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Memory beliefs and function in fibromyalgia patients

Jennifer M. Glass[a,b,*], Denise C. Park[c], Meredith Minear[d], Leslie J. Crofford[e]

[a]Institute for Social Research, University of Michigan, 426 Thompson Street, Ann Arbor, MI 48106, United States
[b]Department of Psychiatry, University of Michigan, 426 Thompson Street, Ann Arbor, MI 48106, United States
[c]Beckman Institute, University of Illinois, United States
[d]Department of Psychology, University of Michigan, 426 Thompson Street, Ann Arbor, MI 48106, United States
[e]Department of Internal Medicine, University of Michigan, 426 Thompson Street, Ann Arbor, MI 48106, United States

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Abstract

Objective: The aim of this study was to investigate memory beliefs and their relationship to actual memory function in fibromyalgia (FM) patients. **Methods:** Twenty-three FM patients, 23 age- and education-matched controls, and 22 older controls completed the Metamemory in Adulthood (MIA) questionnaire, which assessed beliefs about seven aspects of memory function. Group differences on the seven scales were assessed, and scores on the capacity scale were correlated with objective memory performance. **Results:** FM patients reported lower memory capacity and more memory deterioration than did either control group. Patients reported lower control or self-efficacy over memory, higher achievement motivation, higher strategy use, and higher anxiety about memory than age-matched controls did. Among the patients, perceived capacity, achievement motivation, and self-efficacy were significantly correlated with objective memory performance on a recall task. **Conclusion:** FM patients' complaints about memory function have some accuracy.

Keywords: Fibromyalgia; Memory

Introduction

Fibromyalgia (FM) is a disorder characterized by widespread musculoskeletal pain and tender points [1], as well as fatigue, sleep disturbance, and neuropsychological complaints. FM patients often report that cognitive function and mental alertness have declined [2], and many patients state that cognitive dysfunction is a more disturbing and disabling symptom than pain is. A decline in memory ability is frequently cited as one of the cognitive symptoms experienced by FM patients. Consistent with this complaint, a limited number of studies of cognitive function in FM suggest that FM patients may exhibit impaired long-term and working memories (i.e., a person's online processing capacity; [3–7]). We demonstrated that memory in FM patients was impaired compared with age-matched controls and was, in fact, similar to the memory function of controls who were 20 years older than the patients [3]. Because memory function was age inappropriate rather than the result of the normal aging process, we reasoned that beliefs about deficient memory function may be more closely related to memory performance in FM patients than in older controls. We found that, in FM patients, the number of failures in everyday cognitive tasks ([2]; such as dialing a telephone, shopping without a list, etc.) was significantly correlated to their performance on objective memory tasks. This suggests that FM patients may have an accurate, subjective view of their memory function. However, Grace et al. [4] reported more equivocal results. They found that, among their FM patients, reports of subjective memory function were not significantly correlated with objective memory function.

Mixed findings concerning the correlation of subjective memory reports to objective memory complaints are not uncommon [8,9]. Hertzog et al. [9] argued that subjective memory reports will be accurate if the subjective question-

* Corresponding author. Institute for Social Research, University of Michigan, 426 Thompson Street, Ann Arbor, MI 48106, United States. Tel.: +1 734 763 1512; fax: +1 734 764 3576.
E-mail address: jglass@umich.edu (J.M. Glass).

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naire assesses specific behaviors rather than general impressions of memory ability. Because everyday memory performance takes place within a specific context and with specific goals in mind, subjective memory assessment is more accurate when specific behaviors are queried, such as remembering to take medications. We therefore chose a well-characterized questionnaire that used specific instances to assess subjective memory performance, the Metamemory in Adulthood (MIA) questionnaire [10]. Metamemory has been a significant part of memory research since the 1970s [11,12] and refers to the ability to self-reflect on one's own memory function, as well as more general knowledge of how memory works. This instrument contains seven scales that provide an index of several aspects of memory beliefs.

Recognizing the multifaceted nature of metamemory is important for understanding how it might affect remembering [11–14], particularly in disorders like FM, where performance on objective memory tasks is compromised. In normal memory function, an awareness of fallibility in memory can lead to awareness of strategies to improve memory function. In addition, general knowledge of how memory works will influence the strategies that a person is likely to use to bolster memory performance. The function of metamemory in FM patients might differ from that of healthy controls in several important ways. For instance, a person who has knowledge of memory strategies may fail to make effective use of the strategies if they have low self-efficacy. This is particularly important in real-world situations where metamemory is part of the cognitive "equipment" that a person brings to bear for solving everyday issues. By using the MIA questionnaire, we were able to test our main hypothesis that FM patients who self-report lower memory capacity would also perform more poorly on an objective memory test. Beliefs about deficient memory function may be more closely related to memory performance in FM patients than in older controls because the memory function of FM patients is not normal for their age [3]. We were also able to examine secondary hypotheses concerning the associations of strategy, self-efficacy, and motivation with FM patients' objective memory performance.

Three groups completed the MIA: FM patients, age- and education-matched healthy controls, and older controls. The older controls were education matched to the FM patients but were 20 years older. The MIA scales were correlated with FM patients' performance on an objective memory test. The results of this objective recall test have been previously published [3] but are also summarized here. This study is the first to correlate objective memory function in FM patients with memory beliefs using the MIA questionnaire.

Methods

Participants

There were three different groups of participants: 23 FM patients, 23 healthy age-matched controls, and 22 older adults. Exclusionary criteria for all participants included the following: regular use of tobacco, recreational drug use, a history of CNS disease or brain injury, education less than 10th grade, and evidence of a current psychiatric illness. The FM patients were 23 women recruited from the Rheumatology Clinic at the University of Michigan who met the American College of Rheumatology (ACR) classification criteria for FM. The patients did not have any other rheumatic diseases or significant health conditions. All patients underwent structured clinical interviews for the diagnosis of DSM disorders (SCID-IV), and patients with current major depressive disorder or other major Axis I diagnoses were excluded. Prior to testing, patients discontinued all psychoactive medications for 2 weeks, with the exception of stable doses of SSRIs used for the treatment of FM symptoms since these agents do not inhibit cognitive functioning [17]. Approximately 80 FM patients were either excluded or declined participation in the study. The most common exclusions were the following: current depression or anxiety disorder, current smoker, or regular use of steroids. Patients chose not to participate most frequently because they were unwilling to discontinue analgesic medications or because it was too difficult to travel to the test site or get time off of work. Thus, the FM patients that we tested were a relatively healthy sample of patients. We assume that this sampling bias will tend to underestimate differences between the FM patients and the controls. The second group of participants consisted of 23 female volunteers recruited from the community and matched to the FM patients on age and education. The third group of participants consisted of 22 women matched to the FM patients on age plus 20 years and on education. One FM patient did not have a matched older control due to the older participant's failure to complete all of the items in the MIA questionnaire. None of the control participants in either age group were taking psychoactive medication. Each control participant was individually matched to an FM patient for age (or age plus 20 years), plus or minus 3 years, and education. All participants signed informed consent forms approved by the University of Michigan Institutional Review Board. The age and education of the three groups of participants are displayed in Table 1.

The MIA questionnaire

The MIA consists of 108 items that query participants about different aspects of memory beliefs and yields scores for seven different scales (see Table 2), including knowledge about memory, tendency to use effective strategies, perceived capacity, change in capacity, anxiety about memory performance, motivation to have a "good" memory, and self-efficacy or control over memory function. Individual items were rated on a five-point Likert scale where participants indicated their agreement with statements about memory. Older adults typically report lower memory capacity, less stability (i.e., decreasing capacity), and lower self-efficacy

Table 1
Demographic characteristics of the sample

	FM (n=23)	Age-matched controls (n=23)	Older controls[a] (n=22)
Age	47.83	47.83	66.91
Education	14.34	14.39	14.50
Married (%)	75	41	52
Divorced (%)	07	28	13
Single (%)	18	31	09
Widowed (%)	00	00	26
Employed[b] (%)	57	79	19
Retired (%)	03	03	68
Leave of absence (%)	18	00	00
Homemaker (%)	11	08	13
Receiving disability (%)	11	00	00

[a] Each older control was 20 (±3) years older than her matched FM patient. All participants were female. FM patients discontinued medication (except SSRIs) to participate, with a 2-week washout period.
[b] Full or part time.

over memory than young adults did [10,12]. The psychometric properties of the MIA have been studied extensively, demonstrating good internal consistency and convergent validity with other metamemory instruments [10].

The MIA was administered as part of a large battery of questionnaires and cognitive tests. Further details about the method and results of the cognitive testing have been previously reported [3]. The patients and controls were all tested in the afternoon, between 1 and 5 p.m. Each person first filled out several questionnaires, including the MIA. Six domains of cognitive function were then tested: speed of information processing, working memory capacity, long-term recall, recognition memory, verbal fluency, and vocabulary. To measure the relationship between actual memory performance and the MIA scales, we focus on the long-term recall task (free recall), described below. This task provides an index of memory in a fairly demanding task and is most closely related to the recollection of past events or things to do that is assessed in the MIA.

Free recall

Free recall is a measure of long-term memory and the ability to actively retrieve past events. A list of items is presented for memorization, and then recall is tested. In free recall, participants may recall the items in any order. This method of testing memory has been used in psychology for decades and is sensitive to age-related changes in memory. Older adults recall fewer items than young adults do in this memory paradigm [3,15,16]. Free recall involves all of the major components that are important for successful memory performance: encoding the material, storing the material, and retrieving the material [15,16]. We tested free recall using three different 16-word lists of common concrete nouns. The words in each list were not semantically related. The lists were matched for frequency of occurrence in the English language. Participants were instructed ahead of time that they would be asked to recall the word lists. For each list, participants studied the 16 words one at a time on a computer screen. Each word appeared for 5 s. The participants were instructed to study the words and try to remember them. At the end of the list, the word “recall” appeared on the screen. This prompted the participants to write down as many words as they could remember, in any order, on their answer sheets. The score was the number of words correctly recalled, summed over the three lists. Information about specific strategies that the participants may have used to remember the words was not obtained.

Table 3
Metamemory in adulthood scores for each scale, across group

	FM	Age-matched controls	Older controls
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)
	(n=23)	(n=23)	(n=22)
Strategy	68.65 (6.7)	62.83* (8.6)	68.26 (6.6)
Knowledge	61.52 (5.0)	63.04 (9.0)	62.63 (5.9)
Capacity	43.78 (9.7)	57.65** (11.2)	55.84** (6.0)
Stability	43.56 (10.2)	56.52** (11.9)	50.00* (12.0)
Anxiety	48.78 (10.0)	39.00** (10.3)	42.37* (7.6)
Achievement	62.35 (6.8)	54.91* (12.0)	58.68 (5.9)
Self-efficacy	30.43 (4.3)	33.20* (4.4)	31.95 (5.4)

* Significantly different from the FM group, $P<.05$.
** Significantly different from the FM group, $P<.01$.

Statistical analysis

To reduce Type I error, multivariate analysis of variance (MANOVA) was used to assess the overall between-group effects across the seven scales of the MIA. With a significant group multivariate effect [Pillai’s Trace (4,114)=3.139, $P<.001$, η^2=.278, observed power=.996], planned univariate comparisons with contrasts between groups were completed to assess group differences for individual scales.

Table 2
Metamemory in adulthood scales

Scale	Definition	Sample item
Strategy	Knowledge and use of strategies to improve performance	Do you write appointments on a calendar to help you remember them?
Knowledge	Knowledge of basic memory processes	For most people, facts that are interesting are easier to remember.
Capacity	Perception of one’s own memory capabilities	I am good at remembering names.
Stability	Perception of memory abilities as stable, or deteriorating	The older I get, the harder it is to remember things clearly.
Anxiety	Feelings of stress related to memory performance	I get flustered when I am put on the spot to remember things.
Achievement	Perceived importance of having a good memory	It is very important that I am very accurate when remembering names.
Self-efficacy	Perceived personal control over memory abilities	Even if I work on it, my memory ability will go downhill.

Table 4
Correlations between metamemory in adulthood scales and free recall in FM patients

	FM patients	Age-matched controls	Older controls
	Pearson's *r*	Pearson's *r*	Pearson's *r*
Strategy	.233	.164	.041
Knowledge	.093	−.120	.115
Capacity	.467**	−.192	−.059
Stability	.235	−.072	.073
Anxiety	−.046	.123	−.073
Achievement	.407*	.190	−.275
Self-efficacy	.512**	−.183	.027

* $P<.05$.
** $P<.01$.

Pearson product–moment correlations were calculated to assess the relationship between the MIA scales and memory performance on the free-recall task. These correlations were calculated separately for each group (FM patients, age-matched controls, and older controls).

Results

FM patients compared with age-matched controls

This contrast showed an overall group effect [Pillai's Trace (7,38)=4.90, P=.001, η^2=.474, observed power=.988]. Univariate analyses showed that the FM patients were different from the age-matched controls on six out of the seven scales, shown in Table 3. FM patients' knowledge of memory function was similar to that of the age-matched controls [$F(1,44)$=.50, P=.482]. FM patients reported more use of strategies to support memory [$F(1,44)$=6.56, P=.014], more anxiety about memory performance [$F(1,44)$=10.74, P<.001], and higher motivation for good memory performance [$F(1,44)$=6.69, P=.013]. The FM patients also reported lower memory capacity [$F(1,44)$=20.22, P<.001], less stability in memory capacity [$F(1,44)$=15.77, P<.001], and less control over their memory function [$F(1,44)$=4.792, P=.034].

FM patients compared with older controls

This contrast showed an overall group effect [Pillai's Trace (7,34)=3.84, P=.004, η^2=.442, observed power=.952]. Univariate analyses (Table 3) showed that the FM patients reported lower memory capacity than did the older controls [$F(1,40)$=22.20, P<.001], and less stability in memory capacity [$F(1,40)$=4.10, P=.05]. The FM patients were also more anxious about their memory performance [$F(1,40)$=5.32, P=.026]. There was a trend for FM patients to report more motivation for good memory performance [$F(1,40)$=3.39, P=.073]. FM patients were not different from the older controls in their use of strategies [$F(1,40)$=

Table 5
Correlations between metamemory in adulthood scales by group

	1	2	3	4	5	6
FM patients						
1. Strategy	–					
2. Knowledge	.093					
3. Capacity	−.197	.131				
4. Stability	−.323	−.082	.662**			
5. Anxiety	.147	.268	−.508*	−.415*		
6. Achievement	−.136	.260	.133	−.120	.358	
7. Self-efficacy	−.077	.014	.479*	.529**	−.220	.357
Age-matched controls						
1. Strategy	–					
2. Knowledge	.526**					
3. Capacity	−.152	−.155				
4. Stability	−.089	−.088	.628**			
5. Anxiety	.464*	.356	−.584**	−.511*		
6. Achievement	.243	.269	.064	−.165	.391	
7. Self-efficacy	.519*	.332	.168	.325	.077	−.034
Older controls						
1. Strategy	–					
2. Knowledge	.337					
3. Capacity	.003	.319				
4. Stability	.298	.475*	.620**			
5. Anxiety	.100	.064	−.275	−.435		
6. Achievement	.005	.119	−.024	−.186	.561*	
7. Self-efficacy	.398	.137	.346	.517	.023	−.023

* $P<.05$.
** $P<.01$.

.035, P=.852], their knowledge of memory function [F(1,40)=.44, P=.513], or their feeling of control over memory performance [F(1,40)=1.023, P=.318].

Correlations with objective memory performance

To assess the accuracy of FM patients' complaints about memory function, we correlated the scales from the MIA with free-recall scores, an objective measure of memory performance [3]. The performance of the FM patients on free recall was lower than that of the age-matched controls [50%, S.D.=7.85, of items recalled vs. 58%, S.D.=1.67, respectively; t(22)=2.881, P=.005] but is equivalent to the performance of the older controls (50%, S.D.=6.72). The results from the control groups are similar to those found in a larger study using the same free-recall procedure (i.e., 60%, S.D.=2.49, of items recalled in the 40- to 59-year-old group and 50%, S.D.=2.02, of items recalled in the 60- to 79-year-old group; [16]). The correlation for each MIA scale with free recall is shown for FM patients in Table 4. We found that free-recall performance was significantly correlated with perceived capacity, achievement motivation, and self-efficacy, but not with anxiety about memory performance. In contrast, there were no significant correlations between free recall and the MIA scales for either the age-matched or the plus-20 control group.

Correlations between the MIA scales

Table 5 shows the correlations among the seven scales of the MIA questionnaire for each participant group. Among the FM patients, significant correlations were found between capacity and stability, capacity and anxiety, capacity and self-efficacy, stability and anxiety, and stability and self-efficacy. Patients who perceived their memory ability as lower also perceived less stability in memory, had more anxiety about memory, and had lower self-efficacy. Age-matched controls showed a similar pattern between capacity, stability, and anxiety. However, the relationships between self-efficacy and the other scales were different: Self-efficacy was related to strategy use but not capacity or stability. Furthermore, there was a significant correlation between knowledge and strategy use, not significant for FM patients. Among the older controls, significant correlations were found between capacity and stability, stability and knowledge, and achievement and anxiety.

Conclusions

Overall, FM patients reported lower memory capacity and less stability in memory function than did the age-matched controls or the older controls, despite the fact that the objective memory performance between FM patients and older controls was nearly identical [3]. It is plausible that FM patients are more sensitive to their memory loss because their memory function is age inappropriate and may have declined over a shorter time period than is typical with normal aging.

Complaints of decreasing memory capacity seem to be accurate in FM patients because they did have lower memory performance than did the age-matched controls, and their perceived memory capacity was well correlated with objective memory performance. A similar correlation was not found for the control groups, suggesting that the FM patients were accurately perceiving a pathological rather than an expected change in their memory function. Our finding differs from that of Grace et al. [4], who reported that the effect sizes for the differences in memory complaints between their FM patients and control group were larger than the effect sizes for the objective memory measures. Our results also differ from the common clinical experience that FM patients' complaints about memory problems are not commensurate with actual memory performance. We believe that the differences in our results are likely due to the different methods of assessing self-reported memory function. If the focus is on memory *complaints*, then FM patients may seem to exaggerate their symptoms, perhaps to draw a clinician's attention to them or because the memory impairments, while small, are not normal for their age group. In addition, small changes in memory function, as measured on a laboratory task, may have larger functional impact on day-to-day memory function. Thus, a person in a highly demanding job may be more sensitive to small memory impairments than will a person in a less demanding position. If, on the other hand, the focus is on self-reported memory in specific contexts (e.g., I lose my keys or cannot remember items at the store without a list), as in the MIA questionnaire, the self-report assessment of memory function will more closely mirror actual function.

However, there are other explanations for the correlation between perceived capacity and actual memory performance in the FM patients. One explanation is that the FM patients who believed their memory capacity to be poor simply did not try to achieve good performance in the memory test [18]. While it is possible that, in our study, the patients who believe that they have poor memory simply did not expend the necessary effort to perform well on our tests, several observations argue against this explanation. The FM patients scored higher than did the age-matched controls on their use of strategies to support memory, suggesting a willingness to work at maintaining good memory performance. In accordance with this, the FM patients also scored higher on achievement motivation; and achievement motivation was positively correlated with memory performance among the FM group. Furthermore, FM patients show a pattern of impairment on free-recall and working memories but not on information-processing speed [3]. Those participants who were biased to respond in an impaired fashion could easily perform slowly on this task.

We did find that FM patients were anxious about their memory performance. This fits well with clinical observations of increased anxiety in FM patients [17]. Indeed, clinicians may often feel that anxiety is contributing to cognitive problems in FM patients; however, we found that objective memory performance did not correlate negatively with the anxiety scale of the MIA, similar to our previous report with a different measure of anxiety (anxiety subscale of the Mental Health Inventory; [3]). Our findings contrast with those of Grace et al. [4], who found that anxiety was correlated with working memory and long-term memory function. In addition, several authors have reported a relationship between anxiety and pain severity in FM patients [19–21]. Taken together, the results suggest that anxiety is an important component of the FM syndrome; but the relationship between anxiety and cognitive function may not be direct, or it may depend on how anxiety is measured. It should also be noted that our patients were screened for psychiatric illness. A group with more extreme anxiety symptoms may have shown a correlation between anxiety and cognition.

The FM patients also reported less self-efficacy or control over their memory function, and this was correlated with objective memory performance. Others have reported that higher self-efficacy predicts better outcomes after treatment in FM patients [22–25]. There is some evidence that increasing self-efficacy may help improve treatment outcomes in terms of pain control [26], suggesting a possible intervention to improve memory performance in FM patients. Many studies show a strong correlation between memory self-efficacy and memory performance among older adults (e.g., Refs. [27–29]), college students [30], and other populations [31]. And accordingly, memory intervention programs improve both self-efficacy and memory performance [29], suggesting that improvements in self-efficacy may lead to improvements in performance. Although most research has not specifically tested whether improving self-efficacy alone can improve memory performance, there are a few notable exceptions that support this idea. For instance, the Cognitive Behavioral Model of Everyday Memory [32,33] focuses on increasing self-efficacy to improve performance and has been successful in older adults. Other research has shown that subconscious improvements in age-related self-image (testing participants in a room that depicts active, empowered seniors) lead to better memory performance [34]. Given these findings, improving self-efficacy could be a promising intervention for FM patients who experience memory difficulties. Our results show that, among our control participants, self-efficacy was related to a tendency to use strategies in everyday memory. In contrast, the FM patients did not show this relationship. This suggests that memory interventions for FM patients should encourage self-efficacy through the increased use of strategies.

In summary, we found that FM patients' beliefs about memory showed that the patients have similar knowledge about memory as the controls did, but they correctly perceive their memory capacity as lower. Beliefs about memory and self-report of memory problems are important in clinical practice because it is often not possible to do formal testing. Our results suggest that patients' self-report about memory function using the MIA questionnaire appear accurate. The results suggest that memory intervention programs that focus on improving self-efficacy may be helpful for FM patients, and this possibility deserves further investigation.

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