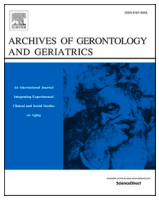
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The association between functional social support, marital status and memory in middle-aged and older adults: An analysis of the canadian longitudinal study on aging

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HIGHLIGHTS

- The present study examined whether marital status modifies the association between functional social support (FSS) and memory in middle-aged and older adults
- FSS was generally positively associated with memory
- However, FSS did not have differing effects on memory based on marital status
- Further examination of this association using different missing data approaches generally yielded similar results

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ABSTRACT

Purpose: Although several studies have reported positive associations between functional social support (FSS) and memory, few have explored how other social variables, such as marital status, may affect the magnitude and direction of this association. We examined whether marital status modifies the association between FSS and memory in a sample of community-dwelling, middle-aged and older adults.
Methods: Data at three timepoints, spanning six years, were analyzed from the Tracking Cohort of the Canadian Longitudinal Study on Aging (n = 10,318). Linear mixed models were used to regress memory onto FSS across all three timepoints, adjusting for multiple covariates. The moderating effect of marital status was assessed by adding its interaction with FSS in the model. Separate regression models were built for overall FSS and four subtypes (positive interactions, affectionate, emotional/informational, and tangible support).
Results: We found significant and positive adjusted associations for overall FSS (β: 0.07; 95 % CI: 0.01, 0.13), positive interactions (β: 0.06; 95 % CI: 0.01, 0.11), and affectionate support (β: 0.05; 95 % CI: 0.00, 0.11) with memory. However, the interaction between marital status and FSS (overall and subtypes) was not statistically significant (likelihood ratio test p-value = 0.75), indicating that FSS does not have differing effects on memory depending on marital status.
Conclusion: Our findings do not provide evidence to suggest that marital status affects the association between FSS and memory in middle-aged and older adults. Nonetheless, policymakers and practitioners should take a comprehensive approach when exploring how various dimensions of social relationships may uniquely influence cognitive trajectories.

1. Introduction

Memory, one of the six domains of cognitive function, is the capacity to encode, store, and retrieve information (Craik & Rose, 2012). Memory is central to healthy aging because it is associated with everyday physical, behavioural, and social functioning, including decision-making, performing job-related tasks, and maintaining functional independence. Memory is also essential for social interactions and relating to others, which are important components of maintaining emotional well-being (Umberson & Montez, 2010). Changes in the

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memory domain of cognitive function are related to aging and may lead to daily challenges for older adults, including difficulty remembering dates, appointments, and locations. Declines in memory are also strong markers for minor and major neurocognitive disorders such as Alzheimer's disease (Tuokko et al., 2017). Aigbogun et al. (2017) reported that 40 to 47 % of adults over the age of 65 years experience memory impairment and 7 % are diagnosed with a major neurocognitive disorder (Public Health Agency of Canada, 2017). Thus, investigating potentially modifiable risk or protective factors for memory is crucial to help offset future health challenges and promote healthy cognitive aging in middle-aged and older adults (Kelly et al., 2017). One such modifiable protective factor is functional social support (FSS) (Mogic et al., 2023).

FSS refers to one's perception of whether members of their social network are available to provide practical help and emotional support when needed (Gow et al., 2013). Higher levels of FSS have been associated with higher levels of cognitive function, specifically memory, in various cross-sectional and longitudinal studies. A recent systematic review by Mogic et al. (2023) assessed 17 articles on the association between FSS and memory in middle-aged and older adults. The evidence generally pointed to a positive association between these two variables, with similar directions of effect reported across different subtypes of FSS and memory.

According to the stress-buffering hypothesis, FSS may help to mitigate the impact of stressful life events on an individual's health (Cohen & Wills, 1985). When individuals perceive that people will be available to help address their support needs (high FSS), they may develop a sense of stability, positive affect, and self-worth (Cohen & Wills, 1985) that allows them to reframe stressful situations as less serious and potentially solvable. This reframing counteracts the physiological changes associated with stress (e.g., elevated blood cortisol levels), which have been shown to negatively affect the areas of the brain responsible for memory (Kuiper et al., 2016). While the evidence and theory support the beneficial effects of FSS on preserving cognitive function, specifically memory, in middle-aged and older adults, a paucity of literature has examined whether the magnitude or direction of this association differs according to one's marital status.

Marriage is a key source of FSS among middle-aged and older adults, especially as health declines (Penning & Wu, 2014). Entering a romantic relationship may expand one's social network through immersion in the partner's social network, thus increasing the number of potential sources of FSS. In addition, the partner may serve as a confidant during times of need, providing the spouse (married or common-law) with a sense of social integration and belonging (Penning & Wu, 2014; Shapiro & Keyes, 2008). Research has consistently shown that persons who are married or in common-law relationships fare better in terms of both physical and psychological health than their unmarried counterparts, especially among middle-aged and older adults (Grundström et al., 2021; Robles, 2014). Indeed, several studies have found that married people report better memory performance than single or widowed individuals (Aartsen et al., 2005; Liu et al., 2019; Mousavi-Nasab et al., 2012). However, debate exists over whether this phenomenon may partly be explained by the marital selection model of health, which proposes that individuals who are not in good health, both physically and psychologically, are less likely to get married compared to their healthy counterparts (Goldman et al., 1995; Spiker, 2014; Wyke & Ford, 1992). Nevertheless, the health benefits of marriage or common-law relationships may also arise from the tendency of married or common-law individuals to encourage healthy behaviours as part of their provision of FSS (Robles, 2014). Conversely, divorce, separation, or the death of a spouse is often associated with a loss of support, both directly from marital partners and indirectly from many of the extended social networks formed due to the union (Shapiro & Keyes, 2008). Therefore, the association between FSS and memory may differ depending on one's marital status. While FSS promotes better memory through stress-buffering mechanisms (Cohen & Wills, 1985), additional FSS from a spouse can further generate a sense of reassurance, foster more effective coping efforts, and reduce stress during physical and mental hardship, which may provide added protection against memory decline, relative to persons who are not in married or common-law relationships. Thus, it is important to consider whether FSS from a spouse, in addition to FSS from other support providers (e.g., children, other family and friends), may demonstrate distinct associations with memory in married or common-law individuals compared to unmarried/unpartnered individuals.

Despite the theoretical rationale supporting marital status as an effect modifier of the association between FSS and memory, this relationship has been understudied in the literature. A recent systematic review by Haghighi and Oremus (2023) found only four articles that explored marital-related variables simultaneously with FSS and memory (Liao & Scholes, 2017; Scholes & Liao, 2022; Windsor et al., 2014; Zahodne et al., 2019). However, none of these articles specifically explored whether the association between FSS and memory differs based on marital status. In these articles, the authors examined whether the source of FSS (i.e., support from spouses versus children, family members, and friends) was differentially associated with memory, rather than marital status. Findings across all four articles generally showed positive, though mostly statistically non-significant, associations between FSS from a spouse/partner and memory.

Taken together, whether one has access to FSS from friends, family, or other loved ones, access to a spouse may differentially impact how FSS is associated with memory. To address the absence of research into whether marital status modifies the relationship between FSS and memory, this study was undertaken to address the following research question: Does marital status modify the association between FSS and memory in middle-aged and older community-dwelling adults in Canada?

2. Materials and methods

2.1. Study design

All analyses for this study were conducted using secondary data from the Tracking Cohort of the Canadian Longitudinal Study on Aging (CLSA) (Raina et al., 2019). The CLSA is a national, population-based, panel study designed to examine the impact of biopsychosocial factors on the health of middle-aged and older adults (Raina et al., 2019). The Tracking Cohort randomly recruited 21,241 community-dwelling participants between the ages of 45 and 85 years at baseline across the 10 Canadian provinces, with 17,052 and 14,848 participants remaining in the study and providing data at the first and second follow-up timepoints, respectively. On average, each timepoint was spread approximately three years apart. All participants in the Tracking Cohort provided data at each timepoint via a 60- to 90-minute telephone interview (Raina et al., 2019).

Tracking Cohort participants were recruited from three sources: (1) provincial healthcare databases, (2) random digit dialing (RDD) of landline telephones, and (3) the Canadian Community Health Survey (CCHS) on Healthy Aging (Statistics Canada, 2010). Participants were recruited into strata based on their province of residence, age group, and sex. After observing that predominantly highly educated persons were being recruited into the study, the CLSA investigators added another stratum for education in the later stages of recruitment to increase the enrollment of participants with lower educational attainment. Further information about the CLSA's design and sampling process is available elsewhere (Canadian Longitudinal Study on Aging, 2023a).

Participants were included in the CLSA if they were between the ages of 45 and 85 years, understood English or French, and resided in one of the ten Canadian provinces. Individuals were excluded from the CLSA if they showed signs of overt cognitive impairment at the recruitment interview. This measure was taken to ensure that participants could provide valid data and comprehend the informed consent process, particularly since the CLSA aimed to follow as many participants as

possible over a 20-year period. Additional exclusion criteria included residing in a long-term care facility, Canadian territory or First Nations reserve, as well as being a full-time member of the Canadian Armed Forces.

Ethics approval for the present study was obtained from the University of Waterloo's Office of Research Ethics (file #44539). Access to the Tracking Cohort dataset was approved by the CLSA's Data and Sample Access Committee. We reported our study in conjunction with the STROBE guidelines (von Elm et al., 2007) and included the reporting checklist in Appendix A.

2.2. Measures

All analyses of the following variables included data from the baseline, first follow-up, and second follow-up timepoints.

Functional Social Support (FSS): FSS was measured using the 19-item Medical Outcomes Study – Social Support Survey (MOS-SSS) (Sherbourne & Stewart, 1991). The survey asks participants to estimate the extent to which four subtypes of FSS – positive social interactions, and affectionate, tangible, and emotional/informational support – are available to them from members of their social network (Sherbourne & Stewart, 1991). Each question on the MOS-SSS consists of five response options ranging from 1 = "none of the time" to 5 = "all of the time". All 19 items were used to derive scores for overall FSS; these items were also grouped to derive scores for each of the four FSS subtypes. The MOS-SSS demonstrates excellent psychometric properties and has been validated and found reliable for use in clinical research, especially for older populations (Cronbach's α range = 0.90 to 0.97) (Robitaille et al., 2011).

Memory: Participants' immediate and delayed recall memory were measured using a modified version of the Rey Auditory Verbal Learning Test (RAVLT) (Rey, 1964). Modification of the RAVLT was performed by the CLSA's Psychology Working Group, who tested the changes to ensure the measure's validity in the CLSA (Tuokko et al., 2017). In the modified version, participants listen to a recorded list of 15 words and immediately recall as many of the words as possible within 90 seconds. Five minutes later, participants are asked to recall as many of the same words as possible, within 60 seconds, without hearing the list again. Each word recalled correctly is awarded one point; each acceptable variant word (a word sounding like the word used in the recording, e.g., "collar" vs. "colour") is also awarded one point if it is used in both the immediate and delayed recall tests. Raw scores for each administration range from 0 to 15. Following the process outlined in Ohman et al. (2023), raw scores were converted into z-scores separately for the immediate and delayed recall administrations. The z-scores were also computed separately for English- and French-speaking participants; persons with bilingual responses were excluded. The z-scores were then added together to obtain a single memory score for each participant. The RAVLT demonstrates good validity and reliability (Cronbach's a = 0.80) (de Sousa Magalhães et al., 2012) and has been used extensively in older populations (Aartsen et al., 2005; O'Connell et al., 2019; Zuelsdorff et al., 2013).

Marital Status: Participants answered the following question – "*What is your current marital/partner status?*" – with one of five response options: single, married or living with a partner in a common-law relationship, widowed, divorced, or separated. To ensure adequate statistical power, we followed Han et al.'s (2014) approach and re-categorized the response options into: (1) married or living in a common-law relationship, (2) single, and (3) widowed, divorced, or separated.

Other Covariates: Data from the following 11 covariates were included in the regression analysis based on the broader literature on FSS and memory (Gow et al., 2013; Hughes et al., 2008; Hülür, 2022; Seeman et al., 2011; Zahodne et al., 2019): (1) sociodemographic variables (sex, age group, education, annual household income, province of residence, and living arrangement), (2) health variables (chronic conditions, functional status/activities of daily living, and depressive symptoms), and (3) lifestyle factors (smoking status and alcohol consumption). Guided by CLSA recommendations, participants' sex, age group, and province of residence were included as variables in all regression models to account for the complex survey design (Canadian Longitudinal Study on Aging, 2023b). Full descriptions of these covariates are provided in Appendix B.

2.3. Statistical analyses

Descriptive statistics were computed for all variables. Categorical variables were examined using frequencies and percentages, whereas continuous variables were examined with means and standard deviations (if normally distributed), or medians and interquartile ranges (if non-normally distributed).

The regression analysis described below used a complete case analysis approach and drew upon the data available at the CLSA's baseline, follow-up 1, and follow-up 2 timepoints. Only individuals with complete data on FSS, marital status, memory, and all covariates were included in the regression analysis. To address the research question, we undertook the following steps: memory was regressed on FSS in a base model adjusting for age group, sex, and province of residence; this model was then re-run with a FSS*marital status interaction. In addition, a fully adjusted model was developed, adjusting for all pre-specified covariates; this model was also re-run with a FSS*marital status interaction.

The analysis was run on the complete case sample described above using a linear mixed effects model with a random intercept and a random time effect. The PROC MIXED procedure in SAS v9.4 (The SAS Institute, Cary, NC) was utilized to conduct the regression analysis. Akaike information criterion (AIC) values were used to assess model fit. Different correlation structures (e.g., unstructured, exchangeable, and autoregressive correlation) were considered when fitting the base model. The correlation structure that yielded the lowest AIC was used in all subsequent analyses. A likelihood ratio test was used to compare the models with and without the FSS*marital status interaction. A significance level of 0.05 was set for all statistical tests.

2.3.1. Sensitivity analyses

To examine different strategies for addressing missing data for the covariates in the regression analysis, we compared the complete case analysis to two approaches:

1) Multiple imputation: this method was used to impute scores for any missing data values for our covariates. Separate regression models were created for each of the 22 imputed datasets and Rubin's rules (Rubin, 1987) were used to combine the results into a single set of regression coefficients.
2) Missing data category method: an additional category called 'missing data' was created for each covariate with missing data values. For instance, smoking status is a three-level variable: 0 = never smoked, 1 = occasional smoker, and 2 = daily smoker. In the 'missing data category' approach, participants with missing data on this variable were coded as '3 = missing data' and retained in the analysis.

Any individuals missing data on FSS, marital status, and memory were excluded from the analyses described above. All regression models were re-run with the multiple imputation and missing data category approaches and results compared to our findings from the complete case analysis.

Considering that most participants did not change their marital status over the three timepoints, another sensitivity analysis was conducted to compare whether the association between FSS and memory changed after stratifying our sample by their baseline marital status (instead of including an FSS*marital status interaction in the model). We re-ran both the base and fully adjusted regression models outlined above for each marital status category. Cuzick's (2005) graphical forest plot method was employed to assess the presence of effect modification.

3. Results

The Tracking Cohort consisted of 14,658 participants who provided data at baseline, follow-up 1, and follow-up 2. After excluding individuals with missing data at baseline, follow-up 1 and/or follow-up 2 on any of the three variables of interest (i.e., FSS, marital status, and memory), we were left with a total of 10,318 participants in our analytical sample (Fig. 1). This sample was used for the regression models in both the multiple imputation and missing data category sensitivity analyses. However, for the complete case analysis, we removed another 5964 participants from the analytical sample because they had missing data on at least one covariate. As such, the sample size for the complete case analysis was 4354.

3.1. Participant characteristics

Sociodemographic, health, and lifestyle characteristics of the analytical sample are presented in Table 1. Approximately 52 % of the sample was composed of women, 81 % of the participants had at least some post-secondary education, 24 % were living in Ontario, followed by 18 % in Québec, and 12 % in British Columbia. Three-quarters of participants reported annual household incomes of $ 50,000 or more and the majority were married or in common-law relationships, while about 80 % reported living with at least one other person.

Overall, participants generally had high scores on FSS at each of the three timepoints, with median scores ranging from 4.5 to 5.0 (Table 2). Median memory scores remained relatively stable across the three timepoints (Table 2). Marital status remained largely unchanged over the course of follow-up (Table 3).

Overall FSS and each of its subtypes were significantly different across the different marital status categories ($p < 0.001$ [Kruskal-Wallis]); this trend was the same for baseline, follow-up 1, and follow-up 2 (Table 4). More specifically, across all three timepoints, married or common-law individuals reported higher scores on overall FSS and each subtype, whereas single individuals displayed the lowest FSS scores. However, given that scores on the MOS-SSS range from 1 to 5, these between-group differences are minimal and unlikely to be clinically or practically relevant, despite being statistically significant.

Median memory scores increased between baseline and follow-up 1 within each marital status category, but decreased between follow-up 1 and follow-up 2. Memory was only significantly different across the different marital status categories at follow-up 2 (Kruskal-Wallis test, $p < 0.001$), with widowed, divorced, or separated individuals displaying the lowest memory scores (Table 5). Memory did not significantly differ between the marital status categories at baseline ($p = 0.46$) or follow-up 1 ($p = 0.09$).

3.2. Regression analyses

In the base models, overall FSS and each subtype were positively associated with memory. Regression coefficients (βs) for FSS in the base models ranged from 0.06 to 0.12; the effects of overall FSS and all subtypes were statistically significant at the 5 % level (Fig. 2; Appendix C1). In the fully adjusted models, however, only overall FSS, positive social interactions and affectionate support had statistically significant associations with memory and these associations are positive (Fig. 3; Appendix D1). In both the base and fully adjusted models, the estimated effect of overall FSS was larger than those of the FSS subtypes, though we could not draw conclusions about the differences in the effects of overall FSS and subtypes of FSS on memory because of overlapping confidence intervals.

After adding the FSS (overall and subtypes) and marital status interaction to both the base and fully adjusted models, we found that the effect of FSS on memory was not significantly different between widowed, divorced, or separated and single participants or between married or common-law and single participants (Figs. 4 and 5; Appendix C2 and D2). The likelihood ratio test was then used to formally assess FSS (overall and subtypes) and marital status interactions by comparing models with and without the interaction terms. The test results indicated no statistical significance in most fitted regression models (Table 6). The exceptions were the TANG*marital status interaction (likelihood ratio test $p = 0.05$) and the EMOINFO*marital status interaction (likelihood ratio test $p = 0.03$) in the base models. However, these interactions did not remain significant in the fully adjusted models.

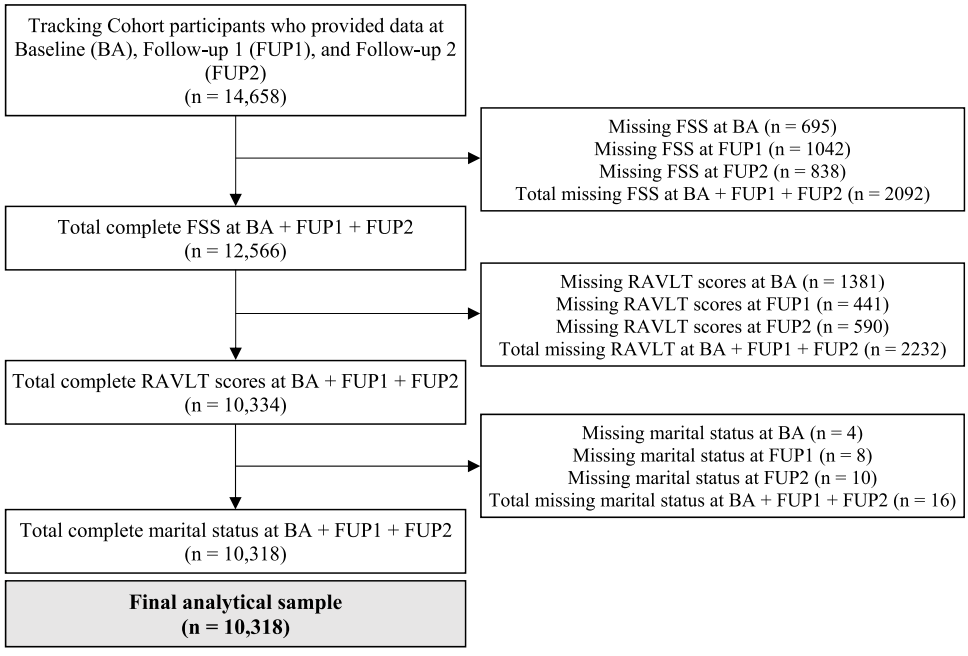


Fig. 1. Flowchart of the analytical sample
BA: baseline; FSS: Functional social support; FUP1: follow-up 1; FUP2: follow-up 2; RAVLT: Rey Auditory Verbal Learning Test.

Table 1
Sociodemographic, health, and lifestyle characteristics of the analytical sample (n = 10,318).

Characteristics	Baseline n (%)	Follow-up 1 n (%)	Follow-up 2 n (%)
Sex			
Male	4919 (47.7)	4928 (47.8)	4919 (47.7)
Female	5399 (52.3)	5390 (52.2)	5399 (52.3)
Age Group			
45–54 years	3333 (32.3)	1565 (15.2)	553 (5.4)
55–64 years	3633 (35.2)	3819 (37.0)	3702 (35.9)
65–74 years	2159 (20.9)	3110 (30.1)	3592 (34.8)
75 years and older	1193 (11.6)	1824 (17.7)	2471 (24.0)
Province			
Alberta	1018 (9.9)	1020 (9.9)	1026 (9.9)
British Columbia	1226 (11.9)	1252 (12.1)	1265 (12.3)
Manitoba	656 (6.4)	639 (6.2)	639 (6.2)
New Brunswick	642 (6.2)	645 (6.3)	643 (6.2)
Newfoundland & Labrador	559 (5.4)	546 (5.3)	541 (5.2)
Nova Scotia	793 (7.7)	805 (7.8)	808 (7.8)
Ontario	2442 (23.7)	2452 (23.8)	2456 (23.8)
Prince Edward Island	548 (5.3)	535 (5.2)	527 (5.1)
Quebec	1841 (17.8)	1842 (17.9)	1840 (17.8)
Saskatchewan	593 (5.8)	582 (5.64)	573 (5.6)
Education			
Less than high school	594 (5.8)	594 (5.8)	594 (5.8)
High school diploma	1304 (12.6)	1304 (12.6)	1304 (12.6)
Some post-secondary education	728 (7.1)	728 (7.1)	728 (7.1)
Post-secondary diploma/degree	7663 (74.3)	7663 (74.3)	7663 (74.3)
Missing	29 (0.3)	29 (0.3)	29 (0.3)
Annual Household Income			
≤ $19,999	374 (3.6)	371 (3.6)	357 (3.5)
$ 20,000 – 49,999	2400 (23.3)	2363 (22.9)	2454 (23.8)
$ 50,000 – 99,999	3757 (36.4)	3715 (36.0)	3531 (34.2)
$ 100,000 – 149,999	1897 (18.4)	1865 (18.1)	1793 (17.4)
≥ $ 150,000	1404 (13.6)	1452 (14.1)	1409 (13.7)
Missing	486 (4.7)	552 (5.4)	774 (7.5)
Marital Status			
Married or common-law	7736 (75.0)	7607 (73.7)	7425 (72.0)
Widowed, divorced, or separated	1862 (18.1)	1970 (19.1)	2200 (21.3)
Single	720 (7.0)	741 (7.2)	693 (6.7)
Living Arrangement			
Alone	1829 (17.7)	2081 (20.2)	2300 (22.3)
With others	8489 (82.3)	8237 (79.8)	8018 (77.7)
Chronic conditions			
No chronic condition	1061 (10.3)	672 (6.5)	0 (0.0)
One or more conditions	9234 (89.5)	9633 (93.4)	8184 (79.3)
Missing	23 (0.2)	13 (0.1)	2134 (20.7)
Functional Status			
No functional impairment	825 (8.0)	1009 (9.8)	1276 (12.4)
Mild impairment	9322 (90.4)	8851 (85.8)	8609 (83.4)
Moderate impairment	107 (1.0)	190 (1.8)	233 (2.3)
Severe or total impairment	44 (0.4)	88 (0.9)	145 (1.4)
Missing	20 (0.2)	180 (1.7)	55 (0.5)
Depressive Symptoms			
Score of < 10	8696 (84.3)	8541 (82.8)	8876 (86.0)
Score of ≥ 10	1442 (14.0)	1576 (15.3)	1258 (12.2)
Missing	180 (1.7)	201 (2.0)	184 (1.8)
Smoking Status			
Never smoker	6200 (60.1)	9595 (93.0)	9676 (93.8)
Occasional smoker (at least one cigarette in the past 30 days)	173 (1.7)	191 (1.9)	145 (1.4)
Daily smoker (at least one cigarette per day for the past 30 days)	677 (6.6)	531 (5.2)	493 (4.8)
Missing	3268 (31.7)	1 (0.0)	4 (0.0)
Alcohol Use			
Never	1028 (10.0)	997 (9.7)	1701 (16.5)
Less than once per month	1501 (14.6)	1410 (13.7)	1371 (13.3)
1–3 times per month	1921 (18.6)	1895 (18.4)	1781 (17.3)
1 or more times a week	5572 (54.0)	5684 (55.1)	5431 (52.6)
Missing	296 (2.9)	332 (3.2)	34 (0.3)

Table 2
Distribution of FSS and memory scores at baseline, follow-up 1, and follow-up 2 (n = 10,318).

FSS Type	Baseline Median (IQR)	Follow-up 1 Median (IQR)	Follow-up 2 Median (IQR)
Overall FSS	4.5 (1.0)	4.6 (1.0)	4.6 (1.0)
Tangible Support	4.5 (1.0)	4.8 (1.0)	4.8 (1.0)
Positive Social Interactions	4.7 (1.0)	4.7 (1.0)	4.7 (1.0)
Emotional/Informational Support	4.5 (1.0)	4.6 (1.0)	4.6 (1.0)
Affectionate Support	5.0 (0.7)	5.0 (0.7)	5.0 (0.7)
Memory Scores	-0.1 (2.1)	0.1 (2.5)	-0.0 (2.5)

FSS: Functional Social Support; IQR: inter-quartile range
Note. The minimum and maximum values for overall FSS and all subtypes were 1.0 and 5.0, respectively.

3.3. Sensitivity Analysis #1 - Regression models stratified by baseline marital status

Since most participants did not change their marital status over the three timepoints, additional analyses were conducted to compare whether stratifying our sample by their baseline marital status, rather than using an FSS*marital status interaction term, would change the association between FSS and memory.

In both the base and fully adjusted models for the married or common-law stratum, overall FSS and each subtype were positively associated with memory. βs ranged from 0.05 to 0.12; the estimates for all FSS subtypes, except for tangible support (in the base model) and emotional/informational support (in the fully adjusted model), were statistically significant at the 5 % level (Appendix Figures E1 and E3). The models for affectionate support produced the largest β.

Similarly, in both the base and fully adjusted models for the widowed, divorced, or separated stratum, overall FSS and each subtype were positively associated with memory. βs ranged from 0.04 to 0.20.

Table 3
Transitions in marital status across timepoints (n = 10,318).

	Baseline to Follow-up 1 n (%)	Follow-up 1 to Follow-up 2 n (%)
Married or common-law → married or common-law	7328 (94.7)	7292 (95.9)
Married or common-law → WDS	349 (4.5)	309 (4.1)
Married or common-law → single	59 (0.8)	6 (0.1)
WDS → WDS	1550 (83.2)	1878 (95.3)
WDS → married or common-law	185 (9.9)	79 (4.0)
WDS → single	127 (6.8)	13 (0.7)
Single → single	555 (77.1)	674 (91.0)
Single → married or common-law	94 (13.1)	54 (7.3)
Single → WDS	71 (9.9)	13 (1.8)

Note. Marital status at each timepoint reflects participants' current marital status and does not capture the specific timing of transitions between different marital status categories. Since the timepoints are approximately three years apart, participants may have experienced several transitions, such as marriage, divorce, or widowhood, in the interval between the timepoints.
WDS: widowed, divorced, or separated

Table 4
Distribution of FSS scores by marital status (n = 10,318).

FSS Type	Married or common-law n = 7736 Median (IQR)	WDS n = 1862 Median (IQR)	Single n = 720 Median (IQR)	p-value
Baseline				
Overall FSS	4.6 (0.8)	4.2 (1.1)	4.1 (1.3)	<0.001
TANG	4.8 (0.8)	4.0 (1.5)	3.8 (1.8)	<0.001
POSINT	4.7 (1.0)	4.0 (1.3)	4.0 (1.7)	<0.001
EMOINFO	4.6 (1.0)	4.3 (1.3)	4.1 (1.4)	<0.001
AFF	5.0 (0.3)	4.3 (1.3)	4.0 (1.7)	<0.001
Follow-up 1				
Overall FSS	4.7 (0.8)	4.2 (1.2)	4.0 (1.4)	<0.001
TANG	4.8 (0.8)	4.0 (1.5)	4.0 (1.8)	<0.001
POSINT	5.0 (1.0)	4.0 (1.7)	4.0 (1.3)	<0.001
EMOINFO	4.8 (1.0)	4.3 (1.3)	4.0 (1.4)	<0.001
AFF	5.0 (0.3)	4.3 (1.3)	4.0 (1.7)	<0.001
Follow-up 2				
Overall FSS	4.8 (0.8)	4.2 (1.2)	3.95 (1.2)	<0.001
TANG	4.8 (0.8)	4.0 (1.5)	3.75 (1.5)	<0.001
POSINT	5.0 (1.0)	4.0 (1.7)	4.00 (1.3)	<0.001
EMOINFO	4.8 (0.9)	4.3 (1.3)	4.00 (1.4)	<0.001
AFF	5.0 (0.3)	4.3 (1.3)	4.00 (1.7)	<0.001

AFF: Affectionate Support; EMOINFO: Emotional/Informational Support; FSS: Functional Social Support; IQR: inter-quartile range; POSINT: Positive Social Interactions; TANG: Tangible Support; WDS: widowed, divorced, or separated

Although the estimates for overall FSS and all subtypes were statistically significant at the 5 % level in the base models (Appendix Figure E1), none of the estimates for any of the FSS subtypes were statistically significant in the fully adjusted models (Appendix Figure E3). The model for overall FSS produced the largest β in the base model, whereas positive social interactions produced the largest β in the fully adjusted model.

Overall FSS and each subtype were also generally positively associated with memory in the 'single' stratum. The exceptions were overall FSS, tangible support, and emotional/informational support in the fully adjusted models, though none of these estimates were statistically significant (Appendix Figures E1 and E3). βs ranged from -0.01 to 0.06. The model for affectionate support produced the largest β in the base model, whereas positive social interactions produced the largest β in the fully adjusted model.

The results of Cuzick's forest plot method for overall FSS and each subtype can be found in Appendix Figures E2 and E4. Generally, for effect modification to be present, the stratified confidence intervals must not contain the unstratified regression coefficient. However, in the current study, all confidence intervals contained the unstratified regression coefficient. Thus, we concluded that effect modification was not present for overall FSS or any subtypes. Therefore, the results of our stratified analysis generally support the conclusions found in our main analysis with the FSS*marital status interaction term.

3.4. Sensitivity analysis #2 - Regression models with multiple imputation and missing data category method

Upon comparing the three strategies for addressing missing data (i.e., complete case analysis versus multiple imputation and missing data category), we found that the regression coefficients were substantively the same (Appendix F). More specifically, using multiple imputation or the missing category method did not change the direction and magnitude of effect of our initial findings. In most cases, the βs did not change by more than ± 0.01 in the sensitivity analyses compared to the complete case analysis.

4. Discussion

We found that FSS was generally positively associated with memory among a cohort of middle-aged and older Canadians. However, this association was not modified by marital status, regardless of whether this was assessed by using an FSS*marital status interaction term or stratifying the sample by their baseline marital status. Further examination of these associations using different missing data approaches (i.e., complete case analysis, multiple imputation and missing data category) generally yielded similar findings.

Our general findings are consistent with earlier analyses of the CLSA, which found positive associations between FSS and both immediate and delayed recall memory (Ohman et al., 2023; Yoo et al., 2023). Ohman et al.'s cross-sectional analysis of the relationship between FSS and memory found adjusted βs in the range of 0.02 to 0.07, whereas Yoo et al.'s analysis of three-year change scores found adjusted βs in the range of 0.03 to 0.07; the findings of both studies match the fully adjusted regression coefficients in our study (range: 0.04 to 0.07). Our findings are also consistent with previous research from various other study populations (Ge et al., 2017; Gow et al., 2013; Krueger et al., 2009; La Fleur & Salthouse, 2017).

We also found that the association between FSS and memory did not significantly differ between married or common-law, widowed, divorced, or separated, and single individuals. Although this is inconsistent with our initial hypothesis, it does support the findings from the aforementioned systematic review by Haghighi and Oremus (2023),

Table 5
Distribution of memory scores by marital status (n = 10,318).

	Married or common-law n = 7736		WDS n = 1862		Single n = 720		p-value
	Median (IQR)	*Change scores*	Median (IQR)	*Change scores*	Median (IQR)	*Change scores*	
Baseline	-0.1 (2.1)	*0.2*	-0.1 (2.4)	*0.1*	-0.1 (2.1)	*0.2*	0.46
Follow-up 1	0.1 (2.4)	*-0.1*	0.0 (2.5)	*-0.4*	0.1 (2.4)	*-0.1*	0.09
Follow-up 2	0.0 (2.4)		-0.4 (2.8)		0.0 (2.8)		<0.001

IQR: inter-quartile range; WDS: widowed, divorced, or separated

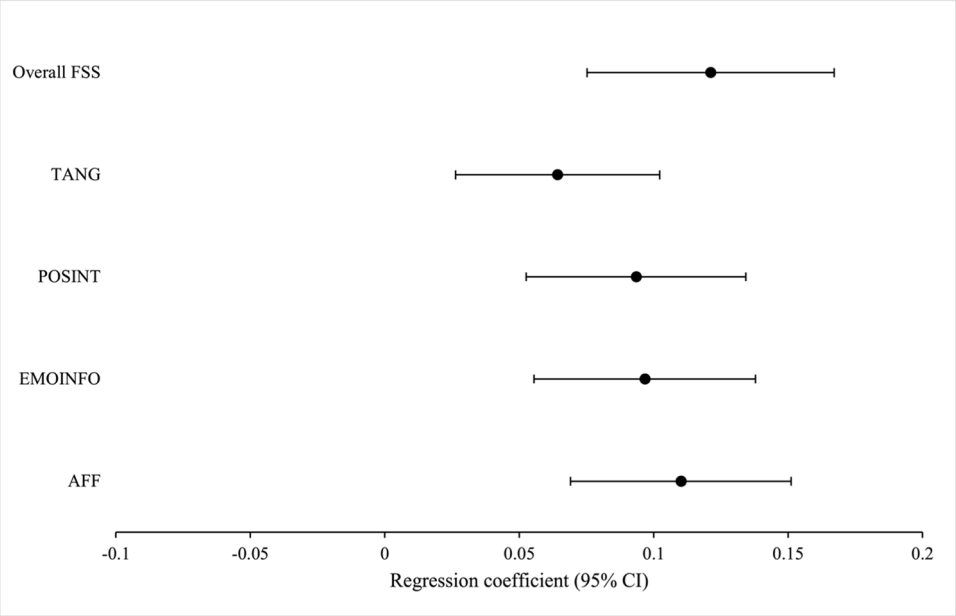


Fig. 2. Forest Plot of the Base Model for the Association Between FSS and Memory
AFF: affectionate support; EMOINFO: emotional/informational support; FSS: functional social support; POSINT: positive social interactions; TANG: tangible support
Note. The base model was adjusted for time, sex, age group, and province.

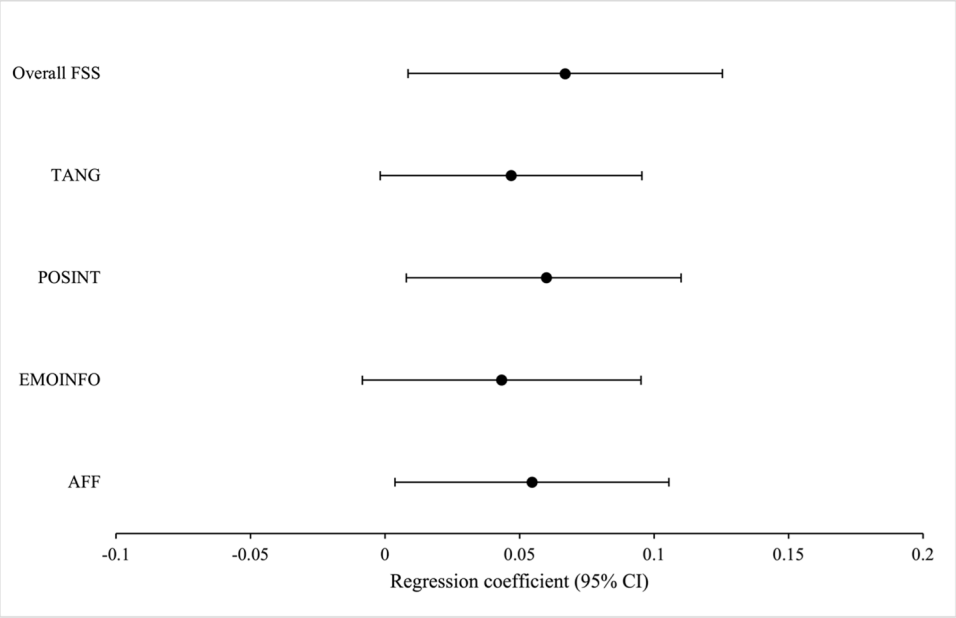


Fig. 3. Forest Plot of the Fully Adjusted Model for the Association Between FSS and Memory
AFF: affectionate support; EMOINFO: emotional/informational support; FSS: functional social support; POSINT: positive social interactions; TANG: tangible support
Note. The fully adjusted model was adjusted for time, age, sex, province, education, income, living arrangement, chronic conditions, functional status, depressive symptoms, smoking status, and alcohol use.

which generally found positive, though statistically non-significant, associations between FSS from a spouse/partner and memory. Furthermore, our findings are also supported by a recent study by Lee and Jiang (2023), which explored whether FSS, measured using a 12-item questionnaire adopted from the Health and Retirement Study (Cornwell & Waite, 2009), moderated the association between widowhood and episodic memory among older Chinese immigrants. Similar to our approach, Lee and Jiang (2023) employed an interaction term to assess the joint effect of social support and widowhood on episodic memory. They used the married group as the reference category. Like our study, none of Lee and Jiang's (2023) interaction terms were statistically significant. However, unlike the current study, they excluded individuals who were divorced, separated, or never married from their analytical sample.

While our findings suggest some support for the stress-buffering hypothesis linking FSS with memory, the lack of statistical significance in the moderating effect of marital status seems inconsistent with this theory. We hypothesized that additional FSS from a spouse would provide an added source of coping assistance and thereby increase stress-buffering effects, compared to persons who were not married or in

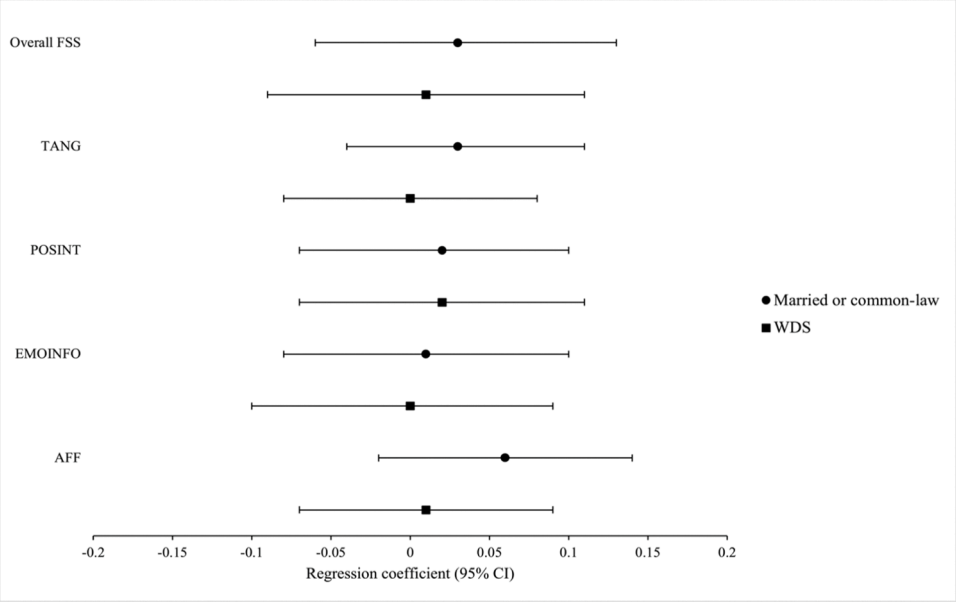


Fig. 4. Forest Plot of the Base Model for the Association Between the FSS*Marital Interaction Term and Memory
AFF: affectionate support; EMOINFO: emotional/informational support; FSS: functional social support; POSINT: positive social interactions; TANG: tangible support; WDS: widowed, divorced, or separated
Note. The reference category was single individuals. The base model was adjusted for time, sex, age group, and province.

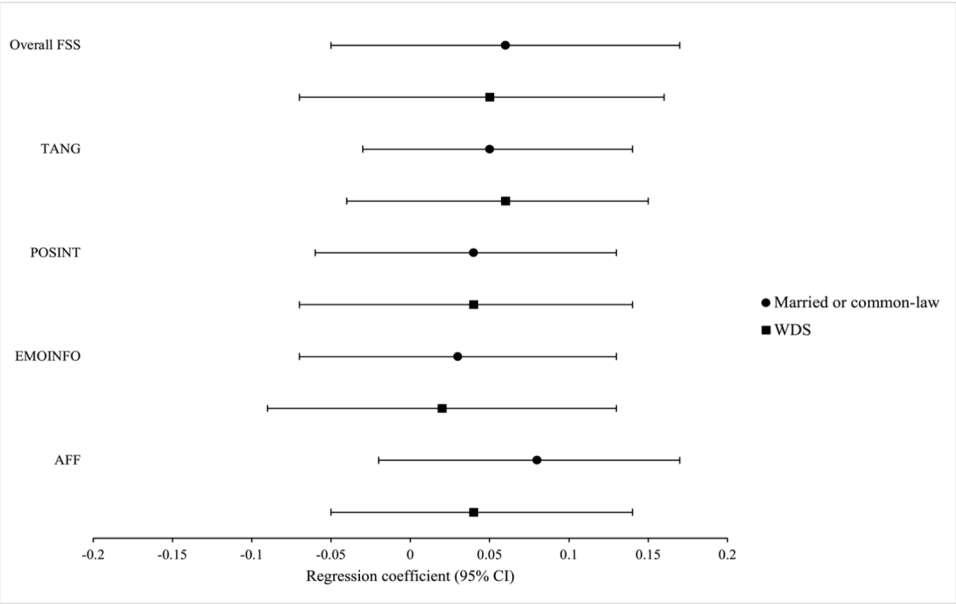


Fig. 5. Forest Plot of the Fully Adjusted Model for the Association Between the FSS*Marital Status Interaction Term and Memory
AFF: affectionate support; EMOINFO: emotional/informational support; FSS: functional social support; POSINT: positive social interactions; TANG: tangible support; WDS: widowed, divorced, or separated
Note. The reference category was single individuals. The fully adjusted model was adjusted for time, age, sex, province, education, income, living arrangement, chronic conditions, functional status, depressive symptoms, smoking status, and alcohol use.

common-law relationships. As such, the association between FSS and memory would be expected to be stronger for married or common-law individuals compared to widowed, divorced, separated, or single individuals. Nevertheless, several reasons may explain the lack of statistical significance in our findings for marital status. For instance, Penning and Wu (2014) wrote that spouses may represent the most preferred source of support for older adults, but other sources are also available in the absence of a spouse. For example, individuals who are not married, but have children, receive more emotional support than married or cohabitating individuals without children (Penning & Wu, 2014). Furthermore, research by Sarkisian and Gerstel (2016) suggests that single individuals are more likely to interact with, provide help to, and receive help from parents, siblings, neighbours and friends, compared to married individuals. Therefore, although marriage is one source of support, close-knit relationships with children, siblings, family and friends may also generate support. Unmarried individuals lacking certain types of support (e.g., emotional support) may compensate for the absence of a spouse by actively restructuring their support networks

Table 6
Likelihood Ratio Test Comparing Models with and without the FSS (Overall or subtypes) and Marital Status Interaction.

	Base Models p-value	Fully Adjusted Models p-value
Overall FSS*Marital Status	0.21	0.75
TANG*Marital Status	0.05	0.65
POSINT*Marital Status	0.11	0.82
EMOINFO*Marital Status	0.03	0.81
AFF*Marital Status	0.11	0.48

AFF: affectionate support; EMOINFO: emotional/informational support; FSS: functional social support; POSINT: positive social interactions; TANG: tangible support

to ensure they have sufficient FSS available from close-knit network members. With regard to our results, the compensatory mechanism for unmarried adults may be strong enough to produce a lack of evident differences across the various strata of marital status.

Moreover, research has found that context matters when examining the effects of marital relationships on cognitive health. Unmarried people are not uniformly disadvantaged and, in some cases, may have better health outcomes than those who are unhappily married (Holt-Lunstad et al., 2008). For example, married or common-law individuals in less fulfilling relationships might not receive substantial FSS from those connections. Thus, when married or common-law individuals get divorced, their levels of FSS may improve. Unfortunately, the CLSA did not collect information about the quality or duration of marriage, so we could not explore the effect of these contextual factors on the relation between FSS and memory. However, context is important when exploring this association and future research should consider marital history to provide a comprehensive understanding of the relationship between FSS, marital status, and memory.

4.1. Strengths and limitations

With our current aging population in Canada, it is important to investigate potentially modifiable factors to promote healthy cognitive function (Kelly et al., 2017). The current study addresses several gaps in the literature, helping to develop a better understanding of how marital relationships may impact the association between FSS and memory. As previously discussed, little research has focused on marital-related variables, FSS and memory simultaneously. We focused on the memory domain of cognitive function specifically because it is highly impacted by aging and central to the processes that contribute to social interactions, which are important in maintaining emotional well-being and helping individuals construct a sense of meaning in their lives (Umberson & Montez, 2010). Furthermore, no published studies have examined whether marital status acts as an effect modifier of the association between FSS and memory. The current study is the first to assess effect modification and this association using longitudinal data from a large-scale national study.

The seminal nature of this study benefited from the breadth and depth of the CLSA as a research platform. The CLSA's follow-up 2 timepoint included data from approximately 14,658 middle-aged and older community-dwelling persons drawn from across Canada's 10 provinces. In addition, these participants provided a wealth of sociodemographic, health, and lifestyle data that permitted us to adjust for a series of important potential confounders. Compared to the four articles included in Haghighi and Oremus' (2023) systematic review, the current study adjusted for the greatest number of covariates, all of whose inclusion in the regression models was supported by the literature. The consideration of multiple facets of FSS served as another strength of this study compared to other research, which typically focused on overall FSS or one or two FSS subtypes.

Furthermore, most studies examining the impact of marital relationships on health often dichotomized marital status into two groups: married/partnered or unmarried/unpartnered. The unmarried group encompasses all individuals who are single, never married, divorced, separated, or widowed. However, such categorization may obscure important inter-group differences between those who are in the unmarried group. More specifically, widowed, divorced, or separated individuals may share very diverse and unique experiences, compared to those who were never married, due to the grief and stress associated with losing a loved one or the dissolution of a long-term relationship. Therefore, given the distinct experiences of individuals within each of these marital groups, another strength of this study is its examination of different marital status categories and their impact on the relationship between FSS and memory. More specifically, we examined widowed, divorced, or separated individuals separately from single individuals to address the possible differences in this relationship. In addition, the results of our descriptive analyses and the direction of effect for the covariates in our regression models are consistent with previous literature, which lends credibility to our overall findings and supports the validity of our results.

A few potential limitations are also noted for this study. For instance, previous research has shown the CLSA to be affected by volunteer bias because participants generally reported high levels of FSS and are predominantly married or in common-law relationships (Yoo et al., 2023). This could have led to overestimates of positive associations between FSS and memory in the regression models. Furthermore, most participants' marital status was stable across the three timepoints; hence, we were unable to assess the impact of changing marital status on FSS and memory. We also did not have access to information regarding when the death of a spouse or the dissolution of a marriage may have occurred; thus, we could not investigate the time effect of this variable. Additionally, the CLSA excluded persons who showed overt signs of cognitive impairment at the baseline recruitment interview, which could bias associations to the null and limit the generalizability of the study results. Consequently, our findings regarding the association between FSS, marital status, and memory may not apply to individuals with severe cognitive impairment and should only be applied to populations who mirror the analytical sample, not to the overall CLSA sample or to the target population from which the CLSA sample was drawn.

Given our findings, a qualitative study may be prudent to add a greater depth of understanding to the results of our analysis of the CLSA data. For instance, in the absence of other research on whether marital status affects the association between FSS and memory, it would be insightful to interview middle-aged and older adults about their marital and social relationships. Such an examination could help contextualize our findings and provide a more expansive understanding of this understudied area.

5. Conclusions

Although we found a positive association between FSS and memory, we did not find any significant interaction between FSS and marital status. Therefore, the present study does not provide evidence to recommend targeted social support interventions based on one's marital status as a means of enhancing memory in middle-aged and older adults. Nonetheless, given society's reliance on familial caregivers (spousal or not) to manage persons with memory decline, especially when such decline is linked to minor or major neurocognitive disorder, an impetus exists for the healthcare system to provide the means for these caregivers to satisfy the unmet social support needs of persons with memory impairment (Rimmer, 2016).

CRediT authorship contribution statement

Paniz Haghighi: Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Leilei Zeng:** Writing – review & editing, Validation, Methodology. **Suzanne L. Tyas:** Writing – review & editing, Validation. **Samantha B. Meyer:** Writing –

review & editing, Validation. **Mark Oremus:** Writing – review & editing, Visualization, Validation, Supervision, Project administration, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data are available from the Canadian Longitudinal Study on Aging (www.clsa-elcv.ca) for researchers who meet the criteria for access to de-identified CLSA data.

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The opinions expressed in this manuscript are the author's own and do not reflect the views of the Canadian Longitudinal Study on Aging.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.archger.2025.105770.

References

Aartsen, M. J., Van Tilburg, T., Smits, C. H. M., Comijs, H. C., & Knipscheer, K. C. P. M. (2005). Does widowhood affect memory performance of older persons? *Psychological Medicine, 35*(2), 217–226. https://doi.org/10.1017/S0033291704002831

Aigbogun, M. S., Stellhorn, R., Krasa, H., & Kostic, D. (2017). Severity of memory impairment in the elderly: Association with health care resource use and functional limitations in the United States. *Alzheimer's and Dementia: Diagnosis, Assessment and Disease Monitoring, 8*, 51–59. https://doi.org/10.1016/j.dadm.2017.04.001

Canadian Longitudinal Study on Aging. (2023a). *CLSA technical document: sampling and computation of response rates and sample weights for the tracking (Telephone Interview) participants and comprehensive participants*. https://www.clsa-elcv.ca/doc/5130.

Canadian Longitudinal Study on Aging. (2023b). *Sampling and computation of response rates and sample weights for the tracking (Telephone Interview) participants and comprehensive participants*.

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98*(2), 310–357. https://doi.org/10.1037/0033-2909.98.2.310

Cornwell, E. Y., & Waite, L. J. (2009). Social disconnectedness, perceived isolation, and health among older adults. *Journal of Health and Social Behavior, 50*(1), 31–48. https://doi.org/10.1177/002214650905000103

Craik, F. I. M., & Rose, N. S. (2012). Memory encoding and aging: A neurocognitive perspective. *Neuroscience and Biobehavioral Reviews, 36*(7), 1729–1739. https://doi.org/10.1016/j.neubiorev.2011.11.007

Cuzick, J. (2005). Forest plots and the interpretation of subgroups. *The Lancet, 365* (9467), 1308. https://doi.org/10.1016/S0140-6736(05)61026-4

de Sousa Magalhães, S., Malloy-Diniz, L. F., & Hamdan, A. C. (2012). Validity convergent and reliability test-retest of the Rey Auditory Verbal Learning Test. *Clinical Neuropsychiatry: Journal of Treatment Evaluation, 9*, 129–137.

Ge, S., Wu, B., Bailey, D. E., & Dong, X. Q. (2017). Social support, social strain, and cognitive function among community-dwelling U.S. Chinese older adults. *Journals of Gerontology - Series A Biological Sciences and Medical Sciences, 72*(S1), S16–S21. https://doi.org/10.1093/gerona/glw221

Goldman, N., Korenman, S., & Weinstein, R. (1995). Marital status and health among the elderly. *Social Science & Medicine, 40*(12), 1717–1730. https://doi.org/10.1016/0277-9536(94)00281-w

Gow, A. J., Corley, J., Starr, J. M., & Deary, I. J. (2013). Which social network or support factors are associated with cognitive abilities in old age? *Gerontology, 59*(5), 454–463. https://doi.org/10.1159/000351265

Grundström, J., Konttinen, H., Berg, N., & Kiviruusu, O. (2021). Associations between relationship status and mental well-being in different life phases from young to middle adulthood. *SSM - Population Health, 14*, Article 100774. https://doi.org/10.1016/j.ssmph.2021.100774

Haghighi, P., & Oremus, M. (2023). Examining the association between functional social support, marital status, and memory: a systematic review. *BMC Geriatrics, 23*(1), 290. https://doi.org/10.1186/s12877-023-03982-3

Han, K. T., Park, E. C., Kim, J. H., Kim, S. J., & Park, S. (2014). Is marital status associated with quality of life? *Health and Quality of Life Outcomes, 12*(1), 109. https://doi.org/10.1186/s12955-014-0109-0

Holt-Lunstad, J., Birmingham, W., & Jones, B. Q. (2008). Is there something unique about marriage? The relative impact of marital status, relationship quality, and network social support on ambulatory blood pressure and mental health. *Annals of Behavioral Medicine, 35*(2), 239–244. https://doi.org/10.1007/s12160-008-9018-y

Hughes, T. F., Andel, R., Small, B. J., Borenstein, A. R., & Mortimer, J. A. (2008). The association between social resources and cognitive change in older adults: evidence from the charlotte county healthy aging study. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 63*(4), P241–P244.

Hülür, G. (2022). Structural and functional aspects of social relationships and episodic memory: Between-person and within-person associations in middle-aged and older adults. *Gerontology, 68*(1), 86–97. https://doi.org/10.1159/000514949

Kelly, M. E., Duff, H., Kelly, S., McHugh Power, J. E., Brennan, S., Lawlor, B. A., & Loughrey, D. G. (2017). The impact of social activities, social networks, social support and social relationships on the cognitive functioning of healthy older adults: A systematic review. *Systematic Reviews, 6*(1), 259. https://doi.org/10.1186/s13643-017-0632-2

Krueger, K. R., Wilson, R. S., Kamenetsky, J. M., Barnes, L. L., Bienias, J. L., & Bennett, D. A. (2009). Social engagement and cognitive function in old age. *Experimental Aging Research, 35*(1), 45–60. https://doi.org/10.1080/03610730802545028

Kuiper, J. S., Zuidersma, M., Zuidema, S. U., Burgerhof, J. G. M., Stolk, R. P., Oude Voshaar, R. C., & Smidt, N. (2016). Social relationships and cognitive decline: a systematic review and meta-analysis of longitudinal cohort studies. *International Journal of Epidemiology, 45*(4), 1169–1206. https://doi.org/10.1093/ije/dyw089

La Fleur, C. G., & Salthouse, T. A (2017). Which aspects of social support are associated with which cognitive abilities for which people? *Journals of Gerontology - Series B Psychological Sciences and Social Sciences, 72*(6), 1006–1016. https://doi.org/10.1093/geronb/gbv119

Lee, Y., & Jiang, Y. (2023). Examining sociocultural factors in widowhood and cognitive function among older Chinese immigrants: findings from the PINE study. *Aging and Mental Health, 27*(11), 2144–2152. https://doi.org/10.1080/13607863.2023.2205350

Liao, J., & Scholes, S. (2017). Association of social support and cognitive aging modified by sex and relationship type: A prospective investigation in the english longitudinal study of ageing. *American Journal of Epidemiology, 186*(7), 787–795. https://doi.org/10.1093/aje/kwx142

Liu, H., Zhang, Y., Burgard, S. A., & Needham, B. L. (2019). Marital status and cognitive impairment in the United States: evidence from the National Health and Aging Trends Study. *Annals of Epidemiology, 38*, 28–34.e2. https://doi.org/10.1016/j.annepidem.2019.08.007

Mogic, L., Rutter, E. C., Tyas, S. L., Maxwell, C. J., O'Connell, M. E., & Oremus, M. (2023). Functional social support and cognitive function in middle- and older-aged adults: a systematic review of cross-sectional and cohort studies. *Systematic Reviews, 12*(1), 86. https://doi.org/10.1186/s13643-023-02251-z

Mousavi-Nasab, S. M. H., Kormi-Nouri, R., Sundström, A., & Nilsson, L. G. (2012). The effects of marital status on episodic and semantic memory in healthy middle-aged and old individuals. *Scandinavian Journal of Psychology, 53*(1), 1–8. https://doi.org/10.1111/j.1467-9450.2011.00926.x

O'Connell, M. E., Tuokko, H., Kadlec, H., Griffith, L. E., Simard, M., Taler, V., Voll, S., Thompson, M. E., Panyavin, I., Wolfson, C., Kirkland, S., & Raina, P. (2019). Normative comparison standards for measures of cognition in the Canadian Longitudinal Study on Aging (CLSA): does applying sample weights make a difference? *Psychological Assessment, 31*(9), 1081–1091. https://doi.org/10.1037/pas0000730

Ohman, A., Maxwell, C. J., Tyas, S. L., & Oremus, M. (2023). Subtypes of social support availability are not differentially associated with memory: a cross-sectional analysis of the comprehensive cohort of the Canadian longitudinal study on aging. *Aging, Neuropsychology, and Cognition, 30*(3), 354–369. https://doi.org/10.1080/13825585.2022.2030294

Penning, M. J., & Wu, Z. (2014). Marital status, childlessness, and social support among older Canadians. *Canadian Journal on Aging, 33*(4), 426–447. https://doi.org/10.1017/S0714980814000385

Public Health Agency of Canada. (2017). *Dementia in CanADA, INCLUding AlzhEIMER'S DISease*. https://www.canada.ca/en/public-health/services/publications/diseases-conditions/dementia-highlights-canadian-chronic-disease-surveillance.html.

Raina, P., Wolfson, C., Kirkland, S., Griffith, L. E., Balion, C., Cossette, B., Dionne, I., Hofer, S., Hogan, D., van den Heuvel, E. R., Liu-Ambrose, T., Menec, V., Mugford, G., Patterson, C., Payette, H., Richards, B., Shannon, H., Sheets, D., Taler, V., … Young, L. (2019). Cohort profile: The Canadian longitudinal study on aging (CLSA). *International Journal of Epidemiology, 48*(6), 1752–1753j. https://doi.org/10.1093/ije/dyz173

Rey, A. (1964). *L'examen clinique en psychologie (The clinical psychological examination)*. Presses Universitaires de France.

Rimmer, A. (2016). BMA meeting: early dementia diagnosis is pointless without support services. *BMJ*, i3505. https://doi.org/10.1136/bmj.i3505

Robitaille, A., Orpana, H., & McIntosh, C. N. (2011). Psychometric properties, factorial structure, and measurement invariance of the english and French versions of the Medical Outcomes Study social support scale. *Health Reports, 22*(2), 33–40.

Robles, T. F. (2014). Marital quality and health: implications for marriage in the 21st century. *Current Directions in Psychological Science, 23*(6), 427–432. https://doi.org/10.1177/0963721414549043

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. John Wiley & Sons. https://doi.org/10.1002/9780470316696

Sarkisian, N., & Gerstel, N. (2016). Does singlehood isolate or integrate? Examining the link between marital status and ties to kin, friends, and neighbors. *Journal of Social and Personal Relationships, 33*(3), 361–384. https://doi.org/10.1177/0265407515597564

Scholes, S., & Liao, J. (2022). Social support, social strain and declines in verbal memory: sex-specific associations based on 16-year follow-up of the English longitudinal study of ageing cohort. *Aging and Mental Health*, 1–9. https://doi.org/10.1080/13607863.2022.2089628

Seeman, T. E., Miller-Martinez, D. M., Stein Merkin, S., Lachman, M. E., Tun, P. A., & Karlamangla, A. S. (2011). Histories of social engagement and adult cognition: midlife in the U.S. study. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 66*(Suppl 1), i141–i152. https://doi.org/10.1093/geronb/gbq091

Shapiro, A., & Keyes, C. L. M. (2008). Marital status and social well-being: are the married always better off? *Social Indicators Research, 88*(2), 329–346. https://doi.org/10.1007/s11205-007-9194-3

Sherbourne, C. D., & Stewart, A. L. (1991). The MOS social support survey. *Social Science & Medicine, 32*(6), 705–714. https://doi.org/10.1016/0277-9536(91)90150-b

Spiker, R. L. (2014). Mental health and marital status. *The wiley blackwell encyclopedia of health, illness, behavior, and society* (pp. 1485–1489). John Wiley & Sons Ltd. https://doi.org/10.1002/9781118410868.wbehibs256

Statistics Canada. (2010). *Canadian community health survey - HeALTHY AGIng (CCHS)*. https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5146&lang=en&db=imdb&adm=8&dis=2.

Tuokko, H., Griffith, L. E., Simard, M., & Taler, V. (2017). Cognitive measures in the Canadian longitudinal study on aging. *The Clinical Neuropsychologist, 31*(1), 233–250. https://doi.org/10.1080/13854046.2016.1254279

Umberson, D., & Montez, J. K. (2010). Social relationships and health: A flashpoint for health policy. *Journal of Health and Social Behavior, 51*(Suppl), S54–S66. https://doi.org/10.1177/0022146510383501

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2007). The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Epidemiology, 18*(6), 800–804. https://doi.org/10.1097/EDE.0b013e3181577654

Windsor, T. D., Gerstorf, D., Pearson, E., Ryan, L. H., & Anstey, K. J. (2014). Positive and negative social exchanges and cognitive aging in young-old adults: differential associations across family, friend, and spouse domains. *Psychology and Aging, 29*(1), 28–43. https://doi.org/10.1037/a0035256

Wyke, S., & Ford, G. (1992). Competing explanations for associations between marital status and health. *Social Science & Medicine, 34*(5), 523–532. https://doi.org/10.1016/0277-9536(92)90208-8

Yoo, S. S., Tyas, S. L., Maxwell, C. J., & Oremus, M. (2023). The association between functional social support and memory in middle-aged and older adults: A prospective analysis of the Canadian longitudinal study on aging's comprehensive cohort. *Archives of Gerontology and Geriatrics, 114*, Article 105076. https://doi.org/10.1016/j.archger.2023.105076

Zahodne, L. B., Ajrouch, K. J., Sharifian, N., & Antonucci, T. C. (2019). Social relations and age-related change in memory. *Psychology and Aging, 34*(6), 751–765. https://doi.org/10.1037/pag0000369

Zuelsdorff, M. L., Engelman, C. D., Friedman, E. M., Koscik, R. L., Jonaitis, E. M., Rue, A. La, & Sager, M. A (2013). Stressful events, social support, and cognitive function in middle-aged adults with a family history of Alzheimer's disease. *Journal of Aging and Health, 25*(6), 944–959. https://doi.org/10.1177/0898264313498416