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Mediators of the relationship between life events and memory functioning in a community sample of adults

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Abstract

The present study examines the association of frequency and severity of life events with memory functioning in a community sample of adults. We tested the hypothesis that stress-related cognitive interference mediated the effects of recent life events on cognition, in addition to examining the potential roles of fatigue, sleep disturbances, and depression. The sample consisted of 310 adults (age range 19–83) who received a battery of cognitive tests assessing their primary memory, episodic memory, and working memory. Individuals rated how stressful previous life events were when they occurred, as well as how stressful the events were for them currently. Ratings of current, but not past severity were negatively associated with working memory performance. Both stress-related cognitive interference and depressive symptoms independently mediated this association. These findings highlight the importance of intrusive and avoidant thinking as a potential focus of psychosocial treatment for remediating stress-related memory dysfunction.

Introduction

Decades of research have established that exposure to elevated levels of stress has negative consequences for physical and mental health (Baum & Poslusny, 1999; Juster, McEwen, & Lupien, 2010; Kessler, 1997). In addition, a growing body of research has emphasized the role that stress plays in shaping cognitive health and functioning (Kirschbaum, Wolf, May, Wippich, & Hellhammer, 1996; Lupien & McEwen, 1997; McEwen & Sapolsky, 1995; Stawski, Sliwinski, & Smyth, 2009; Lupien, McEwen, Gunnar, & Heim, 2009). The accumulated effects of stressful experiences may compromise cognitive health by inducing allostatic load (McEwen & Stellar, 1993). Humans respond to stressful events with changes in cardiovascular, neural, autonomic, immune, and metabolic activity. This response, if

short-lived, serves an adaptive function, however, if the stress response persists over long time periods, as is the case in chronic stress, this creates a 'wear-and-tear' on the organism (McEwen, 1998b; McEwen, 2008; Smyth, Zawadzki, & Gerin, 2013). The notion of allostatic load implies that stressful experiences must result in chronic or prolonged responses to stressors in order to have negative long-term effects on cognitive function. The way through which stressful events affect cognitive function only months after their occurrence may depend upon psychological and behavioural processes. The present study tests the hypothesis that stress-related intrusive and avoidant thinking (cognitive interference) accounts for the enduring effects of stressful life events on cognitive function.

Life events versus severity appraisals of life events and memory function

One common method for operationalizing stress is to measure the frequency of recent stressful life events. Some studies have found that the number of negative life events are associated with worse cognitive function in both younger and older adults (Klein & Boals, 2001a, Study 1; Dickinson, Potter, Hybels, McQuoid, & Steffens, 2011; VonDras, Powless, Olson, Wheeler, & Snudden, 2005). However, Comijs et al. (2011) did not find an effect of the total number of recent life events on cognitive function (memory, information processing speed, and global cognitive functioning) in older adults, but observed differential effects whereby events which were expected to be severe predicted worse cognitive impairment and more mild events predicted improvements on cognitive function. They suggested that mild levels of stress might have an arousing function that stimulates cognitive performance. Rosnick and colleagues (2007) also did not observe an association between the frequency of major life events and cognition, but did observe that a specific type of event (financial problems), if reported as stressful, was associated with poor performance on speeded tasks. Recent work by Stawski and colleagues (2010; 2013), illustrates that higher levels of self-reported exposure to stressful events does not imply worse cognitive function. In fact, they found that persons who reported more daily stressful events performed better on fluid cognitive tasks. However, persons who responded with more emotional distress to daily events exhibited worse cognitive performance. These findings, along a recent study demonstrating accelerated cognitive decline among older adults who perceive their life to be stressful (Aggarwal et al., 2014), suggest that appraisals and emotional responses to events may be more salient for predicting cognitive function than indices of mere exposure.

Current appraisals versus appraisals when the event occurred

It is important to examine both the frequency and severity appraisals of recent life events to help resolve inconsistencies in the literature relating stressful events to cognitive function (Comijs, van den Kommer, Minnaar, Penninx, & Deeg, 2011; Dickinson et al., 2011). In addition, contrasting ratings of how stressful an event was when it occurred with severity ratings of how the event is currently affecting individuals several months later may provide new insights. Including current severity appraisals provides an index of the chronicity of stressful life events. We predict that life events, even if they are severe at the time they occurred, will only be harmful if their effects persist, as measured by current severity appraisals.

Cognitive interference as primary mediator between life event stress and cognitive function

Recent advances in stress theory have emphasized the importance of repetitive, negative thoughts as a “final psychological pathway” through which stress exerts its negative effects (Brosschot, Pieper & Thayer, 2005). There is ample evidence that the experience of stressful events promotes negative and repetitive thinking, which includes both intrusive thoughts, as well as the efforts to avoid of these negative thoughts (Baum, Cohen, & Hall, 1993; Stawski et al., 2009). The perseverative cognition theory of stress (Brosschot et al., 2005) postulates that such repetitive thinking about stressful experiences maintains chronic stress through the persistent activation of mental representations of negative content.

Repetitive thinking about stressful events may impact cognitive function through two types of mechanism. First, by maintaining the physiological effects of chronic stress, stress-related thoughts can lead to physiological dysregulation and eventually, neuro-cognitive impairment (McEwen, 1998a). And second, stress-related intrusive and avoidance thinking can produce “cognitive interference” that depletes limited attentional resources, thereby negatively affecting cognitive performance (Sarason, Pierce, & Sarason, 1996). Attention demanding tasks, such as those that assess working memory, should be especially sensitive to the effects of stress-related cognitive interference (Kahneman, 1973). Several researchers have investigated the association between cognitive interference and impairments in cognitive functioning. Klein and Boals (Klein et al., 2001a, Study 3) observed higher degrees of intrusive and avoidant thinking to be associated with impairments on working memory in college students, and suggested that intrusive and avoidant thinking is analogous to a secondary task that share resources of working memory. In addition, Lemogne et al. (2009) observed avoidant thinking to be associated with decreases in the number and specificity of autobiographical memories in middle-aged adults. In a study of older adults, Stawski et al. (2006) found a strong association between stress-related cognitive interference and poorer performance on episodic memory, processing speed, and working memory and Horowitz et al. (1975) suggested that stress-related cognitive interference might be an important independent pathway in the association between life event stress and cognitive functioning. However, there has been relatively little research that has explicitly examined mediators of the effects of stressful events on cognitive function. Drawing on recent stress theory (Brosschot et al., 2005; Brosschot et al., 2006), the current study will test the hypothesis that stress-related cognitive interference (intrusive and avoidant thinking) mediates the effects of life events on cognitive function.

Because stress is known to affect behaviors and psychological states that may impact cognitive function, particularly sleep and depression, the current study also examined these variables as possible alternative or complementary accounts of how life events impact cognition. There is a considerable evidence demonstrating a positive association of stress with fatigue and sleep problems (Akerstedt, 2006; McEwen, 2006) and that poor sleep quality is associated with cognitive impairments (Jelicic et al., 2002; Nebes, Buysse, Halligan, Houck, & Monk, 2009). In addition to fatigue and sleep problems, there is a considerable evidence that the effects of stress are associated with depression (Kessler, 1997) and that depression is associated with cognitive impairment (Thomas & O'Brien,

2008). Several underlying mechanisms may play a role in this association. First, it is assumed that stress-related depressive symptoms leads to a greater focus on one's current mood state, leaving fewer attentional resources available for cognitive processes, resulting in cognitive impairment (Ellis & Ashbrook, 1988). Second depressed persons may be more vulnerable for the adverse effects of stress, and may show more negative consequences of stress such as cognitive dysfunctioning than non-depressed.

Aims and hypotheses

The current study has three goals. First, we compare how recent life events predict memory function when these events are indexed either by simple counts or weighted counts that consider severity appraisals. We predict that, compared to the number of recent negative life events, the sum of the severity appraisals will be a stronger predictor of memory function. Second, we predict that ratings of current severity (i.e., "how negative is this event for you now?") will be more salient than severity ratings of the event when it occurred (i.e., "how negative was this event for you when it happened?"). A final goal is to assess possible mediators (e.g., fatigue, sleep disturbances, depression, and cognitive interference) that may account for the relationship between negative life events and memory functioning. Based on previous research, we predict that cognitive interference will be the primary mediator of the association between life events and working memory.

Method

Study sample

Data were collected from 324 community adults (age range 19–83) between 2008 and 2010 in Syracuse, New York. Participants were recruited by advertisement in local newspapers, flyers in community centers and other public venues, and through referrals from community leaders. The sample was age stratified (by decade) which created an approximately uniform age distribution. Individuals with a history of psychiatric impairment, cognitive impairment (e.g., dementia) or impairments in sensory-motor function that interfered with use of a computer were excluded from the study. Participants were tested in two sessions scheduled one week apart. During the two in-lab sessions, respondents completed cognitive tasks and health measurements. In between the two sessions, respondents filled out self-reported questionnaires assessing health behaviors and life experiences.

Each participant signed informed consent as approved by the Syracuse University Institutional Review Board. In addition, each participant was compensated up to \$75 (commensurate with their level of participation) for completion of all components of the protocol. Because 14 of the 324 participants did not complete the questionnaire about life events, 310 persons were included in the final study sample.

Measures

Participants completed a battery of psychosocial questionnaires that assessed emotion, personality, health and stress. In addition, demographic characteristics of participants (e.g., age, sex, and years of education) were collected. Only the measures used for the current analyses are described.

Negative life events—A modified version of the Life Experiences Survey (LES) developed by Sarason et al. (1978) was assessed. Participants were asked whether 34 specific events occurred during the last 12 months, additional events could be written down. Sample categories covered by the LES are death of a spouse, death/illness of a close family/friend, changes in work situation, money issues, problems with partner, changes in living conditions, and changes in (social) activities. For any event indicated, participants also rated the perceived negative impact of that event, both for when it occurred as well as currently, on a scale of 0 (no negative impact) to 3 (extremely negative). The number of events that had a negative impact on the person (>0) were summed to form the number of negative life events experienced in the last 12 months (range 0–18). In addition, a sum score was calculated from the perceived negative impact of each event when it occurred (rating of past severity) (range 0–53) and the perceived negative impact of the event at the moment of the interview (rating of current severity) (range 0–53).

Memory functioning

Primary memory: Participants completed two tests of primary memory: digit span and word span (Conway, Cowan, Bunting, Theriault, & Minkoff, 2002). In the digit span, participants saw a series of digits one at a time for one second each. After some number of digits, the participant recalled all of the digits they could recall in the order they saw them. Total number of digits in each series ranged from five to nine and participants attempted two at each length. The word span followed a similar procedure except that the total number of words in each series ranged from four to eight.

Episodic memory: Participants completed three tests of episodic memory performance: logical memory-I (Wechsler, 1997), verbal paired associates (Wechsler, 1997), and auditory verbal learning test (Schmidt, 1996). In Logical Memory-I the examiner read two stories, one at a time, and then asked the respondent to recall as much about the story as possible. This task was scored according to the guidelines outlined by the Wechsler Memory Scale manual. In the verbal paired associates task the examiner read eight pairs of unrelated words to participants at a rate of one pair every three seconds. Participants were then given the first word in the pair and produced the second. This was repeated four times, with the same pairs presented in a different fixed random order each time. The final score is the total number of words correctly recalled out of 32. In the AVLT, participants were given one minute to study a list of 15 unrelated words. At the end of the minute, participants were given one minute to recall as many words as possible. Resulting in the total number of words correctly recalled out of 15.

Working memory: Participants completed three tests of working memory: counting span, operation span, and reading span (Conway et al., 2002). In the counting span, participants were presented with a series of displays that included dark blue circles (targets) and dark blue squares and light blue circles (distractors). After some number of displays, three question marks “???” prompted the participant to recall all of the count totals from that series. The number of displays per series varied from two to six with three series at each length presented in a fixed random order. In the operation span, participants verified equations aloud while trying to remember words. As with the counting span, after a series of

number of equations and words was presented, participants were prompted to recall all the words from that series. The number of equation and word pairs per series varied from two to five with three series of each length presented in a fixed random order. In the reading span, participants verified sentences aloud while trying to remember unrelated letters. After some number of sentences and letters was presented, participants were prompted to recall all the letters from that series. The number of sentence and letter pairs per series varied from two to five with three series of each length presented in a fixed random order. Per memory domain the Z-scores from the separate memory tests were calculated, and mean Z-scores of the corresponding memory tasks were computed. When missing values were present, the mean Z-score of the remaining memory tests was calculated.

Possible mediators

Fatigue: The Positive and Negative Affect Schedule-Expanded Form (Watson & Clark, 1994) was assessed, including the fatigue subscale. Participants indicated the extent to which a series of adjectives described how they felt in general. Ratings were made from not at all (1) to extremely (5). The fatigue subscale included the items *sluggish*, *tired*, *sleepy*, and *drowsy*. Which were summed to give a total score of fatigue (range: 4–20).

Sleep: Sleep was measured with the Pittsburgh Sleep Quality Index (PSQI) (Buysse, Reynolds, III, Monk, Berman, & Kupfer, 1989). The PSQI contains questions about sleep quality in the past month, seven domains of sleep were assessed; subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The total score of these seven domains was used as a global measure of sleep quality (range 0 –21).

Depression: The Center for Epidemiological Studies Depression Scale (CES-D) was used to assess depressive symptoms. This scale was developed with 20 items assessing symptoms of depression in the general population (Radloff, 1977). Items were rated for how the individual was feeling at the current time on a 4-point scale from not at all to very much. The summed scores of these items were used as a measure of depression severity (range: 20–80).

Cognitive interference: Cognitive interference was measured with the Impact of Events scale (Horowitz, 1975). Participants reported the most stressful event of their life along with how stressful this event was (not at all stressful – a great deal stressful), whether they received counseling for this event, and whether the event is continuing to cause them stress. After providing details of the event, participants completed a 15-item rating scale assessing the extent to which they thought about this stressful event in the past week. Responses to the rating scale questions were made on a 4-point scale from not at all (1) to often (4). There were two subscales; intrusive thinking (8 items) and avoidant thinking (7 items), the correlation between the two subscales was high (0.71). Because no differential effects were found for the separate subscales a total score was computed by summing the ratings of both subscales (range 15–58). Previous research found adequate reliability for the rating scale portion of the questionnaire (Cronbach's $\alpha = .86$; Horowitz, Wilner, & Alvarez, 1979), a finding replicated in the current study (Cronbach's $\alpha = .91$).

Statistical analysis

First descriptives of the different characteristics of the study sample were computed. Next, linear regression analyses were performed to examine the association between the number of negative life events, the past severity ratings, and the current severity ratings with memory function (primary memory, episodic memory, and working memory). These models were adjusted for socio-demographics (age, sex and education). Because our sample varied considerably in age, we examined whether effects were consistent across age by testing whether age interacted with the number of life events, past severity, or current severity in the fully adjusted models. Next, possible mediators fatigue, sleep disturbances, depression, and cognitive interference were examined in separate models. When the possible mediator showed a significant association with memory function ($p < 0.05$) and changed the association between life event stress and memory function by at least 10%, the mediating effects were tested in Mplus, version 6 (Muthen & Muthen, 2011). Using bootstrap techniques the direct effect and indirect effect (via candidate mediators) of the association between life events stress and memory function were estimated. Three regression parameters were estimated; 1) association between life event stress and the mediator (a path); 2) association between mediator and memory (b path); and 3) the parameter representing the direct effect of life event stress on cognitive functioning controlled for the candidate mediators (c' path). The indirect effect refers to the $a*b$ pathway. Figure 1 shows the model of the single mediation model. Significant indirect effects ($p < 0.05$) were considered as evidence consistent with mediation. A final model was fit that included all significant mediators to examine unique contribution of each mediator.

Results

Descriptive statistics of the socio-demographics, life event stress, memory function, and possible mediators are presented in Table 1. The mean age of the study sample was 49.8 years ($SD=17.1$), and the mean years of education was 13.3 years ($SD=2.7$). The mean number of negative life events experienced in the past 12 months was 3.48 ($SD=3.51$) and the past severity ratings of the life events were higher ($M = 9.96$, $SD=9.71$) than the current severity ratings ($M=7.79$, $SD=8.92$).

Tables 2abc show the associations between life event stress and memory functioning. Because no significant associations ($p > 0.05$) were observed between life event stress and episodic memory this measure was not examined further. The number of negative life events ($B=-0.029$, $p=0.04$), the past severity ratings ($B=-0.012$, $p=0.02$) and the current severity ratings ($B=-0.014$, $p=0.01$) were all negatively associated with primary memory. These associations could not be explained by any of the possible mediators. There were also no significant interaction effects of age with life event stress on primary memory function.

Only current severity ratings were significantly associated with working memory ($B=-0.014$, $p=0.007$) (Table 2c). There were no significant interaction effects of age with life event stress on working memory.

Next, sleep disturbances, depression, and cognitive interference showed significant negative associations with working memory when they were added to the model. These possible

mediators were tested for significance using bootstrap analyses (Table 3). When examined in separate models, the indirect effects of sleep ($B=-0.005$, $p=0.03$), depression ($B=-0.007$, $p=0.003$) and cognitive interference ($B=-0.007$, $p=0.002$) on working memory were all significant and the direct effect of current severity rating was reduced to non-significance in all cases, indicating that each mediator accounted for the effects of life events on working memory. Next, we examined whether cognitive interference remained a significant mediator when controlling for depression and sleep. When examined in pairs, only depression (indirect effect: $B=-0.005$, $p=0.03$) and cognitive interference (indirect effect: $B=-0.005$, $p=0.02$) uniquely accounted for the association between current life event severity and working memory. Including all significant mediators into a model revealed that only cognitive interference (indirect effect: $B=-0.005$, $p=0.03$) remained significant.

Discussion

This study examined the association of life event stress with memory function and the role of possible mediators. Our results showed that ratings of current severity had a stronger association with memory function than either an unweighted sum of recent life events or ratings of past severity of these events. Although depressive symptoms and sleep partially accounted for the association between current life event stress and working memory, cognitive interference was the strongest mediator.

These results confirm the notion that severity appraisals of life events might provide a more sensitive index than an unweighted sum of life events for predicting cognitive function. Dohrenwend (2006) proposed to reduce intracategorical variability of life events for example by assessing the appraisal of stressful events, which is shown to have a stronger association with psychological distress than the number of life events. The present study provides a novel extension of this approach by comparing both current and past severity appraisals and by examining their association with cognitive functioning. Ratings of current severity may better reflect the long-term impact of life events than either their simple sum or ratings of how stressful the event was when it occurred. One possible reason for the differential sensitivity of current severity ratings is that they reflect the delayed effects of stressful events. For example, losing a job six months earlier might be more stressful now because of worsening financial consequences that were not present when the event occurred. In addition, severity appraisal of negative events generally decreases over time, however, persons with mild depressive symptoms exhibit less decline than non-depressed individuals (Walker, Skowronski, Gibbons, Vogl, & Thompson, 2003). This might be an explanation for the direct association between depressive symptoms and higher current appraisals. Another explanation is that ratings of current severity might reflect enduring effects of events that results in chronic stress, which may have a particularly negative impact on cognitive functioning (McEwen, 2008). The tendency for some people to experience negative intrusive thoughts may play a role in transmitting the effects of past events affect current cognitive function. Emerging evidence and theory suggests that negative events may lead to chronic stress when there is a tendency to relive and re-think previous stressful events (e.g., worry, rumination), as this leads to prolonged or exaggerated stress responses and increases disease risk (Brosschot, Pieper, & Thayer, 2005; Brosschot, Gerin, & Thayer, 2006; Smyth et al., 2013). Repetitive thoughts about past stressful events is also one of the key features of

posttraumatic stress disorder (PTSD), a disorder which has also been linked to poorer cognitive functioning (Golier & Yehuda, 2002; Qureshi et al., 2011).

Cognitive interference may also have mediated the relationship between life events and working memory because it reflected individual differences in attentional resources (Klein & Boals, 2001b; Klein et al., 2001a, Study 3). That is, people who experience cognitive interference have diminished attentional resources, which in turn is associated with their poorer working memory. The cross-sectional nature of the current study precludes more fine-grained analyses to determine whether cognitive interference precedes working memory decrements. Depression accounted for some of the effect of life events on working memory, even after controlling for cognitive interference, possibly because of reduced mental effort and decreased attention often associated with depressive symptoms.

These results suggest that intrusive and avoidant thinking in responses to stressful events may provide a viable target for intervention strategies to prevent or remediate stress-related effects on cognitive function. Consistent with this notion, a study of Klein and Boals (2001b) showed that in college-freshman, an intervention consisting of an expressive writing task about a stressful event designed to decrease intrusive and avoidant thinking, had a positive effect on working memory. A more recent study demonstrated that mindfulness training in college students improved working memory capacity, and that this effect was mediated by reduced mind-wandering (Mrazek, Franklin, Phillips, Baird, & Schooler, 2013). Additional work is required to demonstrate whether such interventions will work in middle and older aged adults.

Age had no influence on the association between life event stress and memory functioning. One reason for this result might be that age exerts competing influences on this association. The ability to inhibit intrusive or off-task thoughts diminishing with advances age (Hasher & Zacks, 1988), which should make older adults more susceptible to stress-related intrusive thoughts. However, older adults might enjoy protective effects against stressful events because they tend to have less exposure than younger adults and be more proficient at emotion regulation and types of coping, especially as time from the stressful event passes (Charles et al., 2010; Neupert, Almeida, & Charles, 2007). These two competing age influences (age benefits in stress exposure and coping vs. age vulnerability in attentional resources) might offset each other in the context of cross-sectional comparisons and account for the lack of age moderation in the present study. Alternatively, because of the high age variation health indicators might have influenced the found associations, however, the findings were very similar when the number of chronic diseases were taken into account.

No associations were observed between life event stress and episodic memory. One reason might be that the sample is relatively young and the impairments on episodic memory might affect older adults more than younger adults. Life event stress was associated with poorer primary memory but none of the possible mediators accounted for this effect. Although symptoms of cognitive interference showed a trend towards possible mediating mechanisms, it might be that other mechanisms could explain the association between life event stress and poorer primary memory.

Some limitations of this study should be mentioned when interpreting the results. Because of the cross-sectional design no conclusions can be drawn about the order of the associations. However, by asking about the past and current life event severity ratings some time effects were included. In addition, we cannot exclude the possibility that life event severity ratings are influenced by current psychological status which may have led to overestimating the mediating effects of depression and intrusive and avoidant thinking.

In conclusion, this study demonstrated negative effects of life event stress on memory functioning. This was mainly observed when current severity ratings, possibly reflecting the impact of chronic stress, were measured. Depressive symptoms and symptoms of intrusive and avoidant thinking might be underlying mechanisms in this association and might be the focus of psychosocial treatment in the prevention of chronic stress, memory dysfunction and depressive symptomatology.

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Figure 1.

The single mediation model in which life event stress is associated with memory functioning through the possible mediators (cognitive interference, fatigue, sleep, depression) as indicated by the products of $a*b$

Table 1

Descriptive statistics of the study sample

Measure	M	SD	Skew	Kurtosis	N
<i>Socio-demographics</i>					
Age	49.8	17.1	0.03	-1.01	310
Education	13.3	2.7	0.21	0.41	310
<i>Life event stress</i>					
Number of life events	3.48	3.51	1.48	2.55	310
Past severity ratings	9.96	9.71	1.49	2.58	310
Current severity ratings	7.79	8.93	1.89	4.16	310
<i>Memory domains- Z-scores</i>					
Primary memory	0	0.93	-0.11	0.17	310
Episodic memory	-0.00	0.82	0.07	-0.61	310
Working memory	-0.01	0.89	0.15	-0.39	310
<i>Possible mediators</i>					
Fatigue	9.13	3.31	0.66	0.01	308
Sleep	6.67	3.35	0.76	-0.02	299
Depression	35.4	10.9	0.78	0.14	305
Cognitive interference	34.1	11.0	-0.11	-0.86	303

Table 2**a. The association between the number of negative life events and memory functioning, and the role of possible mediators**

	Primary memory		Working memory	
	B	p	B	p
# Life events ^a	-0.029	0.04	-0.021	0.11
# Life events ^b	-0.029	0.04		
+ Fatigue	-0.003	0.82		
# Life events ^b	-0.028	0.07		
+ Sleep	-0.021	0.19		
# Life events ^b	-0.017	0.27		
+ Depression	-0.008	0.12		
# Life events ^b	-0.019	0.20		
+ Cognitive interference	-0.008	0.10		

b. The association between past life event severity and memory functioning, and the role of possible mediators

	Primary memory		Working memory	
	B	p	B	p
Past severity rating ^a	-0.012	0.02	-0.008	0.08
Past severity rating ^b	-0.012	0.02		
+ Fatigue	-0.003	0.82		
Past severity rating ^b	-0.012	0.04		
+ Sleep	-0.020	0.21		
Past severity rating ^b	-0.008	0.14		
+ Depression	-0.007	0.14		
Past severity rating ^b	-0.008	0.13		
+ Cognitive interference	-0.008	0.11		

c. The association between current life event severity and memory functioning, and the role of possible mediators

	Primary memory		Working memory	
	B	P	B	p
Current severity rating ^a	-0.014	0.01	-0.014	0.007
Current severity rating ^b	-0.014	0.01	-0.013	0.01
+ Fatigue	-0.002	0.89	-0.014	0.30
Current severity rating ^b	-0.014	0.02	-0.011	0.045

c. The association between current life event severity and memory functioning, and the role of possible mediators

	Primary memory		Working memory	
	B	P	B	p
+Sleep	-0.020	0.24	-0.042*	0.003
Current severity rating ^b	-0.010	0.08	-0.010	0.22
+ Depression	-0.010	0.19	-0.020*	0.001
Current severity rating ^b	-0.011	0.07	-0.010	0.20
+ Cognitive interference	-0.010	0.15	-0.020*	0.001

^a Adjusted for age, sex, education^b Adjusted for age, sex, education, and mediator

* Possible mediators

Table 3

Testing for mediation in the association between current life event severity and working memory

	B	S.E.	95%-CI	P-value
Model 1: Sleep				
Direct: Current severity rating	−0.009	0.006	−0.019;0.001	0.078
Indirect: Sleep	−0.005	0.002	−0.009;−0.001	0.025
Model 2: Depression				
Direct: Current severity rating	−0.007	0.005	−0.016;0.003	0.161
Indirect: Depression	−0.007	0.002	−0.012;−0.003	0.003
Model 3: Cognitive interference				
Direct: Current severity rating	−0.007	0.005	−0.017;0.004	0.208
Indirect: Cognitive interference	−0.007	0.002	−0.012;−0.003	0.002
Model 4: Sleep + cognitive interference				
Direct: Current severity rating	−0.004	0.005	−0.015;0.007	0.471
Indirect: Sleep	−0.004	0.002	−0.008;0.000	0.063
Indirect: Cognitive interference	−0.006	0.002	−0.011;−0.002	0.008
Model 5: Depression + cognitive interference				
Direct: Current severity rating	−0.003	0.005	−0.013;0.007	0.541
Indirect: Depression	−0.005	0.002	−0.010;−0.001	0.026
Indirect: Cognitive interference	−0.005	0.002	−0.010;−0.001	0.017
Model 6: Sleep + depression + cognitive interference				
Direct: Current severity rating	−0.002	0.005	−0.012;0.009	0.755
Indirect: Sleep	−0.003	0.002	−0.008;0.000	0.133
Indirect: Depression	−0.004	0.002	−0.009;0.000	0.079
Indirect: Cognitive interference	−0.005	0.002	−0.010;−0.001	0.030

All models adjusted for age, sex, education.