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Reconciling subjective memory complaints with objective memory performance in the menopausal transition

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Abstract

Objective—The overall aim of this study was to examine the relationship between subjective memory complaints and objective cognitive performance in perimenopausal women. The specific aims were to determine: 1) if subjective complaints of memory problems relate to objective performance on memory tests, 2) if subjective complaints of memory problems relate to other domains of cognitive function and 3) if subjective memory complaints relate to other non-cognitive factors, such as depression, anxiety, and sleep quality.

Methods—Seventy-five perimenopausal women completed a comprehensive neuropsychological battery, which included measures of attention, working memory, verbal memory, verbal fluency, visuospatial skill, and fine motor dexterity, completed self-report inventories of their perceived memory and menopausal symptoms and provided serum levels of estradiol and follicle stimulating hormone.

Results—Memory complaints were not associated with verbal learning or verbal memory, but were associated with working memory and complex attention/vigilance. Memory complaints were also associated with symptoms of depression, anxiety, somatic complaints and sleep disturbance. Regression analyses revealed that memory complaints were best predicted by depressive symptoms, somatic complaints and working memory performance.

Conclusions—Memory complaints in the menopausal transition may reflect true difficulties with attentionally-mediated cognitive processes. Memory complaints may also be associated with other menopausal-related symptoms.

Keywords

Memory; perimenopause; cognition; estrogen; menopausal transition; subjective complaints

Introduction

The menopausal transition (MT) is often associated with subjective reports of cognitive deficits, particularly in memory^{1,2}. While reports vary, most studies suggest that between

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one-third to two-thirds of perimenopausal women report “forgetfulness”, “memory declines” and “concentration difficulties” during this time^{3,4}. In middle aged women, subjective memory complaints have been associated with stress³, anxiety⁵ and depressed mood^{3,5}, but their relationship with objective memory performance is not fully characterized. To date, few studies have sought to reconcile women’s self-report of memory declines with objective testing and other menopausal symptoms.

In a small study of 24 perimenopausal women, we found that subjective memory complaints were associated with immediate verbal memory as measured by Trial 1 of the Rey Auditory Verbal Learning Test (RAVLT), but not delayed verbal recall, as measured by Trial 7 of the RAVLT⁶. Subjective memory complaints were also associated with working memory performance (the ability to hold and manipulate small amounts of information, such as a phone number, in memory for short periods of time). Further, perimenopausal women with significant cognitive complaints performed worse than those with few complaints on tests of frontal lobe function, including attention, working memory, encoding, and phonemic verbal fluency. In a subsequent study of 120 pre-, peri- and post-menopausal women, Schaafsma, et al (2009) report similar findings. They found that subjective cognitive complaints in their sample were associated with verbal memory and attentional deficits⁷.

A biological model for these putative cognitive deficits posits that changing levels of estrogen during the MT lead to cognitive declines. Estrogen receptors are found in brain regions responsible for verbal memory, working memory and retrieval, including the hippocampal formation and frontal lobes⁸. Estrogen promotes neuronal growth and survival⁹, and acts on the cholinergic system, which is closely linked to cognitive functioning, particularly memory¹⁰. Several studies suggest that cognitive function supported by the prefrontal cortex may be particularly sensitive to estrogen.^{11–14}

The overall aim of the present study was to replicate our prior findings in a larger sample. The first aim was to determine if subjective complaints of memory problems relate to objective performance on memory tests. We hypothesized that memory complaints would be associated with immediate, but not delayed verbal memory. The second aim was to determine if subjective complaints of memory problems are related to other domains of cognitive function. We hypothesized that memory complaints would also be associated with tests of attention, working memory and executive function, but not with tests of visuospatial function. The third aim was to determine if subjective memory complaints relate to other non-cognitive factors, such as depression, anxiety, and sleep quality. We hypothesized that subjective memory complaints would be associated with depression, anxiety and sleep disturbance, but that the relationship between complaints and objective cognitive performance would remain after controlling for these variables. A final aim was to determine if serum estradiol and follicle stimulating hormone levels were associated with subjective memory complaints or cognitive performance. We hypothesized that estradiol would be significantly related to performance on tasks of attention and verbal memory.

Methods

Data for this study were collected in two waves. Participants in Wave I were enrolled from January 2005 to December 2006 and participants in Wave II were enrolled between April 2007 and December 2009. Women in both waves were recruited to participate in a study of memory in perimenopause. Twenty-four women participated in Wave I, and their data has been reported previously⁶. Fourteen of the 24 women continued their participation and an additional 51 women were recruited in Wave II, yielding a total sample of 75 women. The data for the entire sample is presented here (24 at Wave I, 51 at Wave II).

Subjects

Participants were recruited through advertisements placed in local newspapers, recruitment posters displayed at local obstetrics/gynecology and primary care clinics affiliated with Strong Memorial Hospital, and recruitment posters placed throughout the University of Rochester Medical Center. The advertisements and posters described a study of memory in perimenopause, but did not specifically target women with memory complaints. Inclusion criteria were: (a) ages 40 to 60; (b) reports of changes in menstrual cycles; and (c) reports of at least one menstrual period in the prior 12 months; and (d) intact uterus. Exclusion criteria were: (a) history of neurological disease; (b) history of psychiatric illness; (c) surgical menopause; and (d) use of exogenous hormone preparations affecting ovarian or pituitary function in the prior three months. All participants gave written informed consent. Our study was approved by the University of Rochester Research Subjects Review Board. Participants in Wave II received \$20 for time and travel and free parking.

Measures

Each participant completed a cognitive battery and self-report questionnaires assessing depression, anxiety, general health, quality of life and memory function.

Cognitive Battery—*Premorbid Intellectual Function.* We estimated premorbid intelligence using a demographically based index that accounts for age, sex, race, education, occupation, and geographic residence.¹⁵ ***Attention.*** We assessed basic attention using the Digit Span (DS) subtest of the Wechsler Memory Scales – III (WMS-III).¹⁶ Participants were asked to repeat increasingly longer strings of digits, first in the order in which the digits were presented (e.g., Forward) and then in reverse order (i.e., Backward). The dependent measure was the total number of correct trials. We assessed vigilance/complex attention using the D2 Test of Attention.¹⁷ Participants were asked to search for targets (a lower case *d* with two dots above or below it) in an array of foils (a lower case *d* with more than 2 or fewer than 2 dots, or a lower case *p* with any number of dots above or below it) over repeated timed trials. The dependent measure was the total number of items completed minus errors (D2TN-E). ***Working Memory.*** We assessed working memory using the Letter-Number Sequencing (LNS) subtest of the WMS-III.¹⁶ Participants were presented with increasingly longer series of digits and letters, which they had to sequence in a specified order (i.e., alphabetical or numerical). Total score was based on the total number of series correctly sequenced. ***Verbal Fluency.*** We assessed verbal fluency using the Controlled Oral Word Association Test.¹⁸ Participants were asked to name as many words as possible beginning with a specified letter (phonemic), and fitting a specific category (semantic) in one minute. In this study, the letters *FAS* and the category *animals* were used. The dependent measure was the total number of words generated for each task. ***Motor.*** We assessed fine motor skills and dexterity using the Grooved Pegboard Test (GP).¹⁹ Participants were asked to place grooved pegs in a pegboard as fast as possible. The dependent measure was the time taken to correctly place all of the pegs. ***Visuospatial.*** We assessed visuospatial skill using the Hooper Visual Organization Test (HVOT).²⁰ Participants were asked to identify an object that had been cut into pieces and rearranged. The dependent measure was the total number of correctly identified objects. ***Memory.*** We assessed verbal learning and memory using the Rey Auditory Verbal Learning Test (RAVLT).²¹ Participants were read a list of 15 words on each of 5 trials. They were then read a second list of 15 different words (interference). Recall of the first (repeated) list was assessed following a short delay (i.e., immediately after the interference trial) and again after a 30-minute delay. A forced choice recognition test followed. The dependent measures were total words correctly recalled from Trial 1 (immediate memory), total words correctly recalled across the five trials (total learning), and total words correctly recalled from Trial 7 (delayed memory).

Subjective Memory Function

We assessed participants' experience of memory function using the Memory Functioning Questionnaire.²² Participants rated their memory problems in everyday life across 64-items assessing on 7-point Likert scales, with higher values indicating a more positive assessment. There are four factor scores: Frequency of Forgetting (ratings of how often forgetting occurs in 28 specific situations and 5 rating of one's memory performance in general), Seriousness of Forgetting (ratings of memory failures in 18 situations), Retrospective Functioning (ratings of change in current memory ability relative to 5 points earlier in life) and Mnemonics Usage (ratings of the frequency with which 8 specific memory aids are used). The score for each factor is the total score divided by the total number of items completed. We also obtained a total score by summing the total score divided by the total number of items completed for the entire questionnaire.

Other self-report inventories

Depression. On the Beck Depression Inventory-II (BDI-II),²³ participants rated the intensity of their experience of 21 symptoms of depression over the past 2 weeks using a four-point scale for each item. Each of the 21 items is summed to give a total score. A total score of 0–13 is considered minimal depression, 14–19 is considered mild, 20–28 is considered moderate, and 29–63 is considered severe. Higher total scores indicate more severe depression. *Anxiety.* On the Beck Anxiety Inventory,²⁴ participants rated their experience of 21 subjective, somatic, or panic-related symptoms of anxiety on a four-point scale with the following points: “Not at all” (0 points); “Mildly; it did not bother me much” (1); “Moderately; it was very unpleasant, but I could stand it” (2); and “Severely; I could barely stand it” (3). The items are summed to obtain a total score. Total score of 0–7 is considered minimal anxiety, 8–15 is considered mild, 16–25 is considered moderate, and 26–63 is considered severe. Higher total scores indicate more anxiety. *Overall Health.* On the Women's Health Questionnaire,²⁵ participants rated their experience of 36 problems across nine domains of physical and emotional health over the past few days. Each item is scored on a one-point scale, with responses of, “Yes, definitely” or “Yes, sometimes” earning 1 point, and “No, not much” or “No, not at all” earning 0 points. The dependent measures were scores on the following subscales: a) somatic symptoms; b) vasomotor symptoms; c) sexual behavior; d) sleep problems; e) menstrual symptoms; and f) attractiveness. The score for each subscale is the total score divided by the total number of items completed, with a maximum score of one. Raw scores on each subscale were converted to T-scores according to published norms.²⁵ Higher T-scores indicate fewer symptoms. We did not utilize the depressed mood, anxiety/fears, or memory/concentration subscales, as these were measured by stand-alone questionnaires as detailed above.

Hormone Levels

Serum estradiol (E₂) and follicle stimulating hormone (FSH) levels were collected on the day of the cognitive testing. Women who were experiencing monthly periods were examined in the early or mid-follicular phase of their cycles (cycle days 4–7). Assays were performed by the General Clinical Research Center at the University of Rochester Medical Center. Total E₂ and FSH were assessed by competitive immunoassay using direct chemiluminescent technology (Advia-Centaur System, Bayer Diagnostics, Tarrytown, NY, USA). The Estradiol-6 serum assay has a sensitivity and assay range of 10–1000 pg/mL (36.7–3670 pmol/L). The FSH serum assay has a sensitivity and assay range of 0.3 – 200 mIU/mL (IU/L).

Statistical analyses

Cognitive Test Performance—To determine rates of objective impairment on cognitive tests, raw scores on the cognitive tests were converted to age-, and where available, education- corrected T-scores (mean = 50, SD = 10) according to published normative data. Normative data was obtained from the test manual where available (WAIS-III, D2 Test of Attention, HVOT, RAVLT)^{16,17,20,21} and other accepted sources when no manual was available^{26,27}. Impaired scores were defined as a T-score of ≤ 30 (i.e., two standard deviations below the mean), Borderline Impaired scores were defined as a T-score of ≤ 36 (i.e., one and a half standard deviation below the mean).

Statistical Analysis—All statistical analyses were carried out using SPSS 18. Correlational analyses (Pearson's product moment) were conducted to determine the linear relationships between memory complaints, and memory performance, non-memory cognitive functions, menopausal symptoms, and hormone levels. Stepwise linear regression was conducted to determine the independent contributors to memory complaints. Factors significantly correlated with the dependent variables in initial analyses were included as independent variables. Criteria for inclusion and exclusion in the model were $p < .05$ and $p > 0.1$, respectively.

Results

Cohort Characteristics

Demographic information, hormone levels, memory complaints, and menopausal symptoms are reported in Table 1. Cognitive performance is reported in Table 2. Participants ranged in age from 40 to 60 years (mean age = 49.3) and all obtained at least 12 years of education. Ninety-one percent were white, 5% African American, and 3% Asian. Three percent of the sample described their ethnicity as Hispanic.

Memory Complaints and Objective Performance

Sixty-seven percent of the women ($n = 50$) reported some degree of memory loss (MFQ Retrospective Functioning < 3) and 41% ($n = 31$) reported forgetting to be at least moderately serious (MFQ Seriousness of Forgetting < 4). When objective performance was examined, 13% of the sample ($n=10$) performed in the Borderline Impaired to Impaired range on at least one verbal memory measure (Trial 1, learning across trials, or Trial 7 of the RAVLT). In contrast, the Barona IQ scores of these participants were Average to Above Average (range: 101–118). Nearly one-quarter ($N= 17$) of the sample endorsed symptoms of mild to moderate depression on the BDI, and one subject scored in the severe range. Twenty percent ($N=2$) of the participants who demonstrated verbal memory deficits discussed above endorsed symptoms of mild to moderate depression.

Raw Correlations

There was no significant correlation between memory complaints, as assessed by the MFQ total and MFQ subscales, and performance on measures of verbal learning or verbal memory. However, when we examined other cognitive function, we found that memory complaints, as assessed by the MFQ Total, Frequency of Forgetting and Seriousness of Forgetting subscales, were associated with poorer performance on the working memory task. Memory complaints, as assessed by the MFQ Frequency of Forgetting subscale, were also associated with poorer performance on the complex attention/vigilance task. Memory complaints, as assessed by the MFQ Retrospective Functioning and Mnemonic Usage subscales, were unrelated to cognitive function.

Memory complaints, as assessed by the MFQ Total and Frequency of Forgetting subscale were associated with greater symptoms of depression and anxiety, somatic complaints, sleep problems, sexual problems and decreased feelings of attractiveness. Memory complaints, as assessed by the MFQ Seriousness of Forgetting subscale, were associated with greater symptoms of depression and somatic complaints. Memory complaints, as assessed by the Retrospective Functioning subscale, were associated with greater symptoms of depression and anxiety, somatic complaints, sleep problems and decreased feelings of attractiveness. MFQ Mnemonics Usage was associated with greater symptoms of depression and anxiety, somatic complaints, and increased hot flashes. See Table 3.

Memory complaints and memory performance were unrelated to hormone levels. FSH was significantly negatively correlated with vasomotor symptoms and significantly positively correlated with menstrual symptoms (WHQ vasomotor subscale, $r = -.27$, $p = .019$, WHQ menstrual subscale, $r = .31$, $p = .008$). FSH levels were not significantly correlated with any cognitive variable. Estradiol was significantly positively correlated with fine motor speed and dexterity (Grooved Pegboard, $r = .23$, $p = .045$), and significantly negatively correlated with menstrual symptoms (WHQ menstrual subscale, $r = -.33$, $p = .004$). Estradiol was not significantly correlated with any other cognitive or non-cognitive variable.

Contributions to Memory Complaints

To determine the relative contribution of these menopausal variables to memory complaints and objective cognitive performance, five stepwise linear regressions were performed. The MFQ total and each MFQ subscale were the dependent variables, and the cognitive and non-cognitive variables factors significantly correlated with the MFQ were the independent variables. MFQ Total score was best accounted for by depressive symptoms, somatic complaints and working memory. MFQ Frequency of Forgetting was best accounted for by depressive symptoms, sleep disturbance and attention/vigilance. MFQ Seriousness of Forgetting and Retrospective Functioning were best accounted for by depressive symptoms. MFQ Mnemonics Usage was best accounted for by somatic complaints. See Table 4.

Discussion

The aims of this study were to determine if women's self-report of memory problems during perimenopause were substantiated on objective memory tests or related to other domains of cognitive function and to determine the impact of menopause-related variables such as hormone levels, mood, vasomotor symptoms, somatic complaints and sleep quality on memory complaints. We found that memory complaints were not associated with measures of verbal memory, but were associated with worse performance on measures of working memory and complex attention/vigilance. Memory complaints were also associated with increased symptoms of depression, somatic complaints and sleep disturbance.

As expected, there was a high prevalence of subjective memory complaints, with two-thirds of our sample reporting a decline in memory function over time. This is similar to the 62% of women reporting changes in their memory in the Seattle Midlife Women's Health Study³. The prevalence of objective deficits was comparatively small, but nonetheless significant, with 13% of the sample showing deficits on some aspect of verbal memory performance (immediate recall, total learning or delayed recall). It is important to note that the normative data for the verbal memory measures are age, but not education, corrected. Thus, although 8% of the population would be expected to perform 1.5 to 2 standard deviations below the mean on any cognitive test, given the high education of this sample, we might expect a much smaller percentage to score in this range (Borderline Impaired to Impaired). Further, the Barona IQ scores of these memory impaired women suggest Average to High Average premorbid intelligence. Performance on cognitive tests is expected to be in the same range as

estimate premorbid IQ. Thus, it could be interpreted that these low scores on verbal memory measures represents a true decline in function. This raises important questions regarding possible risk factors for objective cognitive deficits in the menopausal transition. It is possible that for some women, the menopausal transition is characterized by more significant memory deficits that may or may not ameliorate post-menopause.

Contrary to expectation, memory complaints were not associated with objective verbal memory performance, either in the encoding or storage stage. When we examined other non-mnemonic cognitive functions, however, we found an association between perceived memory and objective performance on measures of working memory and complex attention/vigilance. Poorer performance on both working memory and attention/vigilance tasks independently predicted memory complaints. These data are consistent with the two prior studies comparing subjective and objective cognitive function in perimenopause^{6,7}, and suggest that memory complaints may not be unfounded, but rather reflect declines or deficits in other related areas of cognitive functioning. Working memory can be differentiated from episodic memory both functionally and by its anatomic substrate. Working memory, which requires the simultaneous storage and processing of information for a very restricted period of time, is a predominantly attentional function dependent on frontal and parietal brain regions. Episodic memory, which involves encoding, consolidating and storing information, is dependent on the limbic system, and the hippocampus in particular.

Although memory complaints were not associated with objective verbal memory performance, they were associated with symptoms of depression, somatic complaints and sleep disturbance. This is consistent with our earlier report, as well as larger epidemiologic studies demonstrating an association between poorer perceived health, increased depression, and poorer perceived memory function in midlife women². One possible interpretation of this finding is that women's frequent anecdotal reports of cognitive difficulties during this time reflect psychological or psychosocial stressors, rather than true cognitive declines. In this study, the relationship between memory complaints and depressive symptoms was quite strong. However, we found that poorer working memory performance was also a significant independent predictor of total memory complaints, suggesting a true cognitive component as well.

Increased use of mnemonics was the only form of memory complaints associated with vasomotor symptoms. This is generally consistent with our prior report, in which we found no relationship between memory complaints and hot flashes. This is also consistent with data from the Study of Women's Health Across the Nation (SWAN) showing no relationship between hot flashes and cognitive impairment in a sample of 1903 women²⁸. The SWAN nonetheless reported cognitive changes across the menopausal transition that resolved during the postmenopausal period, suggesting that cognitive changes are separable from other menopausal-related symptoms. Maki and colleagues report an interesting finding that in highly symptomatic midlife women, verbal memory performance is associated with objectively measured, but not subjectively reported, hot flashes²⁹. This suggests a discrepancy between women's perception of vasomotor symptoms and their actual physiological experience, as well as the possibility that physiological rather than psychological correlates of hot flashes are related to menopausal memory disturbance. As we only measured only subjective report, the lack of an association in this study is not surprising. Nevertheless, our data suggests that it is not just symptomatic women who experience cognitive changes, and that not all menopausal symptoms are interrelated.

We also found that the relationships among perceived memory function, objective cognitive performance and other relevant factors varied depending on the types of memory questions posed. For instance, The Frequency of Forgetting and Retrospective Functioning subscales

of the MFQ were related to anxiety symptoms, but the other scales were not, and the Frequency of Forgetting, Seriousness of Forgetting and Total subscales were related to cognitive function while the Retrospective Functioning and Mnemonics Usage subscales were not. Similarly, in the Seattle Midlife Women's Health Study², perceived health and antidepressant use were the best predictors of current memory ratings, health was the best predictor of remembering past events, and depression was the best predictor of frequency of forgetting and seriousness of forgetting. This suggests that "memory complaints" is not a unitary entity, and the cause of such complaints and objective basis of such complaints may differ depending on the specific type of complaint.

We did not find a relationship between hormone levels and subjective memory complaints or objective memory performance. This is consistent with our prior report, another study of endogenous hormones and cognition in midlife women³⁰, and two large-scale epidemiologic studies: the Study SWAN³¹ and the Melbourne Women's Midlife Health Project (MWMHP)³². One possible interpretation is that there is no relationship between endogenous hormone levels and verbal episodic memory. However, this lack of an association may also be due to the methodological limitations of measuring hormones. All of these studies assessed hormone levels at one point in time, which does not reflect life-long, cumulative exposures. Further, this study measured total serum estradiol. It has been suggested the free and bioavailable forms may be stronger correlates of cognition, as they cross the blood-brain barrier more readily.³³ Finally, there is some suggestion that menopausal-related symptoms are due to hormonal fluctuations³⁴, rather than a linear decline in estradiol. It is possible that the relationship to cognition is similar. As this study did not measure fluctuations, it is possible that we missed a true hormonal effect.

Since the current study was cross-sectional, we were unable to compare women to their pre-menopausal stage. It is possible that subjective complaints reflect actual, but subtle declines from pre-menopausal levels, resulting in still intact cognitive performance. For instance, a woman who is of superior or high average intelligence who performs in the low average range on a cognitive measure may indeed be experiencing a *relative* decline from her baseline, but would still be considered to have performed *within normal limits*. Given the high educational attainment of this sample, it is quite possible that we have underestimated the true prevalence of cognitive impairment, if impairment is defined as a significant decline from prior functioning. Two of the prior longitudinal studies of perimenopausal women demonstrated cognitive declines as a failure to improve on repeated administration of cognitive measures, rather than a decline from prior performance^{27,28}. This suggests that menopause related cognitive declines are quite subtle, but nonetheless, significant. Another limitation is that the present sample was composed of high functioning, highly educated, predominantly white women. It remains to be seen if these results are generalizable to other groups, or the population at large.

Conclusions

Memory complaints in the menopausal transition may reflect true difficulties with attentionally-mediated cognitive processes, in particular complex attention and working memory. Memory complaints during the transition are also strongly associated with depression, somatic complaints and sleep disturbance, but these psychological stressors are not the sole contributor to perceived memory function.

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Table 1

Characteristics of Sample

	M±SD (n=75)	Possible range
Age, y	49.3 ± 4.3	
Education, y	16.0 ± 2.3	
Barona IQ	113.3 ± 5.1	
Estradiol, pmol/L	79.1 ± 119.8	
FSH, mIU/mL	33.5 ± 34.8	
Beck Depression Inventory	9.1 ± 6.9	0–63
Beck Anxiety Inventory	6.9 ± 6.2	0–63
Memory Functioning *		
Retrospective Functioning	2.8 ± 1.0	0–7
Seriousness of Forgetting	4.5 ± 1.3	0–7
Frequency of Forgetting	5.0 ± .96	0–7
Mneumonics Usage	2.7 ± 1.1	0–7
Total	4.4 ± .83	0–7
Women's Health Questionnaire **		
Somatic	49.0 ± 10.7	20–72
Vasomotor	49.7 ± 10.9	20–72
Sexual Behavior	49.1 ± 10.9	20–72
Sleep problems	48.7 ± 10.3	20–72
Menstrual Symptoms	50.7 ± 7.9	20–72
Attractiveness	47.0 ± 13.4	20–72

* Lower values indicate more complaints.

** T-scores (Higher values represent fewer symptoms)

Table 2

Cognitive performance of sample

Test	M±SD (n=75)	
	T-score *	Raw-score
Rey Auditory Verbal Learning		
Trial 1 (Immediate Memory)	51.9 ± 9.5	6.7 ± 1.5
Total learning	51.4 ± 8.4	50.4 ± 6.8
Trial 7 (Delayed Memory)	50.4 ± 8.3	10.1 ± 2.5
WAIS-III		
Digit Span	55.1 ± 8.9	19.0 ± 3.9
Letter-Number Sequencing	54.8 ± 7.7	11.5 ± 2.2
D2 Test of Attention	58.6 ± 7.1	442.3 ± 78.0
Controlled Oral Word Association	47.5 ± 9.3	41.6 ± 10.5
Animal Naming	52.4 ± 9.2	22.9 ± 4.8
Grooved Pegboard	48.0 ± 10.3	64.3 ± 8.6
Hooper Visual Organization	50.0 ± 5.7	26.2 ± 2.6

* Higher values represent better performance.

Table 3
Correlation Matrix between memory complaints, cognitive performance, and non-cognitive factors.

	DS [†]	LNS [†]	HT [†]	D2 [†]	GP [†]	A1 [†]	TOT [†]	A7 [†]	FAS [†]	AN [†]	Som ^{††}	Vas ^{††}	Sex ^{††}	Slp ^{††}	Men ^{††}	Attr ^{††}	BDI ^{††}	BAI ^{††}
MFQTot^{†††}																		
<i>r</i>	-.010	.280 [*]	.143	.184	.166	.139	.004	.046	.095	-.015	.449 ^{**}	.118	.269 [*]	.312 ^{**}	.207	.281 [*]	-.529 ^{**}	-.334 ^{**}
p-value	.933	.015	.220	.113	.154	.235	.971	.693	.418	.899	<.001	.314	.020	.006	.075	.015	<.001	.003
MFQFof^{†††}																		
<i>r</i>	-.021	.233 [*]	.121	.258 [*]	.199	.036	.024	.090	.039	-.017	.347 ^{**}	.099	.285 [*]	.383 ^{**}	.197	.279 [*]	-.406 ^{**}	-.251 [*]
p-value	.859	.044	.302	.025	.087	.761	.840	.442	.740	.885	.002	.398	.013	.001	.091	.015	<.001	.030
MFQSoF^{†††}																		
<i>r</i>	.036	.258 [*]	.129	.144	.125	.172	-.006	-.046	.146	.047	.287 [*]	.005	.171	.041	.139	.193	-.383 ^{**}	-.200
p-value	.761	.025	.271	.217	.284	.141	.962	.693	.211	.688	.013	.967	.143	.728	.235	.098	.001	.085
MFQRt^{†††}																		
<i>r</i>	-.052	.064	-.099	-.200	-.099	.170	.029	.077	-.075	.000	.347 ^{**}	.162	.098	.268 [*]	-.085	.308 ^{**}	-.438 ^{**}	-.330 ^{**}
p-value	.659	.585	.397	.086	.399	.145	.807	.512	.521	.998	.002	.166	.404	.020	.466	.007	<.001	.004
MFQMu^{†††}																		
<i>r</i>	-.126	.032	-.016	-.148	.031	-.017	-.096	.005	-.036	-.218	.329 ^{**}	.228 [*]	.100	.186	.137	-.016	-.257 [*]	-.231 [*]
p-value	.281	.783	.892	.205	.789	.882	.410	.966	.756	.060	.004	.049	.394	.109	.240	.891	.026	.046

* P<.05,

** P<.01,

[†] Higher scores represent better performance,

^{††} Higher scores represent more symptoms,

^{†††} Lower scores represent more complaints

DS-Digit Span, LNS-Letter-Number Sequencing, HT-Hooper Visual Organization Test, D2-D2 Test of Attention, A1-RAVLT Trial 1, TOT-RAVLT total Learning Across Trials, A7-RAVLT Trial 7, FAS-COWA, AN-Animal Naming, Som-WHQ Somatic Subscale, VAS-WHQ Vasomotor Subscale, Sex-WHQ Sexual Subscale, SLP-WHQ Sleep Subscale, Men-WHQ Menstrual subscale, ATR-WHQ Attractiveness subscale, BDI-Beck Depression Inventory, BAI-Beck Anxiety Inventory.

Table 4

Results of stepwise linear regressions examining contributions to memory complaints.

Primary outcome	Predictors	95% CI	R ²	P
Memory Functioning Questionnaire subscale				
Total			.36	<.001
	Beck Depression Inventory	-.37	-.071 to -.018	
	WHQ Somatic	.24	.001 to .035	
	Letter-Number Sequencing	.20	.001 to .042	
Frequency of Forgetting			.29	<.001
	Beck Depression Inventory	-.27	-.068 to -.007	
	D2 Test of Attention	.27	.009 to .063	
	WHQ Sleep	.28	.005 to .047	
Seriousness of Forgetting			.15	.001
	Beck Depression Inventory	-.38	-.113 to -.032	
Retrospective Functioning			.19	<.001
	Beck Depression Inventory	-.44	-.094 to -.033	
Mnemonics Usage			.11	.004
	WHQ Somatic	.33	.011 to .058	