

## Summary

# A Review on the Relationship Between Subjective Memory Complaints and Cognitive Functions In Older Adults

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Subjective memory complaints (SMCs) correspond to the forgetfulness experienced by the individual in their daily lives (Açıkgöz et al., 2014). The high rate of conversion of SMC to dementia (Cheng et al., 2017) suggests that it may be the preliminary stage of dementia in old age. For this reason, it is important to follow up and evaluate SMC. In neuropsychological evaluation, older adults who perform normally despite memory complaints are defined as having SMCs (e.g. Pike et al., 2015; Viviano et al., 2019), and those who perform 1.5 or 2 standard deviations below the normal score are defined as mild cognitive impairment (MCI) (Petersen et al., 1999; Schinka et al., 2010). Therefore, SMC differs from MCI in that cognitive performance is not yet objectively impaired (Petersen, 2004). However, it is not clear enough whether there is a diagnostic equivalent for SMC (Abdulrab & Heun, 2008), which does not yet have a standard definition in clinical practice and basic science research.

### Prevalence of SMC

Memory complaints increase with aging, and this increase becomes evident especially in older adulthood. Therefore, it is noteworthy that the majority of studies related to the subject in the literature are focused on the memory complaints of older adults (e.g. Abdulrab & Heun, 2008; Steinberg et al., 2013; Tangen et al., 2020). According to studies, the prevalence of SMC in older adults varies between 33% and 89% (Basset & Folstein, 1993; Montejo et al., 2011; Onur Aysevener et al., 2018).

### Etiology of SMC

According to the literature, SMC have different causes and the foremost among these are the objective cognitive problems experienced by the individual (e.g. Burmester et al., 2016; Reid & MacLulich, 2006; Schmidt et al., 2001). In older adults with SMC, atrophy is observed especially in the hippocampal areas (Cantero et al., 2015). The similarity of the neural processes of SMC with the pathology of Alzheimer's type dementia

(ATD) pathology supports the view that memory complaints are the precursor stages of MCI and ATD (Erk et al., 2011). However, it is unclear whether memory complaints observed in older adulthood are caused by aging or the evolving to dementia (Açıkgöz et al., 2014).

Depression seen in older adulthood is one of the most important factors of SMC. It appears that older adults with depression have more SMCs than do those without (O'Connor et al., 1990). In addition, anxiety (Derouesné et al., 1999), the presence of MCI or dementia in the individual's family, help-seeking behaviors (Hurt et al., 2012), low education level (Açıkgöz et al., 2014; Gagnon et al., 1994), stereotypes about memory functions (Ryan & Kwong See, 1993), personality traits (Metternich et al., 2009; Reid & MacLulich, 2006), and sex (Steinberg et al., 2013) are also associated with SMC.

### Evaluation of SMC

Memory complaints can be evaluated by two methods. Whether individuals have SMC is determined by evaluating memory complaints according to one or more questions about the individuals having a memory-related problem in their daily lives and the "yes" or "no" answer given to these questions (e.g. Açıkgöz et al., 2014; Basset & Folstein, 1993; Jonker et al., 1996). Scales such as the Subjective Memory Complaints Questionnaire (Youn et al., 2009), Memory Functioning Questionnaire (Parisi et al., 2011), and Mac Nair Questionnaire (Auffray, 2016) enable the amount and level of SMC to be determined.

One of the most important problems in the literature is that there is not yet to be a complete consensus on the evaluation of SMC (Hertzog & Pearman, 2014). This deficiency makes it difficult to compare the results obtained from the studies. Although it is more inconvenient to evaluate SMC with one or more questions than with scales, it should not be forgotten while reaching this conclusion that there is no gold standard scale yet in the literature to evaluate SMC.

### Relationships Between SMC and Cognitive Functions in Older Adults

One of the main reasons for the occurrence of SMC is the cognitive problems experienced by the individual (e.g. Burmester et al., 2016; Reid & MacLulich, 2006; Schmidt et al., 2001). As SMCs increase, the scores obtained from global scales for cognitive screening decrease. In addition, it is seen that individuals with SMC are found to score lower on global scales for cognitive screening compared to healthy individuals (Açıkgöz et al., 2014). On the other hand, in the definition of SMC, it is mentioned that the performance determined in the neuropsychological evaluation is normal (e.g. Pike et al., 2015; Viviano et al., 2019). In this context, this inconsistency between the results of studies in the literature and the definition of SMC suggests that it would not be appropriate to use these scales in the evaluation of SMC, as they only provide a general assessment in terms of cognitive functions.

From the review, it is seen that most of the studies evaluating the relationship between SMC and cognitive performance specifically focus on memory performance. One reason for this may be that individuals with SMC apply to clinics mostly with memory complaints. However, when evaluating the relationship between SMC and memory performance, it is absolutely necessary to evaluate different memory structures and processes. This is because other cognitive functions, including attention, executive functions, processing speed, and verbal fluency are also affected in SMC (Cheng et al., 2017; Mitchell et al., 2004), which is likely to evolve into a dementia process.

### Memory Processes

There are limited studies evaluating the relationship between SMC and short-term memory (STM) and working memory (WM) performance in older adults. A limited number of studies have shown that no significant relationships exist between SMC and verbal and visuo-spatial STM (Park et al., 2019), while the visuo-spatial sketchpad (Park et al., 2019), central executive, and episodic buffer—which are the dimensions of WM—are negatively affected by SMC (Poptsi et al., 2020) which are the dimensions of WM, are negatively affected by SMC. However, the results obtained from studies evaluating the phonological loop with cognitive measures are contradictory (Pike et al., 2015; Sun et al., 2021). In summary, the results obtained from extant studies in the literature do not yet provide an adequate explanation for the STM and WM performances of older adults with memory complaints.

The relationships between SMC and cognitive functions were largely evaluated in terms of episodic

memory function. Episodic memory performance based on both verbal and non-verbal information was lower in older adults with memory complaints than in adults without memory complaints (Gagnon et al., 1994; Parisi et al., 2011). As memory complaints increased, impairments in free recall and recognition based on verbal information and free recall based on non-verbal information were found (Park et al., 2019). Longitudinal studies have emphasized that memory complaints are negatively related to episodic memory performance (Parisi et al., 2011). However, there are ongoing debates as to whether the results may have been affected by individuals' awareness of age-related declines in their own memory. Moreover, the relationship between memory complaints in older adulthood and episodic memory has been evaluated using imaging techniques. Accordingly, individuals with SMC have lower connectivity in their posterior memory systems (Viviano et al., 2019) and higher dorsolateral prefrontal cortex (DLPFC) activation compared to those without SMC (Maestu et al., 2011). This increase in activation was assumed to compensate for the decrease in activation in the posterior memory regions.

Time-based prospective memory was impaired, while event-based prospective memory was intact in the SMC. But only two studies evaluating the relationship between SMC and prospective memory were found in the literature (Hsu et al., 2015; Vaskivuo et al., 2018). Therefore, the findings in the literature are not yet sufficient to explain prospective memory processes in SMC.

In studies evaluating semantic memory using the Boston Naming Test (BNT), no significant relationship was found between SMC and BNT performance (e.g. Ahn et al., 2021; Edmonds, et al., 2014; Langlois & Belleville, 2014). However, in some studies using verbal fluency tasks, adults with SMC were found to have lower performance (Açıkgöz et al., 2014; Jonker et al., 1996; Ponds & Jolles, 1996), while in others, no relationship was found between SMC and verbal fluency performance (Edmonds et al., 2014; Park et al., 2019; Pike et al., 2015). According to the findings, semantic memory and language skills not affected by SMC. More studies are needed to comprehensively evaluate the link between memory complaints and semantic memory and language.

### Executive Functions and Attention

Executive functions such as verbal fluency, inhibition, and perseveration are impaired in SMC (Açıkgöz et al., 2014; Kim et al., 2020; Poptsi et al., 2020; Webster-Cordero & Giménez-Llort, 2022). The results of longitudinal studies also report that neuropsychological follow-up measures of individuals with memory complaints show a regression in executive functions, which

is a precursor to MCI and dementia (Rapp & Reischies, 2005; Valech et al., 2018). However, it is noteworthy that different results emerged from the different tests used to evaluate executive functions. Therefore, inhibition processes in SMC should be evaluated with different tasks or paradigms. Conversely, attention processes, which are seen as the source of various cognitive disorders that occur in older adulthood, are key dimensions of impairment in SMC (Langlois & Belleville, 2014). Divided attention, attention capacity, executive attention, and attentional control are negatively affected by SMC (Esmaeili et al., 2022; Park et al., 2019; Poptsi et al., 2020). However, impairments in these functions are not reflected in cognitive processes with the activation of compensatory neural mechanisms (Rodda, et al., 2009; 2011). In this context, a comprehensive evaluation of attention processes in SCM is crucial.

### Processing Speed

Processing speed is closely related to memory complaints (Benito-León, et al., 2010; Rouch et al., 2008). Although the decreases in processing speed are thought to be effective for other cognitive problems experienced by individuals with memory complaints (Vaskivuo et al., 2018), there are also researchers who suggest that processing speed decreases may be related to difficulties experienced during tasks that require more cognitive resources (Stenfors et al., 2003). This assumption supports the explanations for the lack of resources in studies on attentional processes in SMC.

### Discussion and Conclusion

This review discussed cognitive functions, such as memory, executive functions, attention, and language skills, in older adults with SMC were discussed. The most frequently studied cognitive functions associated with SMC in the literature are memory processes. However, this is insufficient for detecting and understanding the cognitive problems that accompanying SMC. Further research on executive functions, attention, and processing speed is required.

The relationship between SMC and cognitive functions is affected by various factors such as depression and the measurement methods used to evaluate SMC. Therefore, it is important to evaluate SMC in older adults using a multifactorial approach. Depression is one of the most important confounding variables to consider when evaluating the relationship between SMC and cognitive functions (Burmester et al., 2016). However, in some studies in which depression was controlled, the findings indicated that the significant relationship between SMC and memory continued (Benito-León et al., 2010; Park

et al., 2019). The results suggest that the relationship between SMC and memory may also be independent of depression. Moreover, there is no consensus in the literature regarding the SMC evaluation method, which can affect the results. This methodological difference may constitute the basis for the contradictory findings obtained from studies evaluating the relationship between SMC and memory functions in the literature. The simultaneous use of both assessment types in the evaluation of SMC may be effective in overcoming this confusion.

Although deteriorations or declines in various cognitive processes, mood disorders (depression and anxiety), and structural or functional impairments in various brain structures seem to be independent of each other in SMC, it is thought that the change in the balance of neurogenesis and apoptosis in favor of apoptosis in advanced adulthood may explain this process. Moreover, the effect of apoptosis on the hippocampus may have contributed to the critical importance of 65 years of age in SMC due to the significant decrease in hippocampal volume that occurs in the late 60s.

A final important issue to consider is that studies evaluating SMC and cognitive functions are largely clinically focused. Neuropsychological measurement tools are used in clinical studies conducted in Turkey. Unfortunately, these measures are often used to differentiate adults with SMC from healthy older adults or those with MCI and dementia, and do not adequately highlight changes in cognitive function. However, it is thought that considering and interpreting SMC in older adulthood alongside cognitive aging theories will bring a different perspective to this issue.