition tasks and process-estimation methods would facilitate meta-analytic synthesis and allow more precise estimation of effect sizes for recollection and familiarity deficits in prodromal and clinical AD. In addition, examining sex/gender, education, and cultural effects on recognition profiles may help tailor assessment batteries to specific populations and improve equity in early detection. Finally, translating process-based paradigms into time-efficient, clinically feasible tools—potentially supported by digital or computerized platforms—represents a key step toward integrating nuanced recognition-memory assessment into routine practice.

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