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The Relationship Between Subjective Cognitive Decline and Cognitive Leisure Activity Engagement: A Systematic Review

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Abstract

Background and Objectives: Subjective cognitive decline (SCD) is a common experience of self-perceived decline without objective cognitive impairment. It has been theorized that SCD is associated with participation in cognitive leisure activities (CLAs), but the evidence base is multifarious and unclear. The purpose of this systematic review was to synthesize current evidence to determine the association between SCD and CLA engagement.

Research Design and Methods: Systematic searches were conducted in EMBASE, MEDLINE, PsycINFO, and Web of Science (last searched April 2023). Data were extracted against a priori inclusion criteria and synthesized narratively using Synthesis without Meta-Analysis guidelines. Risk of bias was assessed using the Newcastle–Ottawa Scale (NOS) and Mixed Methods Appraisal Tool (MMAT). Reporting follows PRISMA guidelines.

Results: From 4,447 records, 11 articles were included. Due to study heterogeneity, evidence on SCD and CLA association is inconclusive. Although a modest correlation was found between greater engagement in CLA and fewer reports of SCD, the heterogeneity in study designs and outcomes, particularly in those addressing only perceived memory decline and CLA engagement, challenges definitive conclusions on this relationship. Evidence from mixed-method and qualitative studies indicated that perceived memory decline may cause negative feelings, such as shame and frustration, which may influence participating in CLA.

Discussion and Implications: These findings suggest that participation in CLA is moderately associated with, and may act protectively against, SCD. However, establishing a directional or causal relationship between CLA participation and SCD outcomes requires further investigation through longitudinal and/or interventional studies.

Keywords: Cognitive activity engagement, Memory, Subjective cognitive decline, Systematic review

Subjective cognitive decline (SCD) refers to an individual's sense of worsening in their cognitive functions in the absence of objective deficits (Jessen et al., 2014). It is characterized by a variety of terms, including subjective cognitive concerns, subjective memory decline (SMD), or forgetfulness (Jessen et al., 2014). Based on data from 15 countries, the prevalence of SCD in people aged 60 and older has been estimated between 23.8% and 25.6% (Röhr et al., 2020). SCD is receiving increased attention in the literature because of its growing prevalence, especially among older people, and as potentially one of the earliest markers of cognitive impairment (Jessen et al., 2014). Furthermore, a link has been found between SCD, impaired mental health (Hill et al., 2016), and worse quality of life (Hill et al., 2017).

A large and growing body of evidence has linked SCD with an increased risk of cognitive impairment, including Alzheimer's disease (AD) and related dementias (Amariglio et al., 2012; Scheef et al., 2012). In a longitudinal study, Jessen et al. (2020) highlighted that people with SCD have a 40%–62% expected risk either to develop mild cognitive

impairment or dementia within 3 years. The prevalence of dementia is expected to almost triple by 2050, and it is predicted that the cost of AD and related dementias will escalate from \$2.8 trillion in 2019 to \$4.7 trillion in 2030 (Nandi et al., 2022). Moreover, cognitive impairment prevents people from successfully living independently, imposing a great deal of financial and societal burden on people, caregivers, and society (Lindsay & Anderson, 2004). Consequently, SCD is regarded as a key early indication, serving as an opportunity to detect symptoms early to postpone or reverse the irreversible damage of these diseases.

It is considered that identification of SCD is an important opportunity for influencing modifiable risk factors and altering the trajectory of cognitive and functional decline (Jessen et al., 2020). One such modifiable risk factor is cognitive leisure activity (CLA). Cognitive reserve (CR) refers to the brain's ability to adapt and maintain functionality despite age-related changes or damage and explains why some individuals are more resilient to brain aging than others (Stern et al., 2020). CR is not fixed but continues to evolve across the

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lifespan, and CLA engagement is a key component in developing and sustaining CR, helping individuals better cope with brain aging and damage (Stern et al., 2020). Engaging in CLA has been found to be favorably correlated with cognitive function, physical functioning, and mental health (Sala et al., 2019; Scarmeas & Stern, 2003). Evidence indicates that CLA engagement is related to a 26% reduced risk for AD onset (Carlson et al., 2008), delays cognitive decline (Krell-Roesch et al., 2017), and shows positive contributions in specific cognitive domains in older people (Stieger & Lachman, 2021). Numerous studies have also concluded that CLA engagement is associated with higher quality of life (Seinfeld et al., 2013; Silverstein & Parker, 2002).

The relationship of CLA participation with cognitive function, which is evaluated using objective tests, is now well-established (Fallahpour et al., 2016; Stern & Munn, 2010). However, little is known about the association of SCD with CLA engagement. It is important to investigate and systematically characterize the relationship between SCD and CLA participation for two reasons. First, considerable evidence has accumulated showing that CLA is related to a lower risk for objective cognitive impairment (Krell-Roesch et al., 2017; Stieger & Lachman, 2021), suggesting that it may also have an association with fewer SCD complaints. Second, the other health outcomes associated with SCD, inducing psychological health problems and lower quality of life are among the issues in which CLA may play a protective role (Sala et al., 2019; Scarmeas & Stern, 2003). As SCD is a precursor to objective impairment, it represents an earlier opportunity for meaningful cognitive interventions. Moreover, understanding which CLAs have a stronger negative association with SCD and/or are preferred by older people (e.g., passive vs active CLAs) will help to inform the design of potential interventions.

Although a previous review has explored SCD and activity participation, a systematic understanding of the association between SCD and CLA engagement is lacking (Wion et al., 2020). Searching up to 2018, Wion et al. (2020) examined SCD and activity participation in their systematic review by separating activities into physical, social, and cognitive domains. They concluded that greater SCD was associated with lower social and physical activity participation, but that there was an absence of studies exploring the specific relationship between CLA participation and SCD. However, the review was limited to quantitative studies, and given the evolving nature of research in this field, new evidence has emerged over the last 5 years on the association between SCD and CLA participation. Hence, the objective of this review was to address the following primary research questions:

1. What is the association between SCD and CLA engagement?
2. Are different CLAs more or less related to SCD?

Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Page et al., 2021) was followed (Supplementary Data Section S1). The review protocol was registered with the Prospective Register of Systematic Reviews (PROSPERO; CRD42023408726, https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023408726).

Eligibility Criteria

The PICOS method was used to define eligibility as follows:

(P) Population: Participants consisted of people who have SCD recruited from any setting (e.g., community-dwelling, nursing homes, or other care facilities). Due to the lack of standardized assessment tools for SCD, broad inclusion criteria were adopted, using definitions of SCD specified by each study. Although SCD is usually observed in older people, it can also affect middle-aged or young adults (Jessen et al., 2014); therefore, there was no age restriction.

(I) Intervention/exposures: Participation in CLAs where seeking or processing information is central, and which involve minimal physical activity or social interaction (Wilson et al., 2007). For this review, CLAs must be unstructured, meaning they did not follow a formal or predetermined framework. Examples include solving puzzles, crosswords, or Sudoku; reading books; or writing for pleasure, such as keeping a diary.

(C) Comparison: Was not required but may have included individuals who participated in less or no CLA than the target group (exposed to or engaged in CLA).

(O) Outcomes: SCD in cognitive domains, including memory, executive functioning, attention, orientation, visuospatial abilities, and language skill.

(S) Study design: Qualitative, quantitative, or mixed methods.

Studies included those examining the relationship between SCD and CLA engagement, even if they were not the primary focus but provided relevant data on these variables. Where necessary, we contacted the corresponding authors for missing or further data. The studies needed to be written in English, and only primary research articles were included. No time restriction was applied.

The exclusion criteria involved individuals with objectively diagnosed cognitive impairments. Because they were delivered with the goal of training or learning, cognitive training interventions (e.g., playing video games, learning a foreign language) were excluded (i.e., they are not “leisure”).

Detailed inclusion criteria for SCD and diagnostic frameworks for excluding people with cognitive impairments are available in [Supplementary Data Section S2](#).

Search Strategy

Database searching was conducted using EMBASE, MEDLINE (via Ovid), PsycINFO, and Web of Science, from inception until April 19, 2023. Moreover, an investigation of additional relevant literature was conducted by screening references and citations of included articles via Google Scholar (last searched June 5, 2023). An expanded list of search terms was used (see [Supplementary Data Section S3](#) for a full list of terms).

Selection Process and Data Extraction

All search results were imported into Zotero reference management software and de-duplicated. Title/abstract screening and subsequent full-text screening were performed by two independent reviewers (E. Akbayrak and N. Tunc). Initially, title/abstract screening was completed in line with prearranged inclusion/exclusion criteria independently. Records were selected for full text review if considered relevant, potentially relevant, or if doubt existed and examined independently. Full text review results were screened by both

reviewers collaboratively for inclusion based on predetermined eligibility criteria, ensuring a thorough and unbiased selection of relevant studies. Any discrepancies encountered at full text review were resolved by discussion with the other members of the research team (S. Barnes and P. A. Powell).

Data extraction was carried out by two researchers using a standardized data extraction form developed during the review. This included the following: study characteristics (author(s), year, location, and design of the study); participant characteristics (sample size, age); method (tools/questionnaires used for measuring SCD and CLA engagement); and outcomes on the association between SCD and CLA engagement.

Quality Assessment

Cross-sectional and longitudinal cohort studies were assessed using an adapted version of the Newcastle–Ottawa Scale (NOS), focusing on three quality parameters (selection, comparability, and outcome) across eight items (Wells et al., 2009). The McGill Mixed Methods Appraisal instrument (MMAT) was used to assess qualitative and mixed-method studies. Responses were categorized as “can’t tell,” “no,” or “yes” (Hong et al., 2018). The total score on the MMAT was computed as a percentage, with a higher percentage indicating greater adherence to the specified methodological criteria, thereby correlating with a reduced risk of bias. Two reviewers (E. Akbayrak and N. Tunc) independently assessed risk of bias. Any disagreements were resolved through discussions with other research team members (S. Barnes and P. A. Powell). All studies were used for synthesis, irrespective of the quality assessment score, rather, quality assessment results were incorporated into the synthesis process narratively (for

full results of the quality assessment, see [Supplementary Data Section S4](#)).

Data Synthesis

Meta-analysis was not feasible methodologically due to the heterogeneity of the study designs and outcomes. Thus, findings were narratively synthesized without using meta-analysis in accordance with the Synthesis Without Meta-Analysis (SWIM) guidelines (Campbell et al., 2020; [Supplementary Data Section S5](#)). This evidence synthesis took into consideration the characteristics and quality of each study. For synthesis, findings were grouped based on the cognitive domains evaluated in the measurement of SCD, in terms of assessing solely perceived memory decline or perceived decline in multiple domains. Next, the quantitative evidence was summarized on the association between SCD or SMD and CLA participation depending on reported statistics, drawing on study findings with reference to quality appraisal. Our primary summary measure was Pearson’s correlation (r), when available. Secondary measures included odds ratio (OR), beta coefficient (β), and unstandardized regression coefficient (b), when available. The main findings from the included mixed-method and qualitative studies were summarized and discussed, in the context of whether the results supported the quantitative findings.

Results

A total of 3,618 records were identified via database searching, from which 590 duplicates were removed and 3,028 were screened at title and abstract ([Figure 1](#)). A total of 177 were further assessed for eligibility at full text, of which 166 were rejected (see [Figure 1](#) for reasons for exclusion). A

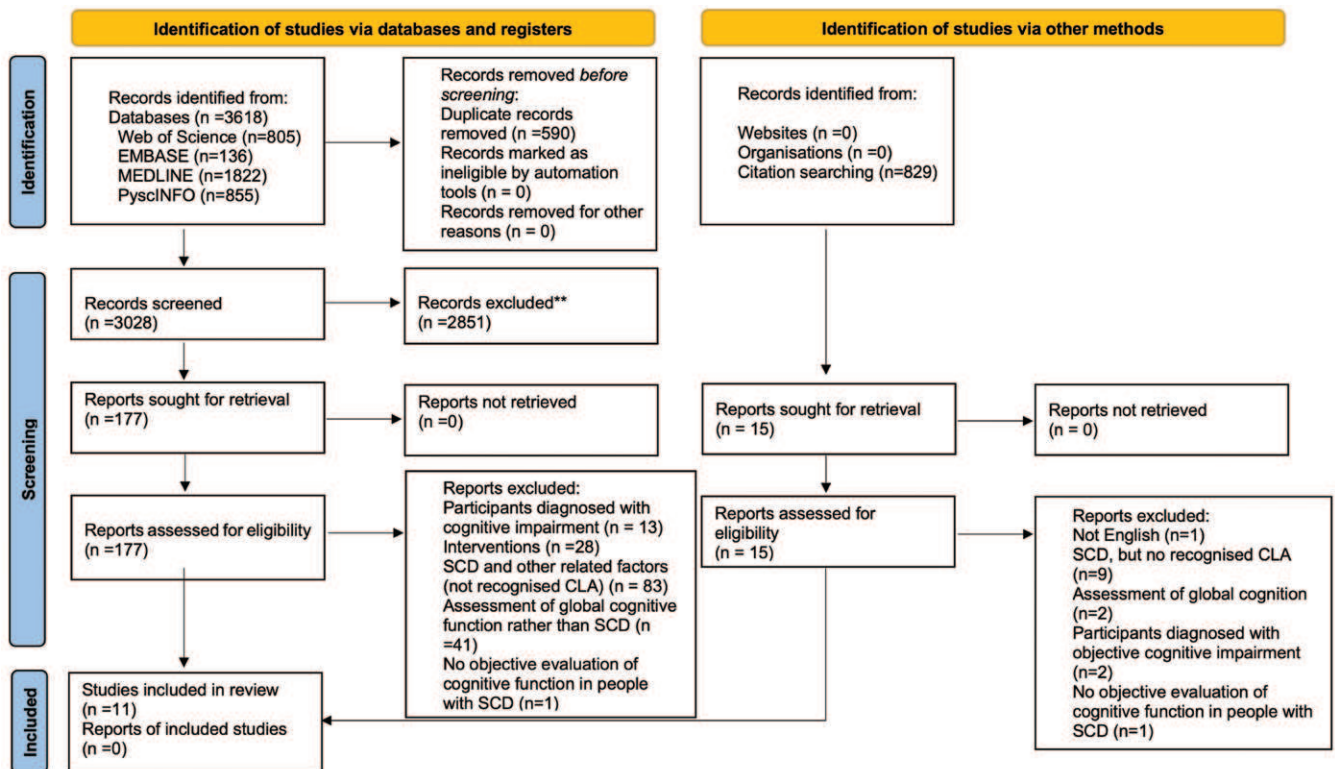


Figure 1. Article selection and inclusion process flow diagram. CLA = Cognitive Leisure Activity; SCD = Subjective Cognitive Decline

Table 1. Study Characteristics

Citation (country)	Study design	Sample (% female)	SCD measurement (domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
Benge et al. (2023) (United States)	Quantitative Cross-sectional study	<i>N</i> = 219 37.9% Community-based Sample age over 65 Mean age (<i>SD</i>) 75.01 (5.21)	The Everyday Cognition Scale (ECOG) Multidomain	A survey on technological activities asked participants to rate their frequency of use of a variety of devices and internet services from 0 (never) to 6 (many times a day). A focus of the current study was (a) the use of general devices across smartphones, computers, and tablets, (b) the use of interpersonal activities (namely texting and video phone calls), and (c) the use of social media	To determine whether older adults' use of digital technology is associated with better or worse subjective cognitive concerns	A higher frequency of technology use was associated with a lower level of overall cognitive concerns ($r = -0.216, p = .001$), less reported memory concerns ($r = -0.199, p < .01$) and less executive concerns ($r = -0.248, p < .01$), indicating modest association between variables	Low
Bransby et al. (2022) (Australia)	Quantitative Cross-sectional study	<i>N</i> = 1,864 75.75% Community-based Sample age between 40 and 70 Mean age (<i>SD</i>) 57.21 (7.16)	The Cognitive Function Instrument (CFI) Multidomain	The Cognitively Stimulating Leisure Activities (CSLA) Survey was used. It explores engagement with current affairs (e.g., politics, economics), entertainment or lifestyle information, and interests in science, history, or technical skills. The survey also examines social and community engagement, including craft activities, community group involvement, and social events. It assesses technological use, covering ownership and usage patterns for computers, tablets, and mobile phones. Language skills are evaluated, focusing on multilingual capabilities and the practice of learning new languages. Lastly, it addresses artistic and musical activities, detailing participation in playing instruments and engaging in artistic pursuits like painting and sculpting. This survey provides a comprehensive assessment of individuals' engagement in these activities	To assess the associations between cognitively stimulating leisure activities and cognitive performance and subjective ratings of cognition	No significant relationship was found between frequency ($\beta = 0.015, SE = 0.022, p = .499$) and variety ($\beta = 0.009, SE = 0.022, p = .679$) of engagement in cognitively stimulating leisure activities and subjective ratings of cognition	Moderate
Bransby et al. (2023) (Australia)	Quantitative Cross-sectional study	<i>N</i> = 1,610 75.9% Community-based Sample age between 40 and 70 Mean age (<i>SD</i>) 57.42 (7.07)	The Cognitive Function Instrument (CFI) Multidomain	CELA (Cognitive Engagement in Leisure Activities) Survey includes "reading books, craft activities (e.g., pottery, quilting, or sewing), computer activities, playing games (e.g., playing cards or doing crossword puzzles), and social activities (e.g., going to the movies or going out with friends)" (Krell-Roesch et al., 2019). Participants were asked how frequently they engaged in each mentally stimulating activity using a structured survey with ordinal responses (once a month or less, 2–3 times a month, 1–2 times a week, 3–4 times a week, 5–6 times a week, and daily)	To identify the association of multidomain modifiable dementia risk factors (MDRFs), including cognitive activity, with cognitive performance and subjective ratings of cognition	No significant relationship was found between leisure cognitive engagement (CELA Survey) and subjective cognition ($r = -0.028$)	Moderate

Table 1. Continued

Citation (country)	Study design	Sample (% female)	SCD measurement (domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
Hill et al. (2018) (United States)	Mixed methods study	N = 19 57.9% Community-based Sample age 60 and over Mean age (SD) 80.7 (6)	A 1–10 scale, with higher scores indicating more frequent memory problems. Memory	The Columbia Extended Instrumental Activities of Daily Living (E-IADLs), including more challenging leisure activities	To describe the experiences of older adults living with varying degrees of subjective memory impairments by assessing how subjective memory impairments fit with the impact of memory problems on daily life as described by older adults	A higher level of subjective memory impairment was associated with withdrawal from engaging in cognitively protective behaviors	Low
Hill et al. (2021) (United States)	Quantitative Longitudinal study	N = 8,321 in total. N = 6,718 NHATS 58.28% No mean age given. N = 663 EAS 63.60% Mean age (SD) 78.10 (5.23) Community-based N = 940 MAP and MARS 77.87% Mean age (SD) 76.40 (7.10) Care retirement communities and low-income housing Sample age 65 and over	Depending on questions related to perceived memory change within 1 year in EAS, NHATS; or over 10 years in EAS, MAP/MARS, e.g., compared with 1 year ago, do you have trouble remembering things more often, less often, or about the same? Memory	In EAS, CLA engagement was evaluated by asking the following questions regarding activities in the last month, with response options of 0 = no (N/A) and 1 = yes (weekly/monthly): reading newspapers or books; playing board games, card games, or computer games; doing crossword puzzles; using the Internet or sending emails; writing for pleasure; playing a musical instrument; participating in an adult learning program; going to the theater or a concert; participating in a support group; singing in a choir or similar group; visiting museums; watching TV; knitting or crocheting. In MAP/MARS, CLA engagement was evaluated by asking the following questions regarding activities in the last year, with response options of 0 = no (once a year/several times a year); 1 = yes (several times a month/several times a week/every day/almost every day): reading newspapers, magazines or books; visiting a library; writing letters; playing games like checkers or other board games, cards, puzzles, word games, mind teasers, or any other similar games; visiting a museum; attending a concert, play, or musical	To examine intraindividual differences in relationships among self-perceived memory decline and participation in cognitive activities in older adults without cognitive impairment over time	There was no significant relationship between 1-year or 10-year perceived decline and cognitive activity: in MAP/MARS, the relationship between 10-year perceived decline and participation in cognitive activity is $r = 0.008$. In EAS, the relationship between 1-year perceived decline and participation in cognitive activity is $r = -0.025$ and the relationship between 10-year perceived decline and participation in cognitive activity is $r = -0.022$, which are not statistically significant	High

Table 1. Continued

Citation (country)	Study design	Sample (% female)	SCD measurement (domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
Iizuka et al. (2021) (Japan)	Quantitative Cross-sectional study	N = 436 73.9% Community-based Sample age 65 and over Mean age (SD) 74.1 (5.8)	Depending on the question “Do you have complaints of forgetfulness?” Memory	The frequency of (ranging from never to almost every day) the following daily intellectual activities: “reading newspaper, reading magazine, reading books, entries in a diary, writing letters, using computers, using cell phones, watching TV, and listening to the radio”	To determine the frequency of specific day-to-day intellectual activities among older adults who complain of forgetfulness	Watching TV and listening to the radio, which were defined as passive activity, reading and technology use were found to be the most preferred daily intellectual activities respectively among participants with complaints of forgetfulness	Moderate
Katayama et al. (2022) (Japan)	Quantitative Longitudinal study	N = 2,569 51.3% Community-based Sample age 65 and over Mean age (SD) 70.9 (4.6)	Depending on four questions that “Do you have any difficulty with your memory?”; (2) “Do you forget where you have left things more than you used to?”; (3) “Do you forget the names of close friends or relatives?”; and (4) “Do other people find you forgetful?” Memory	Cognitive activity was measured by the following questions: (1) “Do you read books or newspapers”; (2) “Do you drive a car”; (3) “Do you use a personal computer”; (4) “Do you engage in activities that use your brain (shogi, learning, etc.)”; and (5) “Do you operate a video/DVD player?”	To examine whether community-dwelling older adults with SCD have more modifiable protective factors, including cognitive activities, against the risk of dementia than older adults with objective cognitive decline	It was found that people with SCD showed more CLA engagement than those with cognitive impairment	High
Lee et al. (2020) (South Korea)	Quantitative Cross-sectional study	N = 182 64.3% Community-based Sample age 65 and over Mean age (SD) 78.4 (5.91)	The Cognitive Failure Questionnaire (CFQ) Multidomain	The Cognitive Activities Scale, including watching television; listening to the radio; reading the newspaper, magazines, and books; playing games and visiting museums. In this study, “Visiting museums” has been deleted and three additional items have been added: “attending lectures or continuing education classes, attending concerts or plays and using the computer or a smartphone”	To investigate factors influencing subjective cognitive decline and cognitive function in older South Koreans	Even though the correlation analysis indicated a weak negative association between CLA participation and SCD complaints ($r = -0.210$, $p = .005$), the multiple regression analysis showed that this relationship is not statistically significant when controlling for other variables ($\beta = 0.079$, $p = .335$)	Low

Table 1. Continued

Citation (country)	Study design	Sample (% female)	SCD measurement (domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
Nemoto et al. (2018) (Japan)	Quantitative Cross-sectional study	N = 5,328 54.5% Community-based Sample age 65 and over No mean age given	The Kihon Checklist (KCL) Multidomain	During the last 7 days, the subjective average duration of television viewing and reading books or newspapers was evaluated. Each activity was classified into four categories based on the amount of time spent on sedentary behavior: <1 hr/day, 1–2 hr/day, 2–3 hr/day, and 3 hr/day for television viewing; <10 min/day, 10–20 min/day, 20–30 min/day, and 30 min/day for reading.	To explore the relationship between single and combined factors of sedentary behavior and physical activity with subjective cognitive complaints in older adults living in the community	The reading behavior was correlated with subjective cognitive complaints in a dose-response manner, with reading more than 10 min per day associated with a reduced risk of subjective cognitive complaints than reading less than 10 min (OR for 10–20 min/day = 0.63; 95% CI = 0.53–0.75; OR for 20–30 min/day = 0.59; 95% CI = 0.49–0.71; OR for ≥30 min/day = 0.47; 95% CI = 0.39–0.57)	Low
Parikh et al. (2016) (Canada)	Qualitative study	N = 37 in total 45.95% Sample age 60 and over Normal memory (N = 23) Mean age (SD) 72.5 (6.4) Amnesic Mild Cognitive Impairment (N = 14) Mean age (SD) 79 (4.3)	The Multifactorial Metamemory Questionnaire (MMQ) Memory	Not specified	To gain a more comprehensive understanding of how memory changes affect the daily lives of individuals with normal aging and mild cognitive impairments with amnesia	Participants who experienced self-reported memory change stated that they participated in more cognitively engaging activities for their brain health benefits	Low
Rotenberg, Maier, et al. (2020) (Israel and Canada)	Quantitative Secondary data analysis	N = 115 65.2% Community-based Sample age 60 and over Mean age (SD) 77.88 (7.15)	The Multifactorial Memory Questionnaire (MMQ) Memory	The Activity Card was used, including leisure with low physical demands (e.g., hand crafts, watching television, attending concerts)	1. To examine perceived changes in participation among older adults with SMD compared to their own participation 5 to 10 years ago. 2. To explore the correlations between participation, subjective memory decline, and objective cognitive performance	1. A notable decrease has been identified in engagement cognitively stimulating activities among people with SMD, with a withdrawal rate of 83%. 2. There is a moderately strong and statistically significant positive correlation between greater CLA participation and less subjective memory concern ($r = 0.35, p = .001$).	Moderate

Notes: *b* = unstandardized regression coefficient; CLA = cognitive leisure activity; EAS = The Einstein Aging Study; MAP/MARS = The Rush Memory and Aging Project/The Minority Aging Research Study; NHATS = The National Health and Aging Trends Study; *r* = Pearson correlation coefficient; SCD = subjective cognitive decline; *SD* = standard deviation; *SE* = standard error; SMD = xxx; β = beta coefficient.

total of 829 records were identified from additional sources (Google Scholar citation searches and reference tracking), but none were suitable for inclusion (see [Figure 1](#) for reasons for exclusion). In total, 11 studies identified via databases were included (nine quantitative studies, one mixed-method study and one qualitative study).

Study Characteristics

Included studies are summarized in [Table 1](#). All articles were published between 2016 and 2023. Six were cross-sectional; two were longitudinal; and one each had a qualitative, mixed-methods, and secondary data analysis design. The studies were carried out in the United States and Japan (three from each); Canada (two studies); Australia (two studies); South Korea and Israel (one from each). Across the 11 studies, there were 20,700 participants, with sample sizes ranging from 19 to 8,321 participants. The mean age of study samples ranged from 57.21 to 80.7 years.

Cognitive leisure activity engagement across various studies was assessed through questionnaires, measuring participation frequency (ranging from many times daily to never) and activity types. Although some studies adhered to the six CLAs recommended by [Verghese et al. \(2003\)](#), including reading, writing, doing crossword puzzles, playing board games or cards, participating in group discussions, and playing musical instruments ([Hill et al., 2021](#); [Iizuka et al., 2021](#)), variations existed. Activities such as reading and playing games were frequently examined by CLAs. Additionally, the use of computers, smartphones, and tablets were also included as CLAs ([Benge et al., 2023](#); [Iizuka et al., 2021](#); [Katayama et al., 2022](#)). Watching TV and listening to the radio, which are considered as “passive mental activities,” were included among the CLAs in some studies ([Iizuka et al., 2021](#); [Lee et al., 2020](#); [Rotenberg, Maeir, et al., 2020](#)). Moreover, beyond commonly assessed CLAs, activities such as handcrafts ([Bransby et al., 2023](#); [Rotenberg, Maeir, et al., 2020](#)), driving cars and operating a video/DVD players ([Katayama et al., 2022](#)) were also regarded as CLAs.

Subjective cognitive decline assessment methods varied, with six focusing solely on memory decline and five assessing multiple domains ([Table 1](#)). Typically, SCD was evaluated with validated tools, asking questions about the frequency and/or severity of perceived changes/complaints in cognitive functions or using a rating scale to assess memory concerns ([Supplementary Data Section S2](#)).

To classify subgroups and exclude individuals with objective cognitive impairment, many studies used standardized neuropsychological tests to exclude participants with objective cognitive impairments. For instance, the Montreal Cognitive Assessment ([Hill et al., 2018](#); [Iizuka et al., 2021](#); [Lee, 2014](#); [Rotenberg et al., 2020](#)), the Mini-Mental State Examination ([Katayama et al., 2022](#)), and the Cogstate Brief Battery ([Bransby et al., 2022, 2023](#)). [Hill et al. \(2021\)](#) selected eligible participants through comprehensive in-person neuropsychological assessments. [Nemoto et al. \(2018\)](#) included only individuals who had never utilized long-term health insurance services. [Benge et al. \(2023\)](#) asked participants if they had been diagnosed with MCI or dementia; those who responded negatively were included. See [Supplementary Data Section S2](#) for detailed information.

Association Between SCD and CLA Engagement

Two high-quality cross-sectional studies provided evidence that CLA participation was related to fewer SCD complaints

([Benge et al., 2023](#); [Nemoto et al., 2018](#)). [Benge et al. \(2023\)](#) concluded that frequent use of technological devices was moderately linked to fewer SCD concerns in older people. A Japanese study demonstrated a dose-response relationship between CLA engagement and lower SCD risk among community-dwelling older people ([Nemoto et al., 2018](#)). Specifically, reading more (vs less) than 10 min a day was found to be significantly related to a lower risk of SCD. Overall, these high-quality cross-sectional studies identified a moderate association between greater CLA engagement and less SCD concerns, especially among older individuals.

Two moderate-quality cross-sectional studies ([Bransby et al., 2022, 2023](#)) and one high-quality cross-sectional study found no significant association between SCD and CLA engagement ([Lee et al., 2020](#)). A study among South Korean older adults reported no significant association between CLA participation and SCD ([Lee et al., 2020](#)). [Bransby et al. \(2023\)](#) examined the association of multidomain modifiable dementia risk factors with SCD in middle-aged adults, including cognitive/social engagement. They showed that the correlation of greater SCD with CLA engagement was nonsignificant ([Bransby et al., 2023](#)). Similarly, a study in Australia reported that neither CLA engagement frequency nor variety showed a significant relationship with SCD in middle-aged adults aged 40 to 70 ([Bransby et al., 2022](#)). It is noteworthy that participants in both studies were not obligated to complete all assessments in a single sitting, potentially leading to varied sample sizes for each test and survey, which may introduce high nonresponse bias. Consequently, interpretations of these findings should be approached with caution, given their moderate risk of bias.

Association Between SMD and CLA Engagement

The six studies investigating perceptions of memory decline and CLA participation had heterogeneous study designs and conclusions. Two of the studies were longitudinal, one was cross-sectional, one was a secondary data analysis, one was a mixed-method study, and one a qualitative study ([Table 1](#)). Among these, the mixed-method and qualitative studies were graded as high-quality, whereas the cross-sectional and secondary data analysis studies were rated as moderate-quality, and the two longitudinal studies were graded as low-quality. Two studies reported higher participation in CLA among individuals with SMD, whereas two others suggested lower engagement. One study found negligible association between SMD and CLA participation, whereas another specifically explored the types of CLAs frequently engaged in by individuals with SMD.

Two studies (one longitudinal, one qualitative study) reported that people with SMD showed greater CLA participation ([Katayama et al., 2022](#); [Parikh et al., 2016](#)). In a 4-year longitudinal study, community-dwelling older participants were divided into four groups: those with SMD, those with normal cognition, those with objective cognitive decline, and those with both SMD and objective cognitive decline, to understand whether people with SMD had a more modifiable protective lifestyle than others ([Katayama et al., 2022](#)). It was concluded that older adults with normal cognition and the SMD-only group adopted significantly more modifiable protective lifestyle behaviors, especially by maintaining cognitive engagement ([Katayama et al., 2022](#)). However, it is important to bear in mind the possible bias in this conclusion because this was a low-quality study (see [Supplementary Data](#)

Table 2. Adapted Newcastle–Ottawa Scale for Quality Assessment of Cross-Sectional and Longitudinal Studies

Study	Selection	Comparability	Outcome	Total score	Risk of bias
Adapted Newcastle–Ottawa Scale for Quality Assessment of Cross-Sectional Studies					
Benge et al. (2023)	***	**	**	7	Low
Bransby et al. (2023)	**	**	**	6	Moderate
Bransby et al. (2022)	**	**	**	6	Moderate
Iizuka et al. (2021)	**	**	**	6	Moderate
Lee et al. (2020)	***	**	**	7	Low
Nemoto et al. (2018)	***	**	**	7	Low
Rotenberg et al. (2020)	**	**	**	6	Moderate
Newcastle–Ottawa Scale for Quality Assessment of Longitudinal Studies					
Hill et al. (2021)	**	**	*	5	High
Katayama et al. (2022)	***	**	0	5	High

Notes: Cross-sectional studies were classified into high risk (4 or fewer points), moderate risk (5–6 points), or low risk of bias (7–8 points; Moskalewicz & Oremus, 2020). It was assigned high risk (5 or fewer points), moderate risk (6–7 points), or low risk (8–9 points) categories according to bias evaluation for longitudinal studies (Wells et al., 2009).

Section S4, Table 2). A high-quality qualitative study among older adults in Canada investigated the impact of SMD on daily life and demonstrated that participants with SMD were motivated to participate in more CLA (Parikh et al., 2016). This study noted that older participants reported some negative life experiences that caused embarrassment or frustration because of SMD, including forgetting the names of acquaintances, losing household items, and repeating themselves in conversations. However, their awareness of the link between intellectual engagement and brain health motivated them to engage in more CLA participation, such as doing crossword puzzles, to compensate for their memory change (Parikh et al., 2016).

Two studies (one cross-sectional and one mixed-methods study) reported an association between having SMD and withdrawal from CLA participation (Hill et al., 2018; Rotenberg, Maeir, et al., 2020). A mixed-methods study conducted by Hill et al. (2018) in the United States investigated how SMD affects daily life in older participants. It was observed that individuals reporting higher levels of SMD tended to engage less in cognitively protective behaviors. Furthermore, these individuals reported experiencing negative emotions such as frustration and embarrassment (Hill et al., 2018). It suggests a link between SMD and less engagement in CLA, alongside increased negative emotions. Likewise, Rotenberg, Maeir, et al. (2020) examined changes in activity participation in older adults with SMD compared to 5 to 10 years ago. They found an association between older adults with SMD and a significant reduction in activity engagement, with withdrawal rates of 83% for cognitively stimulating activities. Nevertheless, this study also indicated that more preserved activity participation is associated with less frequent memory problems in daily life (Rotenberg, Maeir, et al., 2020).

In a longitudinal study in the United States with over 8,000 participants and up to 20 years of follow-up, Hill et al. (2021) revealed that SMD (evaluated over 1 or 10 years, depending on the data source) did not directly influence participation in CLA over time among older adults. However, caution is warranted in interpreting these findings due to the high risk of bias (see Supplementary Data Section S4, Table 2).

One cross-sectional study examined the preferred type of CLAs among older adults with forgetfulness, conducted

in Japan (Iizuka et al., 2021). The study categorized CLA engagement into passive and active groups. Watching TV and listening to radio were considered passive, and 98.6% of the participants affirmed that they do these activities almost daily. Reading, technology use, and writing were classified as active and, while most of the participants stated that they read newspapers, books, or magazines nearly every day (85.8%), over half of the participants reported that they used technology daily. Overall, watching TV, listening to the radio, reading, and technology use emerged as the most frequently preferred CLA types among participants experiencing forgetfulness (Iizuka et al., 2021).

Discussion

The aim of this review was to synthesize evidence on the association between SCD status and participation in CLA. Overall, there was a lack of consistency in studies on this topic due to different outcomes, varying magnitudes of association, and study design, making it difficult to determine the nature of the relationship between them. Nevertheless, high-quality studies investigating the relationship between SCD and CLA participation found a modest association between greater CLA engagement and fewer SCD concerns (Benge et al., 2023; Nemoto et al., 2018; Rotenberg, Maeir, et al., 2020). Although this may suggest CLA engagement is protective for SCD, it is important to acknowledge the possibility of reverse causation, where individuals experiencing less SCD may be more likely to engage in CLA. Previous research supports this bidirectional relationship, with studies finding that higher initial memory performance is linked to slower declines in intellectual social leisure activities (Armstrong et al., 2022) and that individuals with better baseline cognitive performance are more likely to increase their activity levels over time (Bosma et al., 2002).

The review identified that almost half of the studies examining the relationship between SCD and CLA engagement assessed only subjective decline in memory (Table 1). The results of the included studies indicated that older adults with SMD are more likely to be engaged in CLA and to continue participating in activities than older adults with objective cognitive impairments (Katayama et al., 2022; Rotenberg, Maeir, et al., 2020). Even though it is not possible to draw

a definitive conclusion due to the lack and heterogeneity of evidence, it has been observed that CLA participation might be influenced by feelings such as embarrassment and disappointment in people with SMD. Moreover, it has been shown that older people with forgetfulness were more likely to participate in types of CLA that require less cognitive challenge, but this evidence was based on only one moderate-quality cross-sectional study (Iizuka et al., 2021).

Findings regarding greater CLA participation with less SCD complaints are corroborated within the literature (Chen et al., 2014; Lee, 2014). Despite the well-established link between CLA participation and objective cognitive functioning (Fallahpour et al., 2016; Stern & Munn, 2010), this review suggested a predominantly modest or negligible correlation between CLA and SCD, with limited support for a substantial link. It is conceivable that this result arises from the multifaceted nature of SCD, which can be influenced by and in turn affect CLA participation. Notably, SCD is associated with heightened levels of depression and a poor perception of health, with existing studies indicating the detrimental impact of these factors on overall activity engagement (Kimura et al., 2013; Schuch et al., 2017). For instance, research has demonstrated that individuals experiencing depression are four times more likely to report SCD and twice as likely to encounter confusion or memory loss affecting their work or social interactions (Brown et al., 2022). Similarly, it has been acknowledged that perceived health status and depression may influence the relationship between CLA engagement and SCD (Lee et al., 2020). These findings highlight the need for consideration of other related factors in trying to determine the association between SCD and CLA participation.

The results concerning SMD and reduced CLA participation also align with existing literature, indicating a connection between SMD and its potential adverse impact on engagement in CLA, particularly influenced by negative emotions. Rotenberg, Sternberg, et al. (2020) revealed that SMD is linked to withdrawal from social and leisure activities and the loss of meaningful life roles because of emotional responses such as embarrassment, frustration, and anger. As supported by Buckley et al. (2015), SMD can trigger negative emotional reactions such as shame, anger, and disappointment and is more distressing when it occurs in the presence of others, or when the task is considered significant. In addition, it has been argued that people with SMD might refrain from participating in social activities due to the attitudes of others toward their cognitive abilities (Paanalahti et al., 2023). Considering that SMD experienced by individuals is often perceived as a concern or surprise by relatives or friends (Cromwell, 1994), it is noted that people may take measures to compensate for their forgetfulness, such as planning. This underscores the idea that individuals may avoid participating in CLA due to a desire to conceal their SMD. Given that negative emotions, such as anger, are known to influence lifestyle choices (Anton & Miller, 2005), it can be asserted that emotional responses and the perceptions of others regarding the cognitive abilities of individuals with SCD might be factors influencing a decrease in CLA participation.

An important consideration in the current evidence is the lack of consistency in both SCD and CLA participation assessments, making it difficult to arrive at a definitive conclusion. "Memory decline" is considered one of the foremost and distinct signs of cognitive impairment, and studies on this subject generally revolve around SMD and related

modifiable factors (Jessen et al., 2020). SCD is not limited to memory (Jessen et al., 2014); however, the results obtained from these studies may have been affected by the fact that the participants answered only questions regarding subjective decline in memory. Jacova et al. (2020) have shown that there is an age-related trajectory in how people evaluate their cognition, with younger individuals focusing primarily on memory, while older individuals considering both memory and language. Considering that most participants in the reviewed studies were older adults (Table 1), assessing only memory may lead to different results. Additionally, different questions in SCD evaluation may lead to inconsistent results. For instance, Takechi et al. (2020) assessed SCD with three questions capturing different aspects of SMD. Although one question correlated with increased activity participation, the others correlated with decreased activity participation (Takechi et al., 2020). Consideration of the duration of SCD is also crucial in its assessment. However, in studies included in this review by Iizuka et al. (2021) and Katayama et al. (2022), only one or two general questions were used without inquiry into the timeframe. Inconsistent assessments, limited focus on nonmemory domains, and varied questions emphasize the need for standardized approaches in future studies to ensure clarity and consistency.

Likewise, there is also no standard classification and assessment of CLA participation. In contrast to the general classification of CLAs (Fallahpour et al., 2016), using computers and reading were considered as "sedentary leisure time" activities by Cohen et al. (2017). They indicated that people who participated in less sedentary leisure time activities had better SCD. Additionally, daily social media use was found to be related to increased same-day and subsequent memory problems (Sharifian & Zahodne, 2020). Conversely, in this review, technology use (Benge et al., 2023) and reading (Nemoto et al., 2018) have been associated with less SCD. These activities, classified as sedentary by Cohen et al. (2017), have been evaluated as cognitively challenging in the literature (Fallahpour et al., 2016; Stern & Munn, 2010) and linked to less SCD (Ramos et al., 2021). Consequently, considering these contrasting findings, it is worth considering that the classification of CLAs may play a crucial role in the varied outcomes observed. Another noteworthy aspect in the assessment of CLA engagement is that only the frequency of activities was evaluated, while the impact of different types of activities on SCD was overlooked. However, the effect of both CLA frequency and type on SCD may vary (Ramos et al., 2021).

The complicated interplay between sociodemographic characteristics and SCD may contribute to the observed inconsistency in the acquired data. For example, age has been associated with an increase in SCD complaints (Jessen et al., 2020; Taylor et al., 2018) and reduced activity participation (Perlmutter et al., 2010). Corroborating this view, studies investigating the correlation between SCD and CLA engagement (Parikh et al., 2016) revealed that individuals who sought more CLA participation were, on average, nearly 6 years younger than those who withdrew from CLA engagement (Hill et al., 2018; Rotenberg, Sternberg, et al., 2020), even in the presence of similar negative mood experiences stemming from SCD. However, there is evidence that younger individuals may be more affected by SCD. Taylor et al. (2018) reported that older adults may be less aware of the effects of SCD, considering it a normal part of aging, whereas younger

adults may attribute limitations in their lifestyles to SCD and may be more sensitive to its effects. This perspective is also supported by [Chen et al. \(2014\)](#), who claimed that young and middle-aged adults frequently report SMD, suggesting a lower tolerance for memory difficulties in these age groups, possibly due to increased cognitive demands associated with concurrent tasks and responsibilities. Moreover, several studies have shown that SCD does not correlate with age in a significant way ([Bransby et al., 2023](#); [Lee et al., 2020](#)). Although conclusive evidence on the impact of age on the relationship between CLA participation and SCD is lacking, emerging findings indicate that age could play a significant role in this association.

Another possible explanation for the observed inconsistencies in the effects of CLA engagement could be the level of education and its relation to CR. The literature suggests that CLA engagement may have more positive effects on older adults with lower education levels ([Ihle et al., 2015](#)). This is supported by data from [Nemoto et al. \(2018\)](#), included in this review, which indicated that a reading habit was associated with less SCD among participants who were not highly educated. Highly educated individuals are often presumed to have higher CR due to their more stimulating intellectual environments and experiences ([Scarmeas & Stern, 2003](#)). This elevated CR might make them less likely to benefit from CLA as significantly as those with lower CR, as they may already have a greater buffer against cognitive decline. Furthermore, highly educated individuals might be more sensitive to subtle declines in cognitive function, making them more adept at detecting and addressing changes before they affect daily life ([Rabin et al., 2017](#)). Thus, the varying effects of CLA engagement could reflect differences in CR, which influences how individuals benefit from such activities. Future research should incorporate measures of CR, employ longitudinal designs, control for CR, and explore interaction effects to better understand the role of CR in CLA engagement.

This systematic review has highlighted a prevalent focus on memory decline within the literature on SCD, often neglecting the broader spectrum of multidomain cognitive experiences. Most of the included studies were cross-sectional, revealing a modest correlation between less SCD concerns and greater CLA engagement, in line with existing literature. However, the diversity in study designs and outcomes between SMD and CLA engagement complicates drawing definitive conclusions. Notably, the overall inconsistency in the results is likely attributed to the diverse methods employed in assessing both SCD and CLA participation, along with sociodemographic variations among participants.

Strengths and Limitations of Review

This systematic review is the first to investigate the relationship between SCD and CLA participation, encompassing observational studies of quantitative, mixed-method, and qualitative designs across diverse population groups. Most studies in our review were rated as high or moderate quality, with fewer rated as low quality.

This review has some limitations that should be considered. Non-English language studies were excluded, potentially overlooking relevant research. Due to heterogeneity in methods and data presentation, meta-analysis was unfeasible, necessitating a narrative synthesis of findings. Given this heterogeneity and study limitations, the literature yields inconclusive

evidence on the SCD and CLA association. Lastly, the estimated association between SCD and CLA may differ between studies based on sample characteristics and may be affected by third variables, such as depression.

Recommendations for Future Studies

This review identifies key gaps warranting further research. Firstly, existing evidence primarily focuses on memory decline, neglecting assessment across all cognitive domains in SCD. Understanding individuals' assessment of various cognitive functions and their CLA engagement is crucial. Secondly, future research should explore the protective role of specific CLA types and preferences of individuals with SCD. Thirdly, a qualitative exploration of the barriers to CLA engagement and motivational sources for individuals with SCD would provide valuable insights, benefitting healthcare providers, policymakers, and researchers. Fourthly, an imbalance in gender representation is noted in the included studies, with a predominance of female participants, underscoring the importance of maintaining gender balance in SCD research. Finally, most studies exhibit a cross-sectional design or are of lower quality, highlighting the need for more high-quality longitudinal research. Longitudinal studies are crucial for disentangling the directionality of the relationship between SCD and CLA participation, as they track changes over time to provide definitive insights into whether increased CLA engagement leads to improvements in SCD or if individuals with less SCD are more inclined to participate in CLA.

Conclusion

Given the diverse study designs and outcomes, evidence on the link between SCD and CLA participation is inconclusive. However, risk of bias assessments and reported effect sizes suggest a modest association between greater CLA engagement and fewer SCD complaints. Regarding the association of SMD with CLA engagement, there is inconclusive evidence suggesting that adverse emotional states induced by SMD, such as embarrassment and frustration, may be related to less CLA participation. Moreover, an additional finding from studies investigating the link between SMD and CLA engagement suggests that individuals with SMD exhibit more modifiable protective factors, notably heightened CLA participation, compared to those with objectively measured cognitive impairment. This finding provides optimism as it may suggest that given the literature highlighting the elevated risk of objective cognitive impairment in individuals with SCD, protective factors could be adopted in a timely manner, potentially reducing the irreversible impacts of objective cognitive decline. In conclusion, further research is needed to understand the relationship between SCD, modifiable risk factors, and CLA engagement to help safeguard cognitive health effectively.

Supplementary Material

Supplementary data are available at *The Gerontologist* online.

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Conflict of Interest

None.

Data Availability

The data underlying this article are available in the article and in its online supplementary material. The review protocol was registered with the Prospective Register of Systematic Reviews (PROSPERO; CRD42023408726, https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023408726).

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