

## Age does not matter: Memory complaints are related to negative affect throughout adulthood

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**Objectives:** Memory complaints are present in adults of all ages but are only weakly related to objective memory deficits, raising the question of what their presence may indicate. In older adults, memory complaints are moderately related to negative affect, but there is little research examining this relationship in young and middle-aged adults. This study examined whether memory complaints and negative affect were similarly related across the adult lifespan and in adults with varying levels of objective memory performance.

**Method:** The sample included 3798 healthy adults, aged 18 to 99, and was divided into five groups: young, middle-aged, young-old, old-old, and oldest-old adults. Participants completed questionnaire measures of memory complaints and negative affect (neuroticism and depressive and anxiety symptoms), in addition to lab measures of objective memory.

**Results:** Using structural equation models, we found that the relationship between memory complaints and negative affect was moderate in all the age groups, and there was no evidence for moderation by objective memory.

**Conclusion:** For adults of all ages, perceived memory decline may be distressing and/or negative affect may lead to negative self-evaluations of memory.

**Keywords:** subjective memory complaint; negative affect; objective memory; lifespan

### Introduction

Memory complaints are ubiquitous across the adult lifespan (e.g., Crook & Larrabee, 1990; Ginó et al., 2010; Mendes et al., 2008; Ponds, Commissaris, & Jolles, 1997). When asked general questions, such as, 'Have you noticed problems with forgetting in the last month?' around 30% of non-cognitively impaired young adults report forgetfulness (Commissaris, Ponds, & Jolles, 1998; Cooper et al., 2011). This percentage either remains constant (Cooper et al., 2011) or increases (Commissaris et al., 1998) with age. Considering how widespread memory complaints are, it is not surprising that these complaints do not always indicate objective memory deficits (for a recent meta-analysis of this relationship, see Crumley, Stetler, & Horhota, 2014). In fact, among persons age 65 and older, there is considerable evidence that memory complaints are moderately related to components of negative affect (depressive and anxiety symptoms and neuroticism) and that these relationships are stronger than the relations to objective memory performance (e.g., Kliegel, Zimprich, & Eschen, 2005; Pearman, Hertzog, & Gerstorff, 2014; Slavin et al., 2010; West, Boatwright, & Schleser, 1984; for a review, see Hertzog & Pearman, 2013). Researchers have studied the relationship between depression and memory complaints in older adults for many years (e.g., Kahn, Zarit, Hilbert, & Niederehe, 1975; McDougall, 1994; West et al., 1984), and more recently have begun to explore this relationship in young and middle-aged adults as well (Cooper et al., 2011; Mendes et al., 2008; Pearman, 2009). However, little (if any) research has examined whether there are differences

in the relationship between negative affect and memory complaints across the adult lifespan. In this study, we modeled the relationship between memory complaints and negative affect in young (ages 18–39), middle-aged (ages 40–54), young-old (ages 55–64), old-old (ages 65–74), and oldest-old (ages 75–99) adults.

### *Competing hypotheses about age differences in the relationship between memory complaints and negative affect*

The strength of the relationship between memory complaints and negative affect may be similar across the adult lifespan. The rationale for this hypothesis follows from the expectation that perceiving a decline in memory functioning would be upsetting regardless of your age, and that the established influence of negative affect on perceived self-worth and doubt (e.g., self-criticism is a well-established marker of depression; Blatt, Quinlan, Chevron, McDonald, & Zuroff, 1982) would lead to negative self-evaluation about memory functioning at all ages.

Alternatively, the strength of the relationship between memory complaints and negative affect may vary across the adult lifespan. For example, among older adults (ages 55+), for whom memory problems may be seen as more normative, so-called 'senior moments' may be less distressing and, therefore, have a weaker relationship to negative affect than at other ages. In support of this, older adults who reported forgetfulness tended to say this was due to 'age' and not 'mental decline,' likely reflecting a normative attribution (Commissaris et al., 1998). Additionally, there is a greater association of memory

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impairment and depression in younger relative to older depressed patients (Burt, Zembar, & Niederhe, 1995), and young adults who report forgetfulness attribute it to emotional problems more often than do older adults (Commissaris et al., 1998).

However, there are also reasons to expect that the relationship between memory complaints and negative affect could instead be stronger in older adulthood. It may be that when negative affect is present in older adults, it is often expressed as memory complaints because this is such a salient concern for these age groups (e.g., Dark-Freuderman, West, & Viverito, 2006), whereas other concerns may be more salient for young adults (e.g., about career success or relationship formation). It could also be that older adults (mis)interpret normative memory errors as early signs of dementia, perhaps leading to a stronger relationship between memory complaints and negative affect than would be found in younger age groups. In support of this possibility, fear of Alzheimer's disease increases with age from young adulthood to older adulthood (Cantegreil-Kallen & Pin, 2012). Oldest-old adults may be particularly likely to interpret memory errors as signs of dementia, and while prior research has found a relationship between memory complaints and depression in oldest-old adults (Johansson, Allen-Burge, & Zarit, 1997; Pearman et al., 2014; Shmotkin et al., 2013; Zelinski, Burnight, & Lane, 2001), young-old, old-old, and oldest-old adults have not been directly compared.

Analogously, in comparison to older adults, young adults (ages 18–40) may not be as likely to link memory complaints to the onset of a serious neurodegenerative disorder and, in fact, in third-person vignettes they tend to report that a younger target's memory failures are a result of problems in effort as opposed to ability (Parr & Siegart, 1993). While young adults attribute their own forgetfulness to emotional problems more so than older adults, young adults also tend to attribute their memory issues to poor concentration and lack of interest (Commissaris et al., 1998), and thus may still show a weaker relationship between memory complaints and negative affect than older adults.

Whereas prior research helps to shape competing hypotheses for young and older adults, the relationship between memory complaints and negative affect in middle-aged adults (ages 40–54) remains an open question. When included in studies, these individuals are often combined in a sample with young and/or older adults (e.g., Cooper et al., 2011; Ginó et al., 2010; Pearman & Storaandt, 2004). When studied separately, middle-aged adults tend to attribute memory problems to stress and to having 'too much to think about' more so than to aging (Vestergren & Nilsson, 2011). However, there is also a relationship between memory complaints and concern about developing Alzheimer's disease in this age group (Cutler & Hodgson, 2001). Therefore, it is unclear whether the relationship between memory complaints and negative affect in middle-aged adults will more closely resemble that seen in young adults or older adults.

Finally, though many factors besides age may influence the relationship between memory complaints and

negative affect, in this study, we tested one potential moderator: objective memory performance. Memory complaints and negative affect may be less strongly related for individuals with high objective memory performance, because high baseline memory ability may serve as a protective buffer, such that even individuals with high negative affect would not have memory complaints.

In summary, this study will examine whether memory complaints and negative affect are similarly related across the adult lifespan and in adults with varying levels of objective memory performance. Our sample included adults who were not experiencing cognitive impairment, given some evidence that memory complaints are more predictive of decline in those who are already impaired, potentially changing their interpretation (Schofield et al., 1997).

## Method

### Participants

Participants were recruited from newspaper advertisements, flyers, and referrals from other participants. Written informed consent was obtained from all participants, and all data were collected with the approval of the University of Virginia Institutional Review Board. Participants were excluded from analyses if they did not complete the measure of memory complaints or if they had a Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) score of less than 24, indicating potential cognitive impairment. The decision to exclude older adults who were experiencing significant cognitive impairment follows from our aim to assess the relationship between negative affect and memory complaints without introducing a potential confound, given depression (Potter & Steffens, 2007) and anxiety (Seignourel, Kunik, Snow, Wilson, & Stanley, 2008) are highly comorbid with cognitive impairment and most dementias. The sample included 3798 adults, aged 18 to 99, and was divided into five groups (18–39, 40–54, 55–64, 65–74, and 75–99). These groups were chosen to represent young, middle-aged, young-old, old-old, and oldest-old adults. Older adults were subdivided because of higher rates of negative affect (Teachman, 2006) and dementia (Alzheimer's Association, 2013; Jorm & Jolley, 1998) at older ages. Participant characteristics for each age group are displayed in Table 1. In general, these characteristics were similar across the age groups. On average, participant's self-rated health was in the 'good' to 'very good' range, they had 16 years of education, and they performed at around the 75th percentile of a nationally representative normative sample on measures of vocabulary and memory.

### Materials

#### Memory complaints

Memory complaints were assessed using the mean scores on the General Frequency of Forgetting subscale (e.g., 'How often do these present a problem for you?': names,

Table 1. Sample characteristics.

	Age groups				
	18–39	40–54	55–64	65–74	75–99
<i>N</i>	1012	1043	834	514	395
Age	27.0 (6.1)	48.2 (4.2)	59.4 (2.9)	69.1 (2.9)	80.2 (4.5)
Proportion of females	.63	.70	.68	.60	.58
Race					
White	.73	.78	.86	.89	.88
African American	.16	.15	.06	.03	.01
Other	.11	.07	.08	.08	.11
Health	2.1 (.9)	2.2 (.9)	2.1 (.9)	2.3 (.9)	2.5 (.9)
Years of education	15.0 (2.3)	15.5 (2.7)	16.2 (2.7)	16.2 (2.9)	16.0 (3.0)
MMSE	28.9 (1.4)	28.6 (1.5)	28.7 (1.5)	28.6 (1.4)	28.0 (1.6)
Scaled scores (SS)					
Vocabulary (SS)	12.8 (3.3)	11.5 (3.1)	12.9 (2.6)	13.1 (2.7)	13.2 (2.7)
Digit symbol (SS)	11.2 (2.9)	10.6 (2.9)	11.7 (2.7)	11.6 (2.7)	11.8 (2.9)
Logical memory (SS)	11.6 (2.8)	11.3 (2.9)	12.0 (3.0)	12.5 (3.0)	12.1 (2.8)
Word recall (SS)	12.1 (3.1)	11.6 (3.4)	12.6 (3.2)	12.5 (3.2)	11.9 (3.4)

Note: Health is self-rated on a scale from 1 = 'excellent' to 5 = 'poor'. MMSE = Mini-Mental State Examination. The scaled scores are age-adjusted scores from Wechsler (1997a, 1997b). For race, 'Other' includes participants who identified as American Indian, Asian, Pacific Islander, Other, or who selected multiple responses. Across all age groups, 5% or less of the sample identified as Hispanic. On average, the participants in our sample performed at about the 75th percentile of the nationally representative normative sample on the measures of vocabulary, digit symbol, logical memory, and word recall.

faces, etc.) and the Seriousness of Forgetting subscale ('When you actually forget in these situations, how serious of a problem do you consider the memory failure to be?') from the Memory Functioning Questionnaire (MFQ; Gilewski, Zelinski, & Schaie, 1990), as well as one item from the Memory Assessment Clinics Self-Rating questionnaire to assess retrospective memory functioning<sup>1</sup>, 'How would you describe your memory, on the whole, compared to the best it has ever been?' (MAC-S; Crook & Larrabee, 1990). All items were rated on seven-point scales, where a rating of 1 indicated poorer functioning and 7 indicated better functioning.

#### Negative affect

Measures of trait negative affect included the trait subscale from the State-Trait Anxiety Inventory (STAI-Trait; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), the Center for Epidemiologic Studies–Depression Rating Scale (CES-D; Radloff, 1977), and the reverse-coded Emotional Stability subscale from the International Personality Item Pool questionnaire, which corresponds to neuroticism (IPIP; Goldberg, 1999). In our analyses, we used the *z*-scores of the STAI-Trait, CES-D, and the reverse-coded Emotional Stability factor. For 323 participants, there were only data for the CES-D, and for an additional 59, there were only data for the CES-D and Emotional Stability subscale because the other measures had not yet been introduced into the test battery. These participants were still included in analyses, and maximum likelihood estimation was used to accommodate the missing data.

#### Objective memory

Objective memory ability was assessed with logical memory and word recall tests from the Wechsler Memory

Scale III battery (Wechsler, 1997b), as well as with a paired associates test (Salthouse, Fristoe, & Rhee, 1996). The paired associates test was highly correlated with logical memory ( $r = .51$ ) and word recall ( $r = .60$ ), and the three tests have been used together as a single construct in prior research (e.g., Salthouse, 2009). In the logical memory test, participants listened to two stories, and after each one they were asked to freely recall as many story details as they could. For the second story, participants made two separate recall attempts. In the word recall test, participants listened to a list of words and then were asked to recall the words; they repeated this procedure four times with the same list. In the paired associates test, participants were presented with a series of pairs of words and then were shown one word from each pair and asked to recall the matching word.

#### Procedure

Participants completed the objective memory tasks in a 2-hour laboratory session during which they also completed other cognitive tasks not analyzed in the current report. Participants were told that the purpose of the study was to learn about aging and cognitive functioning. The objective memory tasks were always completed in the same order (i.e., word recall, paired associates, logical memory), though other cognitive measures were given in between these tasks so that tests of the same ability were not presented together. Participants received \$120 as compensation for their time, which included two additional laboratory sessions that are not part of the current report. They completed the questionnaires assessing memory complaints and negative affect (along with other questionnaires not central to the current report) at home after visiting the laboratory.

## Results

### Descriptive statistics

See Table 2 for descriptive statistics and Table 3 for a correlation matrix for the negative affect and memory complaint variables. The average scores on the memory complaint measures were generally similar across age groups, while anxiety and depressive symptoms were somewhat lower in the older age groups and emotional stability was somewhat higher (i.e., neuroticism was lower). The individual measures of memory complaints were correlated with the individual measures of negative affect in all age groups.

### Analytic plan

Using Amos Graphics version 20 (Arbuckle, 2011), latent factors were created for memory complaints, negative affect, and objective memory, each of which was defined by three indicators. This approach had the benefits of more broadly sampling each domain and minimizing measurement error by focusing on the shared variance among the indicators.

To compare the relationship between memory complaints and negative affect, and the moderating role of

objective memory across age groups, it was first necessary to test these three latent factors for age-based measurement invariance. This step ensured that all age-group comparisons would be between analogous constructs. In keeping with Byrne (2004), measurement invariance was defined by the presence of (1) configural invariance and (2) metric invariance. The criteria for configural invariance are met if the same indicators load onto a given latent factor for different groups, based on confirmatory factor analysis (Milfont & Fischer, 2010). Evidence for metric invariance, which indicates construct similarity between groups (Steenkamp & Baumgartner, 1998), is found if indicators have similar factor loadings across groups (Milfont & Fischer, 2010).

### Modeling evaluation criteria

Measurement invariance was tested using structural equation modeling (SEM) with maximum likelihood estimation in Amos Graphics version 20 (Arbuckle, 2011). A model was first constructed within a multi-group framework in which all factor loadings were freely estimated (Model 1) across age groups. For example, a one-factor model of negative affect in which the latent factor was

Table 2. Means and standard deviations by age group.

	18–39	40–54	55–64	65–74	75–99
Memory complaints					
Frequency of forgetting	5.1 (.8)	5.0 (.8)	5.1 (.8)	5.1 (.7)	4.9 (.8)
Seriousness of forgetting	4.3 (1.2)	4.3 (1.3)	4.5 (1.2)	4.4 (1.3)	4.4 (1.1)
Retrospective memory	4.0 (1.1)	3.5 (1.1)	3.5 (1.0)	3.5 (1.1)	3.4 (1.1)
Negative affect					
Anxiety symptoms	38.7 (10.3)	37.7 (10.9)	34.7 (10.2)	31.9 (9.0)	31.9 (9.0)
Depressive symptoms	13.3 (8.5)	12.5 (9.2)	10.5 (8.8)	8.5 (7.1)	9.7 (7.1)
Emotional stability	32.3 (8.0)	33.4 (8.0)	35.1 (8.0)	36.5 (7.5)	36.0 (7.7)

Note: Frequency of forgetting (1: always; 7: never), seriousness of forgetting (1: very serious; 7: not serious), retrospective memory (1: much worse; 7: much better), anxiety symptoms (20–80, higher scores indicate more symptoms), depressive symptoms (0–60, higher scores indicate more symptoms), emotional stability (10–50, higher scores indicate higher emotional stability and lower neuroticism).

Table 3. Correlations among indicators.

		Anxiety symptoms	Depressive symptoms	Neuroticism
18–39	Frequency of forgetting	–.34**	–.35**	–.29**
	Seriousness of forgetting	–.25**	–.24**	–.19**
	Retrospective memory	–.22**	–.19**	–.17**
40–54	Frequency of forgetting	–.38**	–.35**	–.31**
	Seriousness of forgetting	–.23**	–.17**	–.21**
	Retrospective memory	–.23**	–.16**	–.19**
55–64	Frequency of forgetting	–.33**	–.32**	–.22**
	Seriousness of forgetting	–.21**	–.17**	–.14**
	Retrospective memory	–.15**	–.13**	–.15**
65–74	Frequency of forgetting	–.32**	–.36**	–.25**
	Seriousness of forgetting	–.18**	–.15**	–.19**
	Retrospective memory	–.12**	–.14**	–.11*
75–99	Frequency of forgetting	–.44**	–.44**	–.34**
	Seriousness of forgetting	–.27**	–.28**	–.22**
	Retrospective memory	–.20**	–.22**	–.15**

\* $p < .05$ , \*\* $p < .01$ .

comprised of depression, anxiety, and neuroticism scores was estimated for each age group. This model was then compared to a second model (Model 2) in which each factor loading was set to be equal between age groups (e.g., in the case of negative affect, the loading for depression was identical for each age group).

Because each latent factor was comprised of only three indicators, Model 1 was fully saturated, making its fit statistics perfect and, therefore, uninterpretable. Consequently, to assess configural invariance, we examined Model 2's comparative fit index (CFI; Bentler, 1990; range 0 to 1 with 0.95 indicating acceptable fit; Hu & Bentler, 1999) and root mean square error of approximation (RMSEA; Steiger & Lind, 1980; range 0 to 1 with .08 or lower indicating good fit; Browne & Cudeck, 1993). These indices were selected due to their relative independence from sample size (Hong, Malik, & Lee, 2003). To assess metric invariance, we focused on loss of fit between Model 1 (saturated, perfect fit) and Model 2. Because a large sample size can render the  $\chi^2$  likelihood ratio test overly sensitive (Bentler, 1990), we tested for a significant change in the  $\chi^2$  statistic as well as a change in CFI of 0.01 or more between models (Cheung & Rensvold, 2002).

### Memory complaint invariance

As previously discussed, participants were divided into five age groups, corresponding to young (18–39), middle (40–54), young-old (55–64), old-old (65–74), and oldest-old (75–99) age.<sup>2</sup> This allowed measurement invariance to be tested across age groups and conclusions to be drawn regarding the relationship between negative affect and memory complaints at different points in the adult lifespan.

Within a multi-group SEM framework, we first created a single-factor model (Model 1) of memory complaints with three indicators: (1) frequency of forgetting, (2) seriousness of forgetting, and (3) retrospective memory functioning. Next, still within the multi-group framework, we created a second model (Model 2) that was identical to Model 1 in every respect except that each indicator was constrained to have identical loadings across age groups. Regarding configural invariance, Model 2 had excellent fit,  $\chi^2(8, N = 3798) = 10.65$ , CFI = .997, RMSEA = .009, suggesting that a one-factor model was appropriate for all age groups. To test for metric invariance, a  $\chi^2$  difference test was conducted between Models 1 and 2, which indicated a non-significant loss of fit ( $p = .222$ ). Further evidence for metric invariance was a decrease of only .003 in CFI between Models 1 and 2. In sum, a one-factor model of memory complaints fit the data well and was found to be age-invariant.

### Negative affect invariance

Identical analyses were conducted for negative affect, which, similarly, was modeled as a single latent factor with three indicators: (1) trait anxiety, (2) depression, and (3) neuroticism. Again, Model 2 demonstrated configural invariance,  $\chi^2(8, N = 3798) = 11.99$ , CFI = .999, RMSEA = .011, indicating that a one-factor solution was

adequate for all age groups. Regarding metric invariance, the change in CFI between Models 1 and 2 was small (.003), and the  $\chi^2$  difference test indicated a non-significant loss of fit in Model 2 ( $p = .152$ ); therefore negative affect was also age-invariant.

### Objective memory invariance

Lastly, we tested measurement invariance for objective memory. Again, three indicators were used to define the latent factor: (1) logical memory, (2) word recall, and (3) paired associates. Model 2 indicated good fit and, therefore, configural invariance,  $\chi^2(8, N = 3798) = 39.87$ , CFI = .989, RMSEA = .030. However, CFI was more than .01 lower in Model 2 than in Model 1, and the  $\chi^2$  difference test indicated a significant loss of fit ( $p < .001$ ). We ran follow-up analyses comparing Model 1 with Model 2 between each pair of age groups (e.g., 18–39 vs. 40–54) to identify any metric invariant groups. This resulted in a total of 10 comparisons. Using change in CFI and significant change in  $\chi^2$  as our criteria, comparisons between the oldest-old group and each of the other groups indicated a loss of fit between Models 1 and 2 (CFI declined by .01 to .032). Therefore, it was decided that the objective memory construct varied between the oldest-old group and the rest of the sample.

### Computation of objective memory and memory complaint factor scores

To examine objective memory as a moderator of the relationship between memory complaints and negative affect, it was necessary to compute objective memory and memory complaint factor scores. We created regression-based factor scores for objective memory using the appropriate factor score weights based on age group (i.e., either 18–74 or 75–99, as the latent objective memory score factor was found to differ among these groups). Given that memory complaints were found to be age-invariant, factor scores were computed for all participants combined.

### Relationship between memory complaint and negative affect

Having established that memory complaints and negative affect are age-invariant across the given age groups, we next built five identical structural equation models (one per age group) to estimate the correlation between the two latent factors (see Figure 1). There was a moderate, significant negative correlation for each age group, indicating that higher negative affect was associated with more memory complaints: 18–39 =  $-.55$  (SE = .05), 40–54 =  $-.51$  (SE = .04), 55–64 =  $-.45$  (SE = .05), 65–74 =  $-.46$  (SE = .06), 75–99 =  $-.64$  (SE = .07), all  $ps < .001$ . Follow-up group comparisons revealed no significant differences between groups in correlation magnitude, using both change in  $\chi^2$  and CFI as criteria.

### Testing moderation by objective memory

To determine whether objective memory moderated the relationship between memory complaints and negative

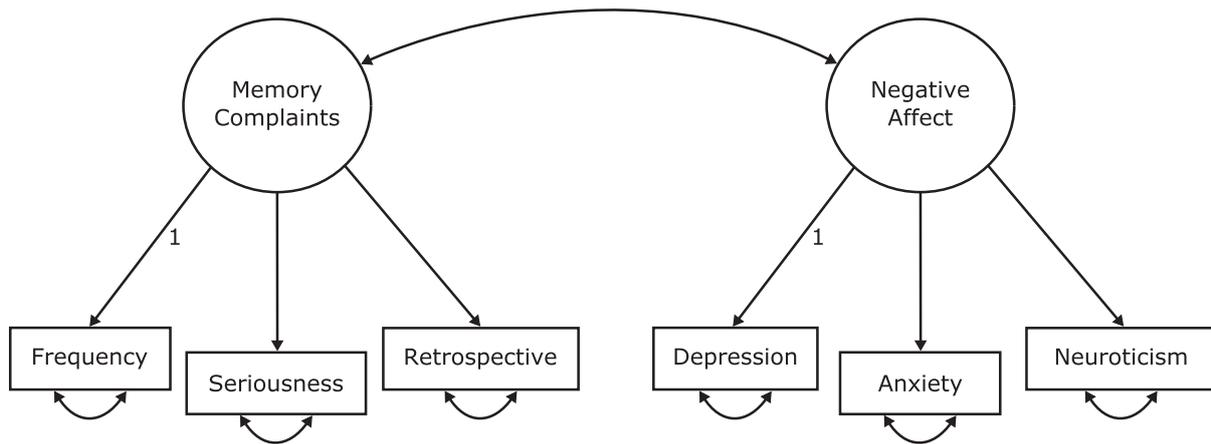


Figure 1. Model of the relationship between memory complaints and negative affect.

affect and whether this varied across age groups, we constructed a model within a multi-group framework using the objective memory and memory complaints factor scores, as well as their interaction (formed by the cross product of the two predictors), as predictors of negative affect (see Figure 2). We compared a model where the paths to negative affect from objective memory, memory complaints, and their interaction were constrained to be equal across age groups (Model 2) to a model where they were freely estimated (Model 1). Model 2 had good fit  $\chi^2(42) = 75.97$ , CFI = .995, RMSEA = .012, and did not show loss of fit from Model 1. The  $\chi^2$  difference test was significant ( $p = .002$ ), but favored Model 2, and change in CFI was minimal ( $\Delta\text{CFI} = .003$ ). Therefore, there was no difference in the moderation effect between age groups. And importantly, in Model 2 there was no evidence of moderation (i.e., the pathway from the interaction term to negative affect was non-significant)<sup>3</sup>, nor did objective memory predict negative affect. However, memory complaints and objective memory were significantly correlated for all age groups (18–39:  $r = .17$ ; 40–54:  $r = .18$ ; 55–64:  $r = .11$ ; 65–74:  $r = .15$ ; 75–99:  $r = .24$ ; all

$ps < .01$ ), though, as expected, the magnitude of these correlations was smaller than the correlations observed between memory complaints and negative affect.

### Discussion

In this study, we examined the relationship between memory complaints and negative affect in young, middle-aged, young-old, old-old, and oldest-old adults. On average, levels of memory complaints were similar across the age groups. Additionally, the constructs of memory complaints (composed of frequency of forgetting, seriousness of forgetting, and retrospective memory) and negative affect (composed of depressive symptoms, anxiety symptoms, and neuroticism) had the same structure across the age groups.

Importantly, despite other research showing increases with age in the fear of developing Alzheimer's disease (Cantegreil-Kallen & Pin, 2012) and the salience of memory concerns for older adults (e.g., Dark-Freuderman et al., 2006), the relationship between memory complaints and negative affect was not stronger for older adults than

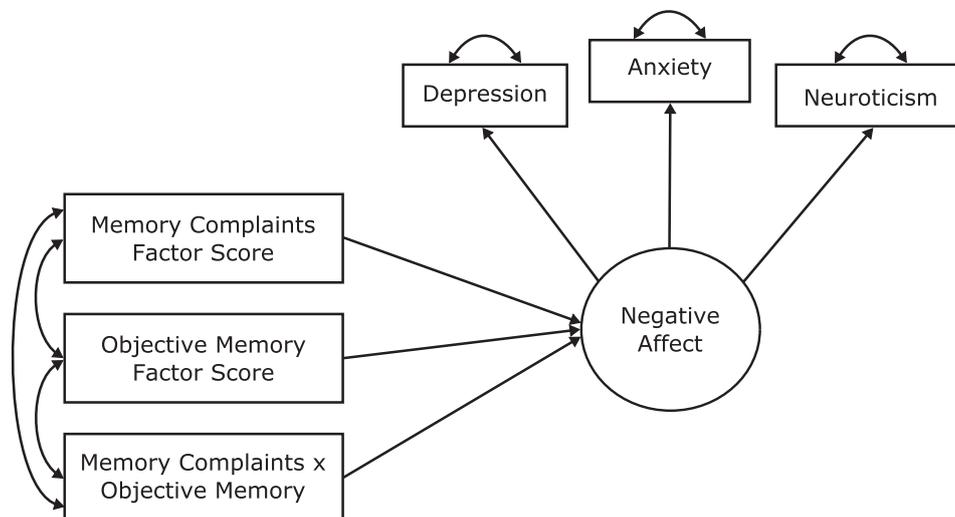


Figure 2. Model of moderation by objective memory on the relationship of memory complaints and negative affect.

for adults of other ages in our sample. Nor was the relationship stronger in young adults even though there is a greater association of memory impairment and depression in younger (compared to older) depressed patients (Burt et al., 1995; though see Castaneda, Tuulio-Henriksson, Marttunen, Suvisaari, & Lönnqvist, 2008). In fact, the relationship between memory complaints and negative affect was moderate in all five age groups.

Given that there is typically only a weak relationship between memory complaints and objective memory performance (Crumley et al., 2014), others have highlighted that treatment of individuals presenting with memory complaints might need to focus on patients' perceptions of their memory, rather than solely their objective performance (e.g., Pearman & Storandt, 2005). Though clinicians who work with depressed older adults are likely already aware of the link between negative affect and memory complaints (indeed, the Geriatric Depression Scale includes an item assessing memory complaints; Yesavage et al., 1982), our findings suggest the need for clinicians to be mindful of the relationship between mood and memory complaints for young and middle-aged adults, as well.

The relatively stable relationship between negative affect and memory complaints across age groups underscores the importance of assessing both domains, regardless of age, rather than assuming greater ties with age. Thus, among non-cognitively impaired individuals, elevated negative affect may be just as likely to signal memory concerns for young adults as it is to signal memory concerns for older adults. An interesting clinical question concerns whether change in one domain will be causally linked to change in the other domain in comparable ways for young and older adults. For example, will a clinician who uses cognitive restructuring techniques to address distorted concerns about memory or self-efficacy based memory training (McDougall et al., 2010) be as effective at reducing related negative affect for young and older adults? Alternatively, will treatments that improve negative affect lead to a decrease in memory complaints, and if so, to the same extent at different ages?

It is possible that while perceiving problems in memory functioning is distressing at any age, the reason for the distress may differ. For example, middle-aged and older adults may experience this distress related to concerns with developing dementia (Cantegreil-Kallen & Pin, 2012; Cutler & Hodgson, 2001), whereas young adults may be distressed by the perceived non-normative nature of memory concerns. Considering the relationship in the opposite direction, throughout adulthood, depression may impact memory complaints by influencing perceived self-worth and doubt (Blatt et al., 1982), and neuroticism may lead people to interpret minor memory errors as important and complain about them more. However, conclusions regarding the direction of the relationship of memory complaints and negative affect are beyond the scope of this study, and it will be helpful in future research to include measures of self-worth, doubt, and additional personality traits to test their potential mediating role.

Additionally, it will be useful in future work to more fully assess both expectations of and actual indicators of

health, particularly as they relate to aging. For instance, stereotypes about aging and cognitive decline may influence both mean level responses and the magnitude of the relationship of memory complaints and negative affect. This issue is intriguing given findings that holding more negative age stereotypes (e.g., 'Old people are absent-minded') is associated with a faster rate of objective memory decline in old age (Levy, Zonderman, Slade, & Ferrucci, 2012), and subjectively feeling older is related to having more memory complaints for adults over 70 years old (Pearman et al., 2014). It will also be valuable in future studies to include a measure of chronic illness given prior findings that people with a greater number of chronic illnesses may have both more memory complaints (Comijs, Deeg, Dik, Twisk, & Jonker, 2002) and more negative affect (Geerlings, Beekman, Deeg, & Van Tilburg, 2000) as a result of their illness.

We found that among cognitively healthy individuals, actual memory performance did not moderate the relationship between memory concerns and negative affect. Thus, we found no evidence to suggest that having high objective memory performance would provide protection against developing memory complaints when one is experiencing negative affect. Of course, a potential limitation in the generalizability of our results is that most of our participants were high functioning and not experiencing severe memory problems. Thus, it is possible that the relationships would be different among individuals experiencing cognitive impairment or in clinical samples (i.e., anxiety or mood disorders).

There are also some limitations of our measures that should be considered. First, while the MFQ and MAC-S are both commonly used research tools, assessments with fewer memory-specific questions may be more common in clinical settings (e.g., Geriatric Depression Scale). The advantage of the questionnaires used here is that by having multiple items, they have greater reliability and cover a wider array of everyday memory experiences. Second, a general challenge when assessing memory complaints is that it can be difficult to know how participants anchor their responses (e.g., assessing their memory relative to others, or to themselves at an earlier time). That said, some of our memory complaint items used explicit anchors (e.g., 'How would you describe your memory, on the whole, compared to the best it has ever been?'), which addresses this concern better than more general questions, such as 'Do you consider yourself as being forgetful?' Third, the use of self-report measures of negative affect and memory complaints means that the relationship between affect and memory complaints may in part reflect social desirability (Lineweaver & Brolsma, 2014) or response bias.

Despite these limitations, this study also had numerous strengths, including a large sample size that included participants across the adult lifespan, as well as the use of latent variables to decrease measurement error. In this large sample, adults across the lifespan showed a similar relationship between memory complaints and negative affect. Clinically, this indicates that age may not be a key consideration when determining whether an individual

with memory complaints is suffering from depressive or anxiety symptoms, or is in need of cognitive testing. Regardless of age, feeling as though one's memory is declining may be upsetting, and/or the influence of negative affect on self-worth may lead to negative self-evaluations of memory.

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### Notes

1. The MFQ Retrospective Functioning items ask participants to rate their memory compared to different numbers of years prior (e.g., 5 years ago, 20 years ago, etc.), which raised concerns that such ratings from younger participants may not be valid (i.e., asking an 18-year-old to compare his or her memory functioning to 5 years ago is not equivalent to asking a 70-year-old the same question). For this reason, the single MAC-S item was used to represent retrospective functioning. The correlations in the different age groups between this single question and the mean for the Retrospective Functioning items from the MFQ ranged from .53 to .63.
2. Two additional sets of age groups (18–39, 40–59, 60–69, 70–99 and 18–39, 40–64, 65–99) were tested. The results for measurement invariance and the relationship between memory complaints and negative affect using these groups did not vary substantially from the results reported here.
3. Two additional sets of age groups (18–39, 40–59, 60–69, 70–99 and 18–39, 40–64, 65–99) showed the same pattern of results.

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