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The Influence of Age and Depression on Episodic Memory Functioning in Adulthood

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THE INFLUENCE OF AGE AND DEPRESSION ON EPISODIC MEMORY FUNCTIONING IN ADULTHOOD

By

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Abstract

Previous research suggests that depression in old age results in deficits in both encoding and retrieval in episodic memory tasks. There is also a general understanding that memory function declines with age, with older adults being the most affected. The focus of this data analysis is to examine a possible interaction between age and depression on episodic memory performance. A multiple regression approach was used to analyze previous data from CREATE I which includes a sample size of 1,204 participants between the ages of 18-91. Age and depressive affect had significant negative effects on episodic memory performance, and these two factors interacted, showing that depressive affect had little impact at young ages but increasingly affected those at older ages. Results suggest that interventions to reduce depressive affect in older populations may also contribute to improved episodic memory performance.

Introduction

The effect of age on memory has been a focus for many years. Memory decline is associated with normal aging. Memory is a complex concept that psychologists have differentiated into many types of memories, one of them being episodic memory. Episodic memory is defined as "memory for information, facts, or events that have an experiential time or place associated with them" (Siedlecki, 2007, p.251). Substantial research shows that memory declines with age. A meta-analysis by Verhaeghen (Marcoen, & Goossens, 1993) included list recall, paired list recall, and prose recall to measure episodic memory performances. Their findings show that episodic memory performance of older adults is poorer than that of young adults. Although, there is extensive research that focuses on memory decline with age, the joint influence of age and depression on episodic memory functioning is still unclear. Research shows that old age depression results in deficits in both encoding and retrieval in episodic memory tasks, and there appear to be more deficits for tasks that involve high demands on effortful, elaborative activities at encoding (Fossatti et al., 2004). Research also indicates that depressed patients as opposed to non-depressed patients, with a mean age of 83.3, have difficulties using organizational structure when encoding information (Watts et al., 1990), fail to benefit from visual imagery (Hart et al., 1987) and do poorly when long memory lists are used as study materials (Henry, Weingartner, & Murphy, 1973). A potential reason for these deficits is that depression arises from abnormal functioning in certain areas of the brain that are also associated with memory. The hippocampus, a brain region associated with memory, mediates cognitive aspects of depression-like memory impairments (Nestler et al., 2002).

Depression interferes with memory performance for reasons aside from brain abnormalities such as poor motivation and low levels of arousal (Backman, Hill, & Forsell, 1996) which results in

less effort to perform tasks. A review of episodic memory functioning in a community-based sample of old adults with major depression indicates that depression results in deficits in recall and recognition of episodic information (Backman & Forsell, 1994). One could argue that the presence of intrusive thoughts may distract the individual from focusing on the task and retrieving information available in memory. This research focused on the older population, but there is a general understanding that rates of depression show a "curvilinear component with age" (Newmann, 1989, p.152), meaning that depression does increase with age, but it is less evident in the younger and older populations. Based on these findings, it is fair to conclude that both age and depression are important factors that can contribute to poorer episodic memory performance.

The purpose of this study is to assess hypotheses about the relationship between age and depressive affect by analyzing data from Center of Research and Education on Aging and Technology Enhancement (CREATE I) with a large non- representative, but diverse sample of 1,204 participants ranging from 18-91 years of age. The data collection includes a composite objective score for episodic memory, and a depression score from the CES-D Scale. The analysis explores possible interactions between depression and age and its effect on episodic memory performance across the lifespan. We tested the hypothesis that both increased adult age and increased depression levels are negatively associated with episodic memory performance. A second hypothesis tested was that depression is more disruptive to older adults than to younger adults for episodic memory performance. These variables, age and depression, will make independent (H_1: as age and depression levels increase, memory performance will decrease) and interactive (H_2: both increased adult age and increased depression levels will be multiplicatively negatively associated with episodic memory performance). We test these hypotheses by assessing whether there are significant beta weights for each factor and their cross-product term in a multiple regression analysis.

Methodology

Specific data from the CREATE I dataset was analyzed, and the interaction between the variables was assessed through a multiple regression analysis. The sample included 1,204 participants between the ages of 18-91. Table 1 shows the demographic characteristics of the sample group. Participants were administered a series of questions to rate their general health, and given standardized tests of cognitive abilities, psychic distress, and depression (Czaja et al., 2006). Depression was measured using the CES-D scale which is an indicator for depressive symptomatology through short self-reports based on how the participant has felt in the past week in terms of depressive symptoms. Possible scores range from zero to 60 with the higher scores indicating more depressive symptoms. The composite score for episodic memory performance is a unit weight of four standardized scores of two California Verbal Learning Test (CVLT) measures, plus meaningful memory scores and digit symbol recall. The measures chosen are widely used in the literature and have demonstrated reliability and validity (Czaja et al., 2006, p. 336). The hypotheses were tested based on the best-fitting equation for a regression, where the two predictor variables, age and level of depression, were entered first, then a cross-product of age and depression in a step-wise procedure. The first hypothesis, that episodic memory is affected by both age and level of depression will be supported if each variable has a significant beta weight. The second hypothesis, that these two variables interact, will be supported if the cross-product term has a significant beta weight.

Table 1
Sample Description

	Younger	Middle Aged	Old
Number	470	273	461
Age (M,SD)	22.02 (4.69)	49.93 (4.50)	70.49 (5.12)
Gender			
Male	177	97	180
Female	239	176	281
Education***			
≤ High school	19%	13%	15%
Some College	74%	40%	31%
College degree	4%	21%	22%
Postcollege degree	3%	26%	33%
Ethnicity***			
White/European Americans	52%	57%	81%
Black/African Americans	15%	25%	11%
Hispanic/Latino Americans	17%	13%	5%
Other	17%	6%	3%

** $p < .01$. *** $p < .001$.

Note. Demographic information. Reprinted from "Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE)" by Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J, 2006, *Psychology and Aging*, *21*, 333-352.

Results

It is difficult to interpret multiple regressions when variables are naturally correlated. Therefore, to avoid collinearity issues, we excluded the outlier cases that can affect the regression estimates, and we centered the age and depression variables. We created a product term from the previous centered variables, and ran the regression to determine the interactive contribution to episodic memory performance. Tables 2 and 3 compare the regressions with centered and uncentered variables. The regression for the uncentered variables showed a VIF value greater than five and a tolerance value closer to zero, particularly for the cross-product term and CESD (depression) variables, indicating that there would have been multicollinearity issues if the variables were not centered. Therefore, Z-scores were the appropriate measurements for this regression.

Table 2. *Multiple Regression of Episodic Memory Performance, uncentered Age and CES-D variables.*

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	.841	.081		10.328	.000	.682	1.001					
Age	-.016	.002	-.457	-10.726	.000	-.019	-.013	-.531	-.298	-.263	.330	3.026
CESD	.007	.007	.064	1.087	.277	-.006	.020	.028	.032	.027	**.173**	**5.782**
Product of Age*CESD	.000	.000	-.155	-2.445	.015	-.001	.000	-.290	-.071	-.060	**.150**	**6.675**

Table 3. *Multiple Regression of Episodic Memory Performance, Age and CES-D.*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	-.007	.020		-.370	.711	-.046	.031					
Zscore: Age	-.428	.020	**-.543**	-21.805	.000	-.466	-.389	-.531	-.536	-.535	.970	1.031
Zscore: CESD	-.058	.020	**-.074**	-2.946	.003	-.097	-.019	.028	-.085	-.072	.956	1.046
Product term of ZAge_ZCESD	-.051	.021	**-.060**	-2.445	.015	-.091	-.010	-.056	-.071	-.060	.986	1.014

Total variance, $R^2 = 0.288$; 29% of variance.

Results showed three significant negative beta weights for predicting episodic memory performance. As shown, in Table 3, age shows a strong negative correlation with performance, beta = -0.543 ($p < 0.05$) a stronger relationship than either depression or the age by depression cross-product term. The beta coefficient for the impact of depression on episodic memory performance was -0.074 ($p < 0.05$) indicating that there is a negative relationship with depression and performance. The product term of age and depression shows a negative beta weight for predicting episodic memory performance, -0.060 ($p < 0.05$), which suggest that depression has a stronger effect on episodic memory performance for older individuals as discussed below. The three predictors accounted for 29% of the variance in episodic memory performance, $R^2 = 0.288$, $F\ (3,1182) = 160.479$, $p < 0.05$.

An equation was computed to predict episodic memory performance from age and depression using the standardized beta coefficients from the regression, where M is episodic memory performance, β_1 is the regression coefficient for age, β_2 is the coefficient for depression and β_3 is the coefficient for the product of age and depression.

$$M = \beta_1(\text{Age}) + \beta_2(\text{Dep}) + \beta_3(\text{AgeDep})$$

$$M = (-0.543)(\text{Age}) + (-0.074)(\text{Dep}) + (-0.060)(\text{AgeDep})$$

To visualize the interaction, slopes for the relationship between age and episodic memory were created by partitioning age into values of +1 standard deviation unit, considered high age, 0 as average age and -1 as low age, and the same values assigned for depression levels (+1, 0, -1). These terms were replaced as values for the two predictor variables into the equation in a Microsoft excel spreadsheet. The values were plotted to portray a linear trend, as shown in Figure 1. As can be seen, level of depressive affect has virtually no effect for younger adults on episodic memory performance (points cluster together on the upper left of the graph). However, at the average age in the sample, the lines for depressive affect level begin to separate, and at a high age, depressive affect has a clear effect on episodic memory performance, with those reporting higher levels of depressive affect showing lower levels of memory performance. At that point, those with high depressive affect perform about 0.3 SD units worse than those with low depressive affect.

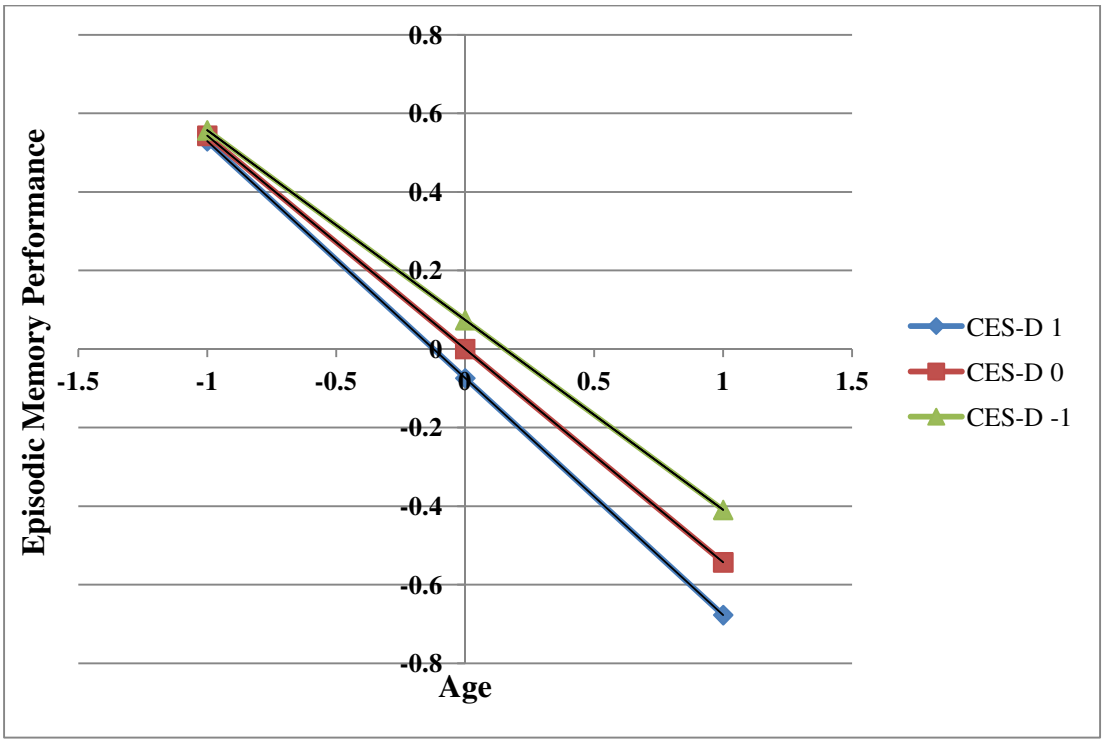

Figure 1. Plot of the interaction of age and depressive affect on episodic memory performance.

Discussion

The purpose of this analysis is to determine the relationships between age, depression, and episodic memory performance in a large, diverse community-dwelling sample. This was accomplished by running a multiple regression of age, depression and the interaction term of age and depression. Based on evidence from previous research, there was still an unclear picture as to whether there was a relationship between depression, age and episodic memory performance; no interaction has been tested. Results from this multiple regression helps clarify this relationship. This analysis reinforces the prior research, like those of Backman's (1994), who found that old–age depression results in episodic memory deficits. Previous research also shows that old-age depression results in deficits in both encoding and retrieval for episodic memory tasks (Fossatti et al.,2004). What makes this analysis particularly different from other literature is the interactive effect of age and depression, which shows

that the depressive affect has its strongest impact on the upper end of the life span. Overall, there are consistent findings that show episodic memory performance has a strong negative relationship with age, and that depressive affect has a negative association with episodic memory. It is important to emphasize that these findings do not indicate a causal relationship between depression and episodic memory performance.

Limitations

Using a non-representative sample of 1,204 participants limits generalizability. Because data was collected from the CREATE I dataset, the sample was diverse but non-representative for the analysis. Having a large sample size was beneficial because results turned out to be significant, even with weak effects shown for the depression variable and interaction term. Future research is needed with representative samples. Also, to assess reliability, replication of the analysis in a different sample is recommended.

Implications

The analysis can lead to future research to explore the clinical aspect of the finding to enhance treatment and memory improvement (cognitive support) for depressed individuals, specifically for the older population. Knowledge about the effects of depression on episodic memory performance would be useful given episodic impairment is the earliest deficit in Alzheimer's disease. An experimental study would be suitable to explore the possible causal link between depression and poor episodic memory performance in aging individuals. This would also be an important step in supporting interventions to treat depression, enhance memory performance, and create a better quality of life for the elderly.

References

Bäckman, L., & Forsell, Y. (1994). Episodic memory functioning in a community-based sample of old adults with major depression: Utilization of cognitive support. *Journal of Abnormal Psychology, 103*(2), 361-370.

Bäckman, L., Hill, R. D., & Forsell, Y. (1996). The influence of depressive symptomatology on episodic memory functioning among clinically nondepressed older adults. *Journal of Abnormal Psychology, 105*(1), 97-105.

Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J. (2006). Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and Aging*, *21*, 333-352.

Fossati, P., Harvey, P., Bastard, G. L., Ergis, A., Jouvent, R., & Allilaire, J. (2004). Verbal memory performance of patients with a first depressive episode and patients with unipolar and bipolar recurrent depression. *Journal of Psychiatric Research, 38*(2), 137-144.

Hart, R. P., Kwentus, J. A., Hamer, R. M., & Taylor, J. R. (1987). Selective reminding procedure in depression and dementia. *Psychology and Aging, 2,111*-115.

Henry, G., Weingartner, H., & Murphy, D. L. (1973). Influence of affective states and psychoactive drugs on verbal learning and memory. *American Journal of Psychiatry, 130,* 966-971.

Newmann, J. P. (1989). Aging and depression. *Psychology and Aging, 4*(2), 150-165.

Nestler, E.J., Barrot, M., DiLeone, R.J., Eisch, A.J., Gold, S.J., & Monteggia, L.M. (2002). Neurobiology of Depression. *Journal of Neuron*, *34*, 13-25.

Siedlecki, K. L. (2007). Investigating the structure and age invariance of episodic memory across the adult lifespan. *Psychology and Aging, 22*(2), 251-268.

Verhaeghen, P., Marcoen, A., & Goossens, L. (1993). Facts and fiction about memory aging: A quantitative integration of research findings. *Journals of Gerontology, 48*(4), P157-P171.

Watts, F. N., Dalgleish, T, Bourke, P., & Healy, D. (1990). Memory deficit in clinical depression: Processing resources and the structure of materials. *Psychological Medicine, 20,* 345-349.