Longitudinal association between subjective and objective memory in older adults: a study with the Virginia Cognitive Aging Project sample

Abstract

The association between subjective memory complaints (SMCs) and objective memory performance (OMP) has been consistently reported as small, but how the dynamics of this association changes as a function of depressive symptoms and the individual's cognitive functioning level remains unclear. Method: using the bivariate dual change score approach, the present study investigated the directionality of the SMC-OMP association in a sample of healthy older adults (N = 2,057) from the Virginia Cognitive Aging Project. The sample was assessed throughout ten years, five-time points, and the impact of education, depressive symptoms, and low-memory functioning were tested. Three dimensions of SMC were assessed: Frequency of Forgetting, Seriousness of Forgetting, and Retrospective Memory. Results: For Frequency of Forgetting and Seriousness of Forgetting, the unidirectional models in which both subjective dimensions predicted subsequent changes in OMP showed the best fit to the data. For Retrospective Memory, the opposite direction was supported, with OMP leading the association. However, significant coupling effects were not found between these pairs of constructs. After including depressive symptoms as a covariate, Frequency of Forgetting significantly predicted subsequent changes in OMP (γ= -1.226, SE = 0.543). A similar result was found for the low-memory functioning group after the inclusion of depression, with the frequency of memory complaints predicting subsequent memory decline (γ = -1.026, SE = 0.112, $p < 0.05$). Our results do not support a predictive value of SMC for OMP without accounting for the influence of depressive symptoms and low-memory functioning in this longitudinal association.

Keywords: Subjective memory, objective memory, depressive symptoms, aging, longitudinal.

Introduction

An important issue in applied gerontological science concerns whether subjective memory complaints (SMC) reflect an actual lower objective memory performance (OMP) among older adults. It is well-established that an age-related decline is expected in the typical trajectory of objective memory (e.g., Salthouse, 2019), whereas memory complaints may increase with age (Mol, van Boxtel, Willems, & Jolles, 2006; Montejo, Montenegro, Fernández, & Maestu, 2011). However, it remains unclear whether self-reports of memory functioning accurately reflect objective memory decline or whether SMC precedes memory decline over time.

The literature identifies three patterns of association between SMC and OMP, each leading to different implications. First, SMCs have been reported as preceding memory decline (Hohman, Beason-Held, Lamar, & Resnick, 2011; Levy, Zonderman, Slade, & Ferrucci, 2012), being, therefore, a predictor of future memory impairment. A plausible explanation for memory complaints preceding an actual OMP decline is that real-life memory problems, captured by self-reports, manifest before age-related changes on memory are captured by objective measures (Hohman et al., 2011). On the other hand, OMP decline may precede SMCs, with memory complaints resulting from the individual's awareness of their poorer memory functioning (Rowell, Green, Teachman, & Salthouse, 2016). A third pattern identified in the literature shows that self-perceived memory decline may arise only when a steeper decrease in OMP is observed (Parisi et al., 2011). Therefore, the subjective-objective association would be even more pronounced for individuals with lower-memory performance.

Additionally, there is also evidence supporting a null association between both constructs. For a typical memory trajectory, the age-related changes might be too subtle to cause the practical consequences captured by self-reports of memory performance. (Schmand, Jonker, Geerlings, & Lindeboom, 1997; Pearman, Hertzog, & Gerstorf, 2014). Subjective memory complaints have also been proposed as a construct linked to negative affect, like depressive symptoms, that would lead to a distorted self-perception on memory that does not accurately reflects memory functioning (Burmester, Leathem, & Merrick, 2016).

The coexistence of different patterns of association between SMC and OMP may reflect the dynamic relationship between both constructs along the individual's longitudinal trajectory. Although this dynamic relationship has driven recent investigation into its temporal ordering (Brailean, Steptoe, Batty, Zaninotto, & Llewellyn, 2019; Hohman et al., 2011; Snitz, Small, Wang, Chang, Hughes, & Ganguli, 2015), findings to date have been mixed. It remains unclear whether SMC predicts change in OMP, changes in OMP predicts changes in SMC, or whether measuring the change in both constructs is necessary to understand the change in the other. Additionally, how the SMC-OMP association depends on depressive symptoms and whether it is significant only for individuals with lower memory functioning are unsolved questions.

The current study uses the Bivariate Dual Change Score Models (BDCSM; McArdle & Hamagami, 2001) to assess the longitudinal association between SMC and OMP and to check the directionality of the temporal prediction (i.e., if SMC predicts OMP, if OMP predicts SMC, or if they predict each other longitudinally) using the Memory Functioning Questionnaire (MFQ) (Gilewski, Zelinski, & Schaie, 1990) and a composite score based on six objective memory tests in a sample of 2,057 older adults collected in five measurement occasions as part of the Virginia Cognitive Aging Project (Salthouse, 2019).

Association between SMC and OMP

Memory complaints have been proposed as an important risk factor for dementia before the cognitive decline is detected by objective measures (Jessen et al., 2014; Reisberg & Gauthier, 2008) and as associated with structural changes in the brain due to Alzheimer's disease (Amariglio et al., 2012; Perrotin, MorminoMadison, Hayenga, & Jagust, 2012; Shultz et al., 2015) even in the absence of cognitive impairment. In 2011, the US National Institute on Aging–Alzheimer's Association (NIA-AA) group presented recommendations to identify predictors of non-normative cognitive decline. Among the criteria, subjective cognitive decline was included as a potential indicator of the presymptomatic stage of mild cognitive impairment. However, mixed results regarding the predictive value of subjective memory complaints have put this conclusion at stake. If, on the one hand, there are reports of self-perceived cognitive decline preceding mild cognitive impairment in fifteen years (Pichep et al., 2006), in the other hand, many studies found no cross-sectional and longitudinal association between subjective and objective memory (e.g., Brailean et al., 2019; Buckley et al., 2013; Schweizer et al., 2018).

One of the major questions when investigating the association between SMC and OMP falls on whether people can monitor their memory functioning over time accurately. That's relevant because a significant association between both constructs is not always supported. For example, cross-sectional studies have reported a small (Haavisto & Boron, 2020; Lam, Lui, Tam, & Chiu, 2005; Van Bergen, Jelicic, & Merckelbach, 2009) or even null association between memory complaints and OMP (Jungwirth, Fischer, Weissgram, Kirchmeyr, Bauer, & Tragl). In the same line, many longitudinal studies show that subjective memory does not reflect the individual's awareness about memory, with the slopes (change) in subjective memory not reflecting the slopes (change) in OMP (Brailean, Steptoe, Batty, Zaninotto, & Llewellyn, 2019; Cook & Marsiske, 2006; Pearman, Hertzog, & Gerstorf, 2014; Mendes et al., 2008).

Other studies, however, show that the link between SMC and OMP may be weak, but it is real and significant. Parisi et al. (2011) found that longitudinal changes in the self-report of frequency of forgetting were associated with a concomitant change in OMP. In a meta-analysis conducted by Crumley, Stetler, & Horhota (2014), the correlations between both constructs ranged from -0.29 to 0.41, with a small mean effect size of .062 (SE = 0.014), indicating that there is an association between subjective and objective memory, but the association is small. The effect was moderated by several demographic variables, with the association being stronger for older, female, high-educated, and less depressed participants. A similar conclusion was reached by Burmester et al. (2016) that reported a small but significant association between both constructs in their meta-analysis. The authors also found that subjective memory tended to associate independently with both OMP and depressive symptoms when assessed by a comprehensive method.

Kahn, Zarit, Hilbert, and Niederehe (1975) investigated the association between subjective and objective memory and identified a dissociation between memory complaints and actual memory performance. The authors concluded that subjective memory is more related to depressive symptoms than to OMP, which could explain the lack of association found in subsequent studies. Alegrete et al. (2015) also found that higher SMC was related to increased depressive and anxiety symptoms, but not with the performance on episodic memory tasks.

Other individual characteristics, like education and cognitive impairment, may impact the association between SMC and OMP. That was the conclusion reached by Jonker, Geerlings, & Schmand (2000), who first reviewed the evidence concerning the relationship between memory complaints and objective performance. The authors found that the association between SMC and OMP depends on the participant's characteristics, such as an MCI diagnosis, higher education, and hospital-based samples showing a more consistent relationship between both constructs. Jonker, Geerlings, & Schmand (2000) also pointed that more years of education might contribute to an increased awareness of subtle changes in cognitive functioning. This finding is corroborated by other studies showing that educated individuals are more accurate to report their memory performance (Crumley et al. 2014; Hulur, Hertzog, Pearman, Ram, & Gerstorf, 2014), maybe because higher-educated people have more relevant testing experiences or use more memory strategies than low-educated groups (Saczynski, Rebok, Whitfield, & Plude, 2007).

Regarding the impact of depression on the SMC-OMP association, several studies have found a stronger relationship between SMCs and negative affect than between SMC and OPM. Rowell et al. (2016) found that higher negative affect was associated with more memory complaints among all age groups (young, middle-aged adults, and older adults), but OMP did not moderate this association. Subjective memory was associated with OMP but with weaker correlations than those observed between SMCs and negative affect. Schweizer, Kievit, Emery, & Henson (2018) reported a null association between SMC and OMP but a robust relationship between memory complaints and depressive symptoms.

Investigating the longitudinal association between SMC, OMP, and depressive symptoms in the Health and Retirement Study (N =27,395), Hulur et al. (2014) reported a small to moderate between-person effect size for subjective and objective memory (0.19) and subjective and depressive symptoms (-0.21), suggesting that subjective memory reflects OMP but is also influenced by depression. In contrast, Brailen et al. (2019) found that the longitudinal association between SMC and OMP changed when accounting for depressive symptoms, but only among cognitively impaired individuals.

The level of cognitive functioning is also a relevant variable to consider when evaluating the association between SMC and OMP. A steeper decline in OMP may increase people's awareness of their memory functioning since the practical consequences of memory decline become evident. However, it seems that cognition needs to be minimally preserved to allow an accurate perception of memory performance. A window of time in which SMCs accurately reflect actual memory performance has been proposed. The association is significant only before a cognitive impairment diagnosis Lenehan, Klekociuk, & Summers, 2012). Once the cognitive impairment's diagnosis is established, the individual's accuracy to evaluate memory functioning decreases. Many studies with mild cognitive impairment (MCI) patients have supported this conclusion by reporting no association between self-reported memory complaints with memory performance after the clinical diagnosis has been established (Chung & Man, 2009; Edmonds, Delano-Wood, Galasko, Salmon, & Bondi, 2014; Fyock & Hampstead, 2015; Lenehan et al., 2012).

Temporal ordering of the SMC-OMP relationship

In a 12-year longitudinal study, Mascherek and Zimprich (2011) reported that the relationship between SMC and OMP was three times stronger between the slopes of these constructs than between their intercepts. This result implies that the association between SMC and OMP is dynamic rather than static and, therefore, requires a method to capture the dynamic nature of this association by assessing the commonality in change rather than the relationship at a given time point. Studies that have examined the directionality of the longitudinal associations between subjective and objective cognition have reported mixed results, leading to an unresolved question in the field: does SMC predicts OMP, OMP predicts SMC or both.

Some studies have found that initial levels of OMP are associated with an increased change in SMC, especially after adjusting for age, education, race, physical and mental health status (Brailen et al., 2019; Parisi et al., 2011; Yang et l., 2019). This direction suggests that memory complaints are a consequence of perceived objective memory decline. Brailen et al. (2019) found that higher baseline delayed recall performance was associated with fewer memory complaints over time, but memory complaints in the baseline were not associated with a faster decline in objective cognitive performance. Higher scores of depression in the baseline were also associated with a steeper objective decline and fewer memory complaints, suggesting that SMCs co-occur with depressive symptoms, and this co-occurrence may be attributable to objective cognitive decline. Using a large sample from the China Health and Retirement Longitudinal Study (N = 7385), Yang et al. (2019) reported significant between-person and within-person associations between subjective cognitive complaints and cognitive functioning after controlling depressive symptoms. Beyond the memory domain, lower initial language capacity and executive function scores have also been reported as leading to a subsequent increase in subjective complaints (Snitz, Small, Wang, Chang, Hughes, & Ganguli, 2015).

As for the opposite direction, Hohman et al. (2011) found that higher initial levels of subjective complaints predicted a faster decline in immediate and delayed recall over around 11 years, supporting subjective complaints as important markers of age-related memory changes. Using a subjective measure to assess aging stereotypes 38 years before objective memory was assessed, Levy et al. (2012) also found that this self-report predicted memory trajectory with higher baseline levels of negative stereotype associated with a steeper decline in OMP (Levy et al., 2012).

A bidirectional association between subjective and objective memory has also been reported, with the trajectories of both dimensions affecting each other over time. For example, Snitz et al. (2015) investigated the SMC-OMP temporal dynamics and found a bidirectional association, suggesting a mutual influence of one construct over the other. Lower levels of SMC were associated with a subsequent increase in OMP, and lower levels of OMP predicted a subsequent decline in complaints.

The mixed results may be partially explained by methodological differences, especially regarding measurement and analytical approaches. Differences in the robustness of memory assessment may also contribute to divergent findings. The use of single questions/tests to assess subjective and objective memory (e.g., Brailen et al., 2019; Hohman et al., 2011; Hulur et al., 2019; Yang et al., 2019) may compromise the detection of a statistically significant association between SMC and OMP (Fyock, 2015). Salthouse (2012) showed that significant associations are less likely to be found at the lowest levels of a hierarchical model, i.e., at the observed level (measure) compared to the highest levels (high-order factors), compelling evidence against the use of single tests (e.g., recall test) in aging studies. The use of unappropriated statistical techniques to investigate the directionality of the association between SMC and OMP may also explain the mixed results of the field (Grimm, 2007). Some studies rely on longitudinal growth curve (LGC) models (e.g., Brailean et al., 2019; Levy et al., 2012; Parisi et al., 2011) or analysis of change (e.g., Hulur et al. 2014; Yang et al., 2019), while fewer studies used change score models to investigate temporal-ordering relationships (e.g., Snitz, 2015). Although latent growth curve models can be used to investigate the relationship between intercepts and slopes, it is not possible to address directionality. To investigate wheatear SMP predicts OMP or OMP predicts SMP, or both, the bivariate dual change score model (or similar techniques) must be employed.

The Current Study

This study aims to investigate the temporal ordering of the SMC-OMP association using data from the Virginia Cognitive Aging Project (VCAP) with participants ranging from 60 to 99 years old. The group was accessed in five-time points throughout ten years, with an interval of 2.5 years between the assessments. There are mixed results about the directionality of the SMP-OMP relationship, and the disparate findings are likely explained by methodological limitations, particularly regarding measurement and analytical approaches. To increase subjective and objective memory assessment robustness, the current study used an objective memory battery composed of six tests and a subjective memory scale to assess three dimensions of this construct: Frequency of Forgetting, Seriousness of Forgetting, and Retrospective Memory. Using the BDCSM analyses, we were able to investigate the temporal order of the SMC-OMP association by testing three hypotheses: 1) OMP at time t predicts changes in subjective memory (between time t and t+1); 2) SMC at time t predicts changes in OMP (between time t and t+1); and 3) changes in both constructs are necessary to understand changes in the other. We also investigated the role of depressive symptoms and education as covariates and the longitudinal association between SMC and OMP for a subgroup of low-memory functioning.

Method

Participants

The sample was composed of 2,057 participants ranging from 60 to 99 years old at the first measurement point (Mean = 70.25; SD = 7.74), with 16.23 years of education on average (SD = 2.85). Among respondents, 62% (n = 1280) were females, and none of the participants met the cognitive impairment criteria for the MMSE (score of ≤ 23 points, according to Tombaugh & McIntyre, 1992). Clinically relevant depressive symptoms were found for 2.5% of the participants (score ≥ 16 in the Center for Epidemiologic Studies Depression Scale, CES-D Beekman, Deeg, Van Limbeek, Braam, De Vries, & Van Tilburg, 1997). A subgroup of 168 participants with low-memory functioning was selected to test the influence of lower memory performance on the association with self-perceived memory. The criterion used to select this subsample was one standard deviation below the mean performance calculated on a composite score of objective memory tests in the first measurement occasion. This group aged 60 to 85 years old (M = 66.96, SD = 5.29) and had 16.87 of average years of education (SD = 2.56). None of the participants from this subsample met the cutoff score for dementia by the MMSE or depression by the CES-D. Regarding the selectivity of attrition for this sample, Salthouse (2014) reported that returning participants had a higher cognitive performance at an initial measurement occasion among adults older than 50 years old, possibly due to a greater dropout of older participants with lower cognitive performance. For a summary of the recruitment strategies and data collection, see Salthouse (2019).

Measures

Objective Memory

Memory was evaluated using six tests: 1) Paired Association test (Salthouse, Fristoe, & Rhee, 1996): participants hear six pairs of unrelated words. They are then presented with the first word in each pair and asked to recall the second word; 2) Logical Memory (Wechsler, 1997): participants listen to two different stories and are asked to repeat as many details as they can recall; 3) Word Recall (Wechsler, 1997): participants heard a list of words and were asked to recall the words in any order throughout three trials. After a second list being presented and recalled, the participants are asked to recall the first list; 4) Delayed Memory Word Recall (Wechsler, 1997): participants are asked to recall a list of words presented four times earlier; 5) Delayed Memory Paired Associates: the participants are asked to recall the second word in the associates pairs presented earlier after being prompted with the first word in each pair; 6) Delayed Memory Logical Memory test (Wechsler, 1997): participants are asked to recall as many details as possible from stories presented earlier in two conditions (no cue and cue) (Wechsler, 1997). For each time point, a composed score was calculated by summing the scores of the individual tests.

Subjective Memory Complaints

Subjective memory was assessed as a global measure by the Memory Functioning Questionnaire (MFQ) (Gilewski, Zelinski, & Schaie, 1990), a self-report that aggregates responses across a range of different scales (General Frequency of Forgetting, Seriousness of Forgetting, Retrospective Functioning, and Mnemonic Usage) that results in a general score of subjective memory ability. The dimensions assessed by MFQ cover the individual's perception of his memory (memory ability) and memory complaints. This study analyzed three dimensions of the MFQ that assess memory complaints: 1) General Frequency of Forgetting, with higher scores indicating less frequency of forgetting (e.g., 1 represents "always" and 7 represents "never"), 2) Seriousness of Forgetting, with higher scores indicating less seriousness of forgetting (e.g., 1 represents "very serious" and 7 represents "not serious"), and 3) Retrospective Functioning, with higher scores indicating better retrospective memory (e.g., 1 represents "much worse" and 7 represents "much better").

Depressive Symptoms

Depressive symptoms were assessed using the full version (20-items) of the CES-D scale (Radloff, 1977). Participants reported how often they experienced symptoms of depression in the past week on a Likert scale of four points: 0 = "rarely or never"; 1 = "some of the time"; 2 = "occasionally"; 3 = "mostly or always". The present study analyzed the separate effects of three CES-D scales as covariates: somatic symptoms, depressed affect, and positive affect.

Table 1 presents the means and standard deviations for our sample across the five-time points. For memory, the scores were converted into z-scores, and the mean was calculated based on the difference between the delayed test and its corresponding immediate test. The negative values indicate a poorer performance for the delayed test. Table 1 also portrays the means and standard deviations for each dimension of MFQ.

Table 1

Means and Standard Deviations for Study Variables Across Waves

Variables		T1	T2	T3	T 4	T5
Memory	Word Recall	-0.073 (1.012)	-0.223 (1.152)	-0.306 (1.032)	-0.557 (0.993)	-0.603 (1.105)
	Paired Association	0.0841 (0.890)	-0.034 (1.122)	0.080 (1.005)	-0.111 (0.959)	-0.100 (0.872)
	Logical Memory	-2.303 (2.359)	-2.526 (2.602)	-2.502 (2.532)	-2.623 (3.117)	-2.785 (3.234)
MFQ	Frequency of Forgetting	5.01 (7.54)	5.04 (8.32)	5.02 (7.95)	5.05 (7.80)	4.96 (8.46)
	Seriousness of Forgetting	4.50 (1.21)	4.55 (1.23)	4.61 (1.19)	4.65 (1.24)	4.44 (1.25)
	Retrospective memory	3.28 (8.77)	3.32 (9.32)	3.24 (8.87)	3.23 (9.06)	3.26 (9.98)

Note: Standard deviations are in parentheses. MFQ: Memory Functioning Questionnaire.

Data analysis

In this study, the reciprocal and directional relationships between SMC and OMP were addressed using the longitudinal structural equation modeling framework via the univariate and the bivariate dual change score model (McArdle & Hamagami, 2001). We propose the following BDCS model to capture the dynamical directional relations of cognition and depressive symptoms. Let SM (subjective memory) and O (objective memory) be two repeatedly measured variables.

$$SM_{it} = sm_{it} + e_{SM_{it}},$$
$$OM_{it} = om_{it} + e_{om_{it}}, (1)$$

Where SM_{it} and OM_{it} represent the observed scores of subjective memory complaints and objective memory performance, respectively, for person i ($i = 1, \ldots, N$ with N denoting sample size) at time t ($t = 1, \ldots, T$ with T denoting measurement occasions). Equation (1) shows that the observed scores of SM_{it} and OM_{it} can be written as functions of their theoretical true scores sm_{it} and om_{it} and time-specific residuals $e_{SM_{it}}$ and $e_{OM_{ij}}$.

Assume autoregressive relationships or event-contingency in SM and OMP, the true score at the current time t is a function of the true score at the immediately preceding time $t-1$ plus the true change and can be represented as

$$SM_{it} = sm_{i(t-1)} + \delta sm_{it},$$
$$OM_{it} = om_{i(t-1)} + \delta om_{it}. (2)$$

Equation (2) shows that the true memory score at the current time t is equal to the true memory score at time $t-1$ plus the true change in memory. The same logic applies to the repeatedly-measured scores for SMC.

As mentioned previously, the BDCSM focus on the changes in trajectory and therefore the latent changes (i.e., δsm_{it} and δom_{it}) are typically the outcomes of the interest in BDCS. Based on the dual change score model, one typical form of the bivariate change equations can be represented as:

$$\delta sm_{it} = \beta_{sm0} \times S_{smi} + \beta_{sm1} \times som_{i(t-1)} + \beta_{sm2} \times om_{i(t-1)},$$
$$\delta om_{it} = \beta_{om0} \times S_{omi} + \beta_{om1} \times om_{i(t-1)} + \beta_{om2} \times sm_{i(t-1)},$$

where S_{smi} and S_{omi} represent the rates of change, similar to the latent slope factors in growth curve analysis. The second sources of latent difference come from the variables of their previous states, which are summarized in the proportional change parameters β_{sm1} and

β_{om1}. Additionally, there is a third part that contributes to the latent changes in OMP and SMC, which makes the BDCSM advantageous to determine the directional relationships between objective and subjective memory. These unique sources of latent difference are captured in the coupling parameters γ_{sm2} and γ_{om2}, demonstrating the amounts of latent differences that are explained by the previous state of the other variable. In other words, γ_{sm2} determines whether memory is a leading indicator of changes in subjective memory and vice-versa for γ_{om2}.

In summary, the BDCS model is represented in Equations (1), (2), and (3) and will be used for the analysis in the study. From the model representations, the BDCSM share the benefits of Growth Curve Models (GCM) in that both models study the intraindividual change and interindividual differences in change (i.e., S_{smi} and S_{omi} in the model representation). Besides, the BDCSM answer additional research questions that traditional GCM cannot answer as it examines the separate time-dependent changes in depressive symptoms and cognition, where their previous time scores can predict their later developments in subjective and objective memory (i.e., the proportional change parameters β_{sm1} and β_{om1}). Furthermore, the BDCS allows the changes in one latent factor to covary with the previous status of the other latent factor, leading to the estimation of the directional relationship between subjective and objective memory (i.e., the coupling parameters γ_{sm2} and γ_{om2}). Significant coupling parameters are evidence of decisive relations of one variable affecting the other variable.

Measurements of subjective and objective memory and depressive symptoms were collected for five-time points over ten years, with an interval of around 2.5 years between occasions. Everyone in the sample was measured approximately at the same time. Longitudinal score change models were fitted to the five repeated measurements as a function of five timepoints. Different restrictions were imposed on the models to determine the directionality of the subjective-objective memory association. For each pair of dimensions (e.g., frequency of forgetting and OMP), four BDSC models were fitted: no coupling, unidirectional OMP → SMC, unidirectional SMC → OMP, and full coupling (bidirectional) model. For the BDCS full coupling model, all coupling parameters were freely estimated. In the unidirectional BDCS models, only one of the coupling parameters was estimated, and the other fixed to zero. Therefore, to test the directionality from objective to subjective memory, only the coupling parameter OMP→SMC was estimated; and from subjective to objective memory, only the coupling parameter SMC→OMP was estimated. Figure 1 portrays the full coupling model diagram used in this study.

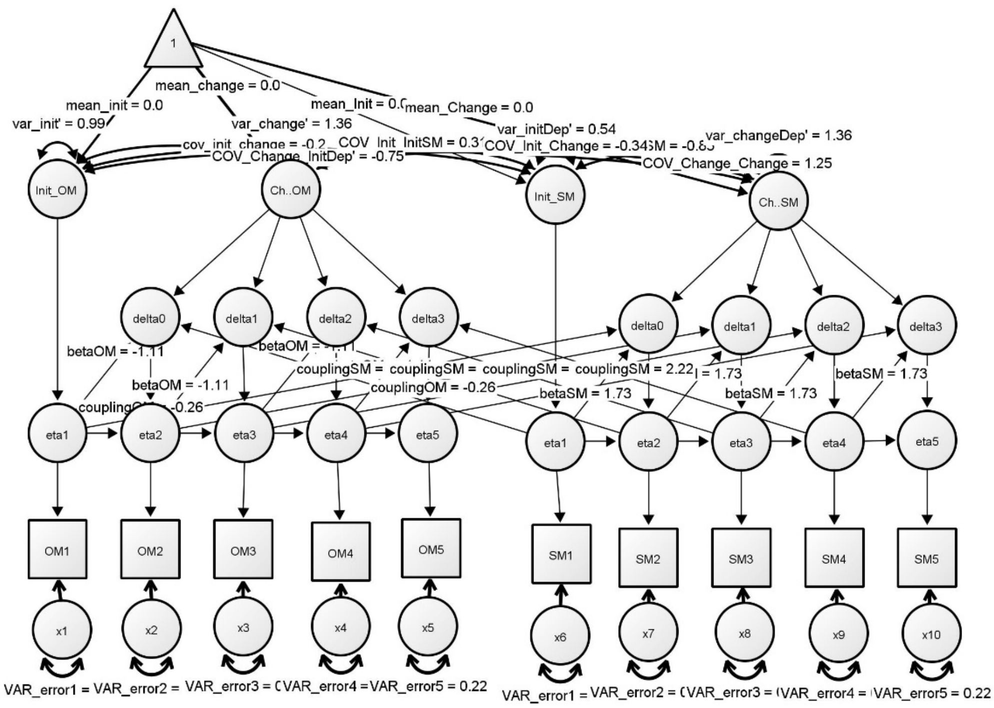

Figure 1. Bivariate dual change score model diagram. Squares depict the observed variables, and circles represent the latent variables. Regression weights are shown by one-headed arrows and variance and covariance by two-headed arrows. An autoregressive parameter is exemplified by the arrow connecting *eta1* to *delta0*, while an example of a coupling parameter is the arrow connecting eta*1* to *delta0*.

Univariate dual change score models were also employed to examine the longitudinal trajectories for subjective and objective memory. Following the guidelines from Grimm, An, McArdle, Zonderman, and Resnick (2012), four models were specified: proportional change, constant change, the dual change (including both proportional and constant change parameters), and the changes-to-changes model, in which changes in time [t] influences changes in time [t + 1].

All analyses were implemented in R (Team, 2017). The BDCSM graph (Figure 1) was implemented on Onyx (von Oertzen, Brandmaier, & Tsang, 2015), following the guideline suggested by Kievit et al. (2018). Onyx is a graphical user interface for SEM that uses R in the background. Model fit was evaluated based on the guidelines proposed by Hu and Bentler (1999) for good fit. To compare the four models and choose the final, we adopted the same holistic approach proposed by Nelson, Jacobucci, Grimm, and Zelinski (2020), which includes the analysis of the Akaike Information Criterion (AIC) (Akaike, 1987) and the Bayesian Information Criterion (BIC) (Raftery, 1995) with lower values indicating better model fit. Following Nelson et al. (2020) approach, we defined meaningful improvements in model fit as a difference in the model's information criteria higher than 10 points. In the case of equal model fit or difference between information criteria lower than 10, we chose in favor of the simplest model.

Covariates

To control potential confounder variables in the association between SMC and OMP, predictors of the latent change variables were included in each final model. We tested the influence of depressive symptoms and education in the complete sample and a subgroup of low-memory functioning. Education was assessed by the number of years the participant attended formal education.

Results

Univariate dual change score models

Univariate dual change score models were applied for estimating the univariate trajectories of the three dimensions of subjective memory and OMP. For OMP, the dual change and the changes-to-changes models presented adequate fit to the data (CFI = 1, RMSEA = .00; 90% CI .04 – .005), and the difference between information criteria was lower than 10 (subtracting the dual change model information criteria values from those of the changes-to-changes model, ΔAIC = 1.204; ΔBIC = 5.144). Selecting in favor of the simpler model, the dual change model was retained as the final model. Regarding memory's trajectory across age, the mean of the constant change component was 0.003 (SE = 0.036, p = 0.937), combined with a proportional change parameter of -0.774 (SE = 0.09, p < 0.001) as shown in Table 2.

Table 2

M*emory Univariate Dual Change Score Model Fits*

Model	**AIC**	**BIC**	**RMSEA/CFI**
Constant change	4345.313	4368.954	0.113 / 0.883
Proportional change	4378.909	4394.670	0.131 / 0.823
Dual	4277.115	4304.696	0.000 / 1.000
all	4278.319	4309.840	0.000 / 1.000

For Frequency of Forgetting, information criteria (Table 3) also indicated that the dual change and the change-to-change models fit equally well, with a difference lower than 10 points between criteria (subtracting the dual change model information criteria values from those of the changes-to-changes model, ΔAIC = -1.549; ΔBIC = -5.489). Thus, selecting in favor of the simpler model, the dual change model was retained. For Seriousness of Forgetting, all models fit equally well, and a difference higher than 10 points was found between the constant change and the change-to-change models (ΔAIC = 18.581; ΔBIC = -10.701) with information criterion favoring the latter, which was selected as the final model. For Retrospective Functioning, all models also fit equally well. Between the constant change and proportional change models, we retained the proportional change as one of the information criteria differences was higher than 10 (ΔAIC = 3.532; ΔBIC = 11.413). The differences also favored the proportional change model compared with the dual change (ΔAIC = -5.008; ΔBIC = -16.909) and the change-to-change models (ΔAIC = -2.595; ΔBIC = -18.356), being the proportional change model selected as the final model.

Table 3

SMC Univariate Dual Change Score Model Fits

Dimension	**Model**	**AIC**	**BIC**	**RMSEA/CFI**
Frequency of Forgetting	Constant change	4021.170	4044.811	0.009/ 0.999
	Proportional change	4018.815	4034.575	0.004/0.064
	Dual	**4018.720**	**4046.301**	**0.0/ 1.0**
	Change-to-change	4020.269	4051.790	0.0/ 1.0
Seriousness of Forgetting	Constant change	4038.850	4062.491	0.017/0.998
	Proportional change	4037.328	4053.089	0.019/0.997
	Dual	4040.849	4068.430	0.023/0.996
	Change-to-change	**4020.269**	**4051.790**	**0.0/ 1.0**
Retrospective Memory	Constant change	4100.559	4124.200	0.021/0.996
	Proportional change	**4097.027**	**4112.787**	**0.012/0.998**
	Dual	4102.115	4129.696	0.025/ 0.994
	Change-to-change	4099.622	4131.143	0.0/ 1.0

Note. The final models are highlighted in bold. AIC = Akaike information criterion; BIC = Bayesian information criterion.

Regarding the trajectories for the three SMC dimensions, for Frequency of Forgetting, the mean of the constant change component was 0.000 (SE = 0.028), combined with a proportional change parameter of -0.630 (SE = 0.313) resulted in a trajectory that shows no significant changes. For Seriousness of Forgetting, the mean of the constant change component was -0.073 (SE = 0.041), combined with a proportional change parameter of -0.630 (SE = 0.313), meaning that the decline in this dimension was slowing over the time points (due to the negative proportional change parameter). For Retrospective Functioning, the mean of the constant change component was -0.003 (SE = 0.014), indicating a non-significant decline (p = .796).

Bivariate dual change score models

In this section, the directionality of the association between subjective and objective memory is reported. The holistic approach protocol employed by Nelson et al. (2020) was adopted to choose the final model. The estimates for each parameter of the four models (no coupling, unidirectional models, and full coupling) are shown in Table 4. The fit indices for all models are presented in Supplemental Material.

Table 4

Bivariate Dual Change Score Model Fit statistics

Dimension	Fit indices	No coupling	Mem [t] → ΔFreq [t + 1]	Freq [t] → ΔMem [t + 1][a]	Bidirectional coupling
Frequency of Forgetting	-2LL	8206.865	8216.343	8208.522	8199.639
	Parameters	26	27	27	28
	AIC	8258.865	8254.343	8246.522	8255.639
	BIC	8405.219	8361.295	8353.473	8413.251
	aBIC	8409.662	8365.737	8357.915	8417.694
	RMSEA	0.05	0.052	0.046	0.046
	CFI	1.0	0.998	1.0	1.0

	Fit indices	No coupling	Mem [t] → ΔSer [t + 1]	Ser [t] → ΔMem [t + 1][a]	Bidirectional coupling
Seriousness of Forgetting	-2LL	8237.028	8246.635	8243.015	8236.311
	Parameters	26	27	27	28
	AIC	8289.028	8284.635	8281.015	8292.311
	BIC	8435.382	8391.586	8387.966	8449.923
	aBIC	8439.825	8396.028	8392.408	8454.366
	RMSEA	0.051	0.052	0.05	0.052
	CFI	0.999	0.997	1.0	0.998
	Fit indices	No coupling	Mem [t] → ΔRet [t + 1][a]	Ret [t] → ΔMem [t + 1]	Bidirectional coupling
Retrospective Memory	-2LL	8322.041	8321.894	8322.222	8314.665
	Parameters	26	27	27	28
	AIC	8374.041	8359.894	8360.222	8370.665
	BIC	8520.395	8466.845	8467.173	8528.277
	aBIC	8524.838	8471.287	8471.615	8532.72
	RMSEA	0.061	0.055	0.055	0.058
	CFI	0.987	0.993	0.993	0.991

Note: Mem = Memory; Feq = Frequency of Forgetting; Ser = Seriousness of Forgetting; Ret = Retrospective Memory. The models are depicted from the simplest to the more complex with the addition of one parameter in the sequence. The No coupling model is the simplest one. The Mem [t] → ΔFreq_Ser_Ret [t + 1] models test the addition of the coupling parameter γ from memory at time t – 1 to each dimension of subjective memory, whereas the models Feq_Ser_Ret [t] → ΔMem [t + 1] test the addition of the coupling parameter γ from each dimension of subjective at time t – 1 to objective memory. The Bidirectional coupling model tests the addition of both coupling parameters. -2LL = Minus Two Log Likelihood; AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = adjusted Bayesian information criterion.
[a] Final model

All BDCS models converged and presented an adequate fit to the data (CFI = 1, RMSEA = .00; 90% CI .04 – .005). The following paragraphs describe the model comparison procedures and present the estimated parameters of the final selected models.

For Frequency of Forgetting, removing the coupling parameter Freq [t] → ΔMemory(Mem) [t + 1] from the bidirectional model resulted in the unidirectional model Mem → ΔFreq. This removal improved model fit with most differences between the information criteria between both models greater than 10 (ΔAIC = 9.117; ΔaBIC = 51.96). To test the opposite direction, the coupling parameter from memory to subsequent changes in Frequency of Forgetting was removed, resulting in the unidirectional model Feq. [t] → ΔMem [t + 1]. This removal also resulted in a better model fit (ΔAIC = 9.12; ΔaBIC = 59.78). Thus, selecting in favor of the simplest model, the unidirectional models were chosen. The model Freq [t] → ΔMem [t + 1] was selected as the final for showing lower information criteria values among the two unidirectional models. This model showed no coupling effects, suggesting that changes in Frequency of Forgetting do not predict subsequent changes in OMP. There was no significant correlation at the baseline levels, between the slopes, and between the initial levels and slopes of both constructs, as shown in Table 5.

Table 5

BDCSM parameter estimates from the final model Freq[t] → ΔMemory[t + 1]

Parameter	Estimate	SE.
Correlations		
Level of Memory w/ Slope of Memory	0.206	0.062
Level of Freq. Forg w/ Slope of Freq. Forg	0.008	0.051
Level of Memory w/ Level of Freq. Forg	-1.096	0.555
Level of Memory w/ Slope of Freq. Forg	-0.142	0.052
Level of Freq. Forg w/ Slope of Memory	-0.001	0.028
Slope of Memory w/ Slope of Freq. Forg	0.371	0.290
Proportional Changes		
Memory → ΔMemory (βm)	-0,974	0,123
Freq. Forg → Δ Freq. Forg (βs)	0.304	0.098
Coupling effects		

Freq. Forg → ΔMemory (γ_S)	0.001	0.025

Note: Slope = constant change over five measurement points; Proportional changes and coupling effects represent score at a starting time as predictive of change in a score at a subsequent time. Freq.Forg = Frequency of Forgetting.
* significant at $p < 0.05$

For Seriousness of Forgetting, removing the coupling parameter Ser [t] → ΔMemory(Mem) [t + 1] from the bidirectional model resulted in the unidirectional model Mem → ΔSer, and this removal improved model fit (ΔAIC = 7.676; ΔaBIC = 58.337). For the opposite direction, the coupling parameter from memory to subsequent changes in Seriousness of Forgetting was removed, resulting in the unidirectional model Ser [t] → ΔMem [t + 1]. Again, this removal resulted in a better model fit with the difference between the information criteria higher than 10 points (ΔAIC = 11.296; ΔaBIC = 61.958). Thus, selecting in favor of the simplest model, the unidirectional models were chosen. Among them, the model Ser [t] → ΔMem [t + 1] was selected as the Final Model for presenting the lowest information criteria values. This model showed no coupling effects, suggesting that changes in Seriousness of Forgetting do not predict subsequent changes in OMP. No significant correlations were found at the intercept and prospective levels (Table 6).

Table 6

BDCSM parameter estimates from the final model Ser[t] → ΔMemory[t + 1]

Parameter	Estimate	SE.
Correlations		
Level of Memory w/ Slope of Memory	0.142	0.078
Level of Ser.Forg. w/ Slope of Ser.Forg.	0.003	0.061
Level of Memory w/ Level of Ser.Forg.	1.135	0.734
Level of Memory w/ Slope of Ser.Forg.	-0.005	0.055
Level of Ser.Forg.w/ Slope of Memory	-0.013	0.040
Slope of Memory w/ Slope of Ser.Forg.	-0.693	0.399

Proportional Changes		
Memory → ΔMemory (βm)	-0.592	0.156
Ser.Forg.→ Δ Ser.Forg. (βs)	0.523	0.147
Coupling effects		
Ser.Forg.→ ΔMemory (γ_S)	0.002	0.040

Note: Slope = constant change over five measurement points; Proportional changes and coupling effects represent score at a starting time as predictive of change in score at a subsequent time. Ser.Forg = Seriousness of Forgetting.
* significant at $p < 0.05$

Finally, for Retrospective Functioning, after removing the coupling parameter Ret [t] → ΔMemory(Mem) [t + 1] from the full coupling model, the unidirectional model Mem → ΔRet presented a better fit with the difference between information criteria higher than 10 points (ΔAIC = 10.771; ΔaBIC = 61.434). For the opposite direction, the coupling parameter from memory to subsequent changes in Retrospective Memory was removed from the full model, resulting in the unidirectional model Ret [t] → ΔMem [t + 1] with a better model fit (ΔAIC = 10.443; ΔaBIC = 61.104). Thus, selecting in favor of the simplest model, the unidirectional models were chosen, and among them, the model Mem [t] → ΔRet [t + 1] was selected as the final model for presenting the lowest information criteria values. This model showed no coupling effects, suggesting that changes in Retrospective Functioning do not predict subsequent changes in OMP. Like the other two dimensions, no significant correlations were found at the baseline levels, between the slopes, and between the initial levels and slopes of both constructs (Table 7).

Table 7

BDCSM parameter estimates from the final model Ret[t] → ΔMemory[t + 1]

Parameter	Estimate	SE.
Correlations		
Level of Memory w/ Slope of Memory	0.208	0.042

Level of Retr. w/ Slope of Retr.	0.004	0.035
Level of Memory w/ Level of Retr.	-0.657	0.475
Level of Memory w/ Slope of Retr.	-0.105	0.048
Level of Retr.w/ Slope of Memory	0.044	0.189
Slope of Memory w/ Slope of Retr.	-0.072	0.033
Proportional Changes		
Memory → ΔMemory (βm)	-0.775	0.067
Retr. → Δ Retr. (βs)	1.944	0.850
Coupling effects		
Retr. → ΔMemory (γ_S)	0.031	0.160

Note: Slope = constant change over five measurement points; Proportional changes and coupling effects represent score at a starting time as predictive of change in the score at a subsequent time. Retr. = Retrospective Memory.
* significant at $p < 0.05$

Covariate associations

Depressive Symptoms and education were included in the final models as covariates. All models converged and presented a good fit. A summary of the estimates is provided as Supplementary Material. With the inclusion of depression in the final model of Frequency of Forgetting, a significant coupling parameter was observed (γ = -1.226, SE = 0.543), indicating that an increase of one SD in Frequency of Forgetting predicts a subsequent decrease of -1.226 SDs in objective memory. Higher depressive symptoms were significantly correlated with higher initial reports of Frequency of Forgetting (b = -0.273, SE = 0.045), indicating a negative correlation at baseline between both constructs. The inclusion of education as a covariate did not alter the pattern of results previously reported.

For Seriousness of Forgetting, the inclusion of education and depressive symptoms did not change the dynamics reported, with no significant coupling effects found. A negative correlation between depressive symptoms and Seriousness of Forgetting was found, with higher depressive symptoms associated with higher baseline reports on Seriousness of Forgetting (b = -0.169, SE = 0.040) and its slope (b = -0.132, SE = 0.040).

Finally, including depressive symptoms and education as covariates in the final model of Retrospective Functioning did not change the pattern of results, and no significant coupling effect was found. Higher depressive symptoms were negatively associated with initial levels of retrospective memory (b = -0.196, SE = 0.047), indicating a worse self-perceived memory functioning for participants with higher scores in CES-D.

Low-memory functioning

A subgroup of 168 participants with OMP below one standard deviation from the mean was selected to investigate the impact of memory functioning on the subjective-objective memory association. All BDCS models converged and presented an adequate fit to the data, and the final models were chosen based on the same holist approach adopted for the complete sample.

A more pronounced change in the pattern of associations was observed for Retrospective Functioning. As for the previous analyses, the unidirectional model Memory[t] → ΔRetrospective[t + 1] was selected as the final. A significant coupling effect was found for this subgroup of low-memory functioning (γ = 4.953, SE = 0.787), indicating that higher OMP predicts subsequent positive changes in self-perceived memory. For Frequency of Forgetting and Seriousness of Forgetting, no significant differences were found in the subjective-objective memory association for the low-memory functioning group.

This scenario changed after including depressive symptoms as a covariate in the final models. All models adjusted and fit well to the data. For the unidirectional model with Frequency of Forgetting leading the prediction, a significant coupling effect was found (γ = -

1.226, SE = 0.543, $p < 0.05$), indicating that higher frequent reports of memory problems preceded a subsequent memory decline. That suggests depressive symptoms as a relevant influence on the Frequency of Forgetting-OMP association. Higher levels of depressive symptoms were also associated with higher Frequency of Forgetting (b = -0.273, SE = 0.045, $p < 0.05$) and with OMP at the baseline level (b = 0.358, SE = 0.047, $p < 0.05$). For Retrospective Functioning, the coupling effect lost its significance after including depressive symptoms as covariate ($\gamma = -0.121$, SE = 0.088, $p > 0.05$), suggesting that depressive symptoms may not play a significant influence in the retrospective-objective memory association.

Discussion

In the present study, the relationship between SMC and OMP and the direction of this association were tested in a sample of 2057 individuals aged from 60 to 99 years old at the first measurement point (Mean = 70.25; SD = 7.74). The sample was assessed throughout ten years by five-time points, with an average of a 2.5-year interval between occasions. Bivariate change dual score models (BCDSM) were implemented to investigate the longitudinal associations between the three dimensions of SMC and OMP and the direction of these associations.

For Frequency of Forgetting and Seriousness of Forgetting, the unidirectional models in which both subjective dimensions led the longitudinal association with OMP (that is, SMC [t] → ΔOMP [t + 1]) showed the best fit and adjustment to our data. In contrast, for Retrospective Functioning, OMP led this association, with the unidirectional model Mem [t] → ΔRetrospective [t + 1] presenting the best adjustment to our data. However, no significant coupling effects were found between these pairs of constructs, meaning that neither

Frequency of Forgetting nor Seriousness of Forgetting predicted subsequent changes in OMP, nor OMP was predicting subsequent Retrospective Functioning changes. No significant correlations were found between the three subjective memory dimensions and OMP at the baseline levels, between the slopes, and between the initial levels and slopes. Our findings converge with a vast literature that points out to a null or small association between subjective and objective memory either in cross-sectional (e.g., Jungwirth et al., 2004; Pearman & Storandt, 2005) and longitudinal studies (e.g., Brailean et al., 2019; Pearman et al., 2014; Mendes et al., 2008).

Although we have not found significant coupling effects, our results support the unidirectional models in which SMCs (Frequency and Seriousness of Forgetting) are the leading variables in the temporal ordering with the OMP association. Several studies have supported this direction that propose SMC as having significant prognostic value for future cognitive impairment. In a meta-analysis of longitudinal studies, Mitchell, Beaumont, Ferguson, Yadegarfar, and Stubbs (2014) found that, among individuals cognitively normal (N = 14,714), those with high SMC had an annual conversion rate of 2.33% to dementia, compared with 1% conversion rate for those without memory complaints. Mendonça, Alves, and Bugalho (2016) also concluded that subjective cognitive complaints (SCCs) (not only memory complaints) are an important indicator of later dementia diagnoses as the risk to develop dementia was 1.5 – 3 times greater for participants with higher baseline levels of SCCs.

A couple of explanations have been proposed for the weak association between subjective-objective memory found in this study. One proposed interpretation is that SMC may be associated with a cognitive decline only for individuals who present lower initial levels of cognitive performance and cannot develop compensatory strategies to deal with the cognitive decline (Burmester et al., 2016). Then, the absence of effective compensation would lead to a greater functional impact on one's daily life, resulting in more complaints.

To test whether a different pattern of subjective-objective memory association would be found for specific groups, a subgroup of low-memory functioning individuals (n = 168) was selected. No significant differences were found in the subjective-objective memory association for Frequency and Seriousness of Forgetting. However, for Retrospective Functioning, a significant coupling effect was found (γ = 4.953, SE = 0.787) in the final model Memory[t] → ΔRetrospective[t + 1], indicating that higher OMP predicts subsequent changes in self-perceived memory. That leads to the conclusion that, for low-memory functioning individuals that are more likely to face real-life memory problems, a worse initial level of OMP precedes a worse self-perceived memory functioning. That suggests an accurate report when comparing the actual and prior memory functioning.

However, a similar conclusion was not supported for Seriousness and Frequency of Forgetting, which showed no significant association even for the low-memory group, contrasting with previous studies that reported a stronger association between SMC and OMP for individuals with a steeper cognitive decline (Parisi et al., 2011). Alternatively, instead of objective memory decline becomes more evident for lower functioning individuals (making the SMC-OMP association stronger), it has been suggested that the weak association reported for low-cognitive functioning individuals is due to a reduced insight to judge their memory ability, reflected in the self-report accuracy (Snitz et al., 2015). This lowered awareness of the objective memory decline has been claimed as particularly pronounced for mild cognitive impairment (MCI) groups. The fact that MCI patients do not complain of memory problems suggests that they have a diminished awareness of their memory and cognitive deficits. As indicated by the literature, such awareness requires an intact functioning of executive abilities and an absence of cognitive impairment (White, Engen, Sorensen, Overgaard, and Shergill, 2014).

A second explanation of the lack of association between subjective and objective memory is that other factors might influence this relationship. Among them, education and depressive symptoms were tested in our study by including both variables as covariates in the final models. The inclusion of education as a covariate did not alter the dynamics reported for the complete sample and the low-memory functioning group. That contradicts previous studies that have reported education as an important covariate, with highly educated individuals showing a stronger association between SMC and OMP (Crumley et al., 2014) and higher subjective memory ratings (Hulur et al., 2014).

Among the psychological factors examined by literature, depression appears to have the greatest influence on subjective-objective memory association (Jonker et al., 2000; Reid & MacLullich, 2006; Burmester et al., 2016), and our results confirmed that. After including depressive symptoms as a covariate in the final model of Frequency of Forgetting, a significant coupling parameter was observed (γ= -1.226, SE = 0.543), indicating that an increase of 1.00 SD on the frequency of memory reports predicted a subsequent decrease of -1.226 SDs in OMP. With respect to cross-sectional baseline associations, higher depressive symptoms at baseline were also correlated with higher initial levels of Frequency of Forgetting (b = -0,273, SE = 0,045), higher reports on Seriousness of Forgetting (b = -0,169, SE = 0,040) and with a worse self-perceived memory functioning (b = -0,196, SE = 0,047). As for prospective associations, the intercept of depressive symptoms was negatively associated with the slopes of Seriousness of Forgetting (b = -0,132, SE = 0,040).

For the low-memory functioning group, the inclusion of depressive symptoms as a covariate in the final models also altered the dynamics reported. A significant coupling effect was found for Frequency of Forgetting predicting changes in OMP ($\gamma = -1.026$, SE = 0.112, $p < 0.05$). When it comes to low-memory functioning individuals, this result not necessarily indicates that SMCs precede OMP decline as this group has already experienced a more pronounced memory decline. This result may imply that an increased frequency of memory problem reports is associated with a subsequent worsening of OMP. For Retrospective Functioning, the coupling effect lost its significance after including depression as a covariate ($\gamma = -0.121$, SE = 0.088, $p > 0.05$), suggesting that depressive symptoms may not play a significant influence in the retrospective-objective memory association.

Our results are consonant with previous studies that support an important dynamic relationship between depression (and negative affect), SMC, and OMP. Yang et al. (2019) reported significant between-person and within-person associations for subjective cognitive complaints and cognitive functioning only after controlling depressive symptoms. Memory complaints have been reported as more associated with negative affect than objective memory (Rowel et al., 2016) and as being predicted by depression and neuroticism, but not by objective memory (Pearman et al., 2014). Depression seems to be an important source of influence on memory self-reports (Hulur et al., 2014). The frequency of memory complaints increases as a function of depressive symptoms but not as a function of OMP (Schweizer et al., 2018).

Why are depressive symptoms changing the SMC-OMP association? Brailen et al. (2019) found that increasing depression severity was associated either with subjective and objective memory decline for older adults and concluded that "the co-occurrence of depressive symptoms and subjective memory complaints may be attributable to objective cognitive decline" (p. 150). The negative relationship between depression and memory has been extensively reported. Cross-sectional and longitudinal studies have demonstrated that higher scores in self-reported depressive symptoms are associated with lower scores in objective memory measures and with an accelerated cognitive decline (Gale, Allerhand, & Deary, 2012; Kommer et al., 2013; Wang, Yip, Lu, & Yeh, 2017). Using the VCAP sample, Teles and Shi (in press) found that higher depressive symptoms predicted an accelerated subsequent memory decline in older adults. This result was replicated for specific depressive dimensions, like somatic symptoms and depressed affect. The opposite direction in which memory predicts subsequent changes in depression was not supported by the study, suggesting that depressive symptoms are a leading variable in the temporal ordering of the association with memory.

The discrepancy between subjective and objective memory may be explained by how individual differences in depression influence both dimensions (Haavisto & Boron, 2020). Depressive symptoms can negatively impact self-perception of memory, as depressed people tend to have pessimistic views about themselves (Hulur et al., 2014). Additionally, individuals who underestimate their memory functioning may not engage with the required amount of effort and right strategies in a task, resulting in poor objective performance. That suggests a special link between eventual memory complaints, affective symptoms, and objective memory performance.

It has been well-acknowledged that the detection of meaningful relationships may be limited by the brevity of the measures used in many studies (e.g., single questions dichotomizing presence versus absence in memory self-reports), which compromises the robustness of the assessment (Fyock & Hampstead, 2015). Our study aims to advance in the investigation of the subjective-objective memory association with a robust memory assessment conducted in a large sample throughout five timepoints. Our findings, however, must be interpreted in light of some methodological limitations. First, the sample was not assessed through a formal diagnosis of mild cognitive impairment and depression, hampering conclusions regarding the prognostic value of SMCs to predict dementia, as well as the investigation of SMC-OMP association in a clinical group of cognitively impaired individuals. Additionally, the sample attrition across time resulted in a sample with higher memory functioning, leading to a small association of initial levels of subjective and objective memory (Salthouse, 2014). The relatively high-functioning community sample may also explain the lower scores in memory complaints in contrast with many other studies that report an increase in SMCs among older adults (Montejo et al., 2011).

Conclusion

The present study found no significant associations between subjective complaints and retrospective memory with objective memory performance, neither in the cross-sectional level nor in the prospective associations. The bivariate change dual score models supported a unidirectional association between constructs, with Frequency and Seriousness of Forgetting leading the temporal ordering association with OMP and OMP leading the longitudinal association with Retrospective Memory. The subjective-objective association became stronger after including depressive symptoms as a covariate and the low-memory functioning group. Our results do not support a predictive value of subjective memory complaints for objective memory decline without including depressive symptoms in this dynamic association.

Disclosure of Interest

The authors report no conflict of interest.

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