Age-related changes in word retrieval vary by self-reported anxiety but not depression symptoms

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Abstract

Tip-of-the-tongue states (TOTs) are known to increase in frequency across adulthood, but there is wide variability in older adults' TOT rates, suggesting that individual difference factors contribute to TOT incidence. We investigated the role of affect by examining the relationship between self-reported anxiety and depression symptoms and the frequency of TOTs during a laboratory task. Participants were young, middle-aged and older adults in a population-based sample of adults aged 18 – 87. Increased anxiety was associated with fewer TOTs for the middle-aged group but more TOTs for the older adult group. There was no relationship between anxiety and TOTs for younger adults and no relationships between depression symptoms and TOT incidence for any age group. We discuss our results in terms of attentional control theory, which provides an explanation of how age may affect the relationship between anxiety and TOTs.

Introduction

Normal aging is accompanied by an increase in word finding failures known as "tip of the tongue" states (TOTs; Burke, MacKay, Worthley, & Wade, 1991). TOTs result from a temporary failure to access phonological representations during word retrieval, and this phonological access becomes more vulnerable to failure with increasing age (Burke, MacKay, & James, 2000; Burke et al., 1991). Additionally, older adults take longer to resolve TOTs (Burke et al., 1991), and evidence from fMRI demonstrates age-related deficits in recruiting the cognitive control systems necessary for TOT resolution (Shafto, Stamatakis, Tam, & Tyler, 2010).

Although the age-related increase in TOTs is reliable, there is a great deal of individual variability in TOT rates amongst older adults, and understanding these individual differences is important for supporting successful word retrieval. The current study examined self-reported trait anxiety and depression symptoms as two possible sources of individual differences in TOT incidence. We assessed these relationships across the adult lifespan in order to understand whether individual differences in affect contribute to the age-related increase in TOTs.

Previous studies provide a complex picture regarding the link between affect and cognition in older adults. While many studies support a linear relationship between increasing depressive symptoms and declining cognitive performance (Bierman, Comijs, Jonker, & Beekman, 2005; Bunce, Batterham, Christensen, & Mackinnon, 2014; Dotson et al., 2014; Lockwood & Alexopoulos, 2002; Mantella et al., 2007), the evidence from measures of anxiety is less consistent. Whereas some studies of older adults find that increased trait anxiety is associated with impaired cognition (Beaudreau & O'Hara, 2009; Mantella et al., 2007; Williams et al., 2016), there is also evidence for the opposite pattern, that higher anxiety is associated with better performance (Dotson et al., 2014).

Inconsistent findings may be in part due to the limited number of studies examining anxiety compared to depression, as well as the wide range of cognitive tasks examined, including those measuring processing speed and inhibition (Beaudreau & O'Hara, 2009), cognitive control (Beaudreau, MacKay-Brandt, & Reynolds, 2013), learning and delayed recall (Bierman et al., 2005), and working memory and attention (Dotson et al., 2014). However, these findings may also reflect a broader pattern of curvilinear relationships between anxiety and performance, which are frequently interpreted in the context of the Yerkes Dodson model (Yerkes & Dodson, 1908). In this model, optimal performance is associated with moderate levels of arousal, while high levels of arousal are associated with declines in performance as attentional resources become overtaxed. Understanding how individual differences in anxiety symptoms relate to TOT rates therefore requires understanding both how anxiety levels and attentional resources are affected by age.

In the current study, anxiety and depression were measured using the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), which was found to have only small relationships to age in a large norming study (Crawford, Henry, Crombie, & Taylor, 2001). Thus, in the current study, differences in the effect of anxiety symptoms on cognition cannot necessarily be explained as due to age-related changes in the severity or frequency of anxiety symptoms. Indeed, previous evidence that older adults' cognition is particularly impaired by anxiety relative to younger adults has been explained using *attentional control theory* (Beaudreau & O'Hara, 2009; Bierman et al., 2005). Under this account, increased levels of trait anxiety can interfere with aspects of attentional control that contribute to executive function (e.g., Eysenck & Derakshan, 2011), and age-related declines in attentional control (Salthouse, 2009) mean that older adults' performance on cognitive tasks is differentially vulnerable to the additional attentional load created by anxiety (Beaudreau & O'Hara, 2009). This framework predicts that amongst older adults, even

moderate increases in anxiety symptoms could interfere with performance while the same levels of anxiety for younger people may have no effect or facilitate performance. In response to the possibility that anxiety may differentially impact older adults' cognition, the current study tested how age affects the relationship between affect and TOTs; in response to evidence that the effect of anxiety may reverse across the adult age range, we additionally tested for quadratic interactions with age.

Although the link between attentional control theory and anxiety has not been tested in the context of age-related increases in TOTs, there is evidence from fMRI that attentional control is critical for TOT resolution as younger adults recruit cognitive control systems in response to TOTs (Maril, Wagner, & Schacter, 2001; Shafto et al., 2010). Older adults under-activate these systems during TOTs which is linked to increased TOT incidence (Shafto et al., 2010), suggesting that age-related declines in attentional control may create a vulnerability to the effects of anxiety.

Participants in the current study were an adult lifespan, population-based sample of adults aged 18-87 who were part of the Cambridge Centre for Ageing and Neuroscience project (Cam-CAN; for protocol see Shafto et al., 2014). As such, our sample includes primarily participants with subclinical levels of anxiety and depression (see Results), differing from many studies of mental health and aging which focus primarily on clinical populations (e.g., Beekman et al., 2000). Using this representative sample is in keeping with studies that have highlighted the link between cognitive performance and subclinical measures of anxiety and depression symptoms (e.g., Beaudreau & O'Hara, 2009; Stillman, Rowe, Arndt, & Moser, 2012).

Finally, the current study aimed to differentiate the roles of depression and anxiety symptoms, which can be difficult to separate as depression and anxiety are frequently comorbid (Beekman et al., 2000; Schoevers, Beekman, Deeg, Jonker, & Van Tilburg, 2003).

Despite this, studies that have measured both sets of symptoms suggest that anxiety and depression may not only independently predict cognitive performance (Yochim, Mueller, & Segal, 2013) but may affect different underlying cognitive processes (e.g., Beaudreau & O'Hara, 2009; Mantella et al., 2007; Williams et al., 2016). Similarly, age may differentially interact with the effects of anxiety and depression: for example, whereas the effect of depression symptoms may strengthen with age (Bierman et al., 2005; Dotson et al., 2014; Lockwood & Alexopoulos, 2002), the effect of anxiety symptoms may reverse from younger to older adults (Dotson et al., 2014). In the current study, we examined the roles of anxiety and depression symptoms jointly in order to clarify their independent contributions to TOT rates, including how they may uniquely interact with age.

Method

Participants

Participants were between the ages of 18-87 years and came from the Cam-CAN cohort, a population-based sample of cognitively healthy adults. A total of 708 participants in the cohort completed detailed cognitive testing, and the current sample completed both a TOT task and measures of anxiety and depression (N = 643; see Table 1). This is a largely overlapping sample of Cam-CAN participants as described in a previous examination of TOT performance by Shafto, James, Abrams, Tyler, and Cam-CAN (Shafto, James, Abrams, & Tyler, 2017). For some analyses we created younger (18-39 years; N=155), middle-aged (40-64 years; N=266), and older adult (65-87 years; N=222) groups based on conventional age divisions in the cognitive aging literature, and further characteristics of the age groups are presented in Table 1.

Participants were recruited equally across seven deciles from age 18 to 87, and equivalent numbers of men and women were recruited within each decile (50% female in the whole sample; 51% of younger adults, 52% of middle-aged adults, and 47% of older adults).

Participants were not excluded for self-reported diagnosis of anxiety disorders or depression, but were excluded for serious psychiatric disorders (e.g., schizophrenia), neurological disorders (e.g., Parkinson's Disease), or poor performance (scoring 24 or below) on a dementia screening task (Folstein, Folstein, & McHugh, 1975).

[Table 1 here]

Materials and Procedure

To measure TOTs, participants responded to 50 faces of public figures (e.g., actors, politicians, and athletes) that were pretested for participants' ability to generate correct and TOT responses. Faces were included that had been previously pretested with 9 young and 11 older adults to avoid floor effects (i.e., high Don't Know rates). TOT materials were the same as reported in Shafto et al. (Shafto et al., 2017). Participants had 5 s to say the name of each pictured person, to indicate they did not know the name, or to indicate that the name was on the tip of their tongue (TOT). Participants were given 10 practice trials before the main experiment, which began with an additional 10 "lead in" trials that were not included in analyzed results, in order to assure that participants were comfortable with the response requirements. Following Gollan and Brown (2006), all of our analyses use a measure of TOTs as a ratio of known names (TOTs / [TOTs + correct names]). This ratio measure allows TOT rates to be calculated only for stimuli where participants knew the name, which helps control for differences in knowledge that may affect a population-based adult lifespan sample such as in the Cam-CAN cohort.

Anxiety and depression symptoms and TOTs were measured as part of a wide range of cognitive testing in the Cam-CAN project. Shafto et al. (2014) describe the full battery of epidemiological and neurocognitive tests. Participants completed the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). Participants responded to 14 questions on their typical mental state (e.g., *I feel tense or "wound up*") on a 4-point scale (*Never* to

Most of the time), and there are two subscales scored separately for anxiety (7 questions) and depression (7 questions). Scores are continuous but can be used categorically as an aid to diagnosis, where for the anxiety and depression subscales separately, scores 0-7 are "normal", 8-10 are "borderline" or "mild", 11-15 are "moderate" and 16 or above are "severe". Participants were not excluded from Cam-CAN participation for having high scores on the anxiety or depression subscales of the HADS questionnaire.

Two background measures were used as control variables in the analyses. First, participants responded to a yes/no "memory concern" question, "Do you feel you have any problems with your memory?". We included this measure as a covariate because older adults may have greater anxiety than younger adults during the TOT task due to worries about age-related memory declines. If so, this task-related anxiety could interfere with the effects of our trait anxiety measure of interest.

Second, participants provided details about their educational attainment, specifically whether they had a university degree. University attainment was used to control for differences in education levels across age groups which may affect general knowledge. We used university attainment in our analyses as a binary measure of education to capture a meaningful transition in level of educational attainment (Shafto et al., 2017).

As with Cam-CAN's testing materials, a full description of testing procedures is given in Shafto et al. (2014). Most relevant for the current study, cohort members were assessed for their eligibility to participate during an initial interview session conducted in their home or other place of their choosing. The HADS was administered during this session where university education and the memory concerns question were also assessed, along with a range of demographic, health and lifestyle factors, and basic cognitive function. The TOT task was administered in a laboratory setting in a testing session including other cognitive experiments which always occurred on a separate day following the initial interview session.

Analysis overview

Our main analyses involved a series of regressions for which the dependent measure was TOTs, and key predictor variables were measures of affect (anxiety and depression symptoms) and age. All regressions were controlled for self-reported memory concerns and university education. In all regression models, continuous independent variables (anxiety symptoms, depression symptoms, and age) were mean-centered to avoid multicollinearity and improve interpretation of interactions.

The key aims of this study were to examine how the relationship between affect and TOTs changes over the adult lifespan and whether there are unique contributions of anxiety and depression symptoms. Consequently, we first conducted a two-step regression analysis, in which control variables (education and memory concerns) were entered in the first step, and the second step contained main effects of age and affect (anxiety and depression symptoms) as well as all linear and quadratic interaction terms between those variables (see Table 3). Education and memory concerns were entered first to determine whether our key predictors have effects over and above these control variables. Including the main effects and interactions in the second step allowed us to test not only the age x affect interactions that were central to our hypotheses, but also the independent contributions of anxiety and depression symptoms which are known to be related to each other. Interaction terms were calculated for quadratic as well as linear expressions of age because of previous evidence that the direction of the effect of affect may change across the lifespan (Beaudreau & O'Hara, 2009; Dotson et al., 2014; Mantella et al., 2007; Williams et al., 2016).

Second, to aid in the interpretation of continuous age interactions, a second set of regression analyses was conducted within young, middle-aged, and older age groups. These analyses also help contextualize the current results in terms of previous TOT research, which

has primarily relied on data from discrete age groups. Although studies of aging and TOTs do not often involve continuous age ranges including middle-aged participants, our younger and older groups' age ranges are typical of previous research (Farrell & Abrams, 2011; L E James & Burke, 2000; Oberle & James, 2013; Shafto et al., 2010). While age interaction terms were not included in the age group regressions, a linear expression of age was included to control for a potential effects of age on TOTs within age groups (which had broad age ranges over 20 years).

Results

Descriptive statistics and correlations

For the HADS subscales, 81.3% of participants were in the normal range for anxiety, 12.4% scored as mildly anxious, 5.4% as moderately anxious, and 0.6% as severely anxious (Snaith & Zigmond, 1994). This meant that in total 18.4% of participants were above the "normal" category of anxiety (28.4% of younger adults, 16.9% of middle-aged adults, and 13.6% of older adults). For the depression subscale, 94.6% of our participants were in the normal range, with 3.7% mildly depressed, 1.2% moderately depressed, and 0.2% severely depressed (Snaith & Zigmond, 1994). In total 5.1% of participants were above the "normal" category of depression (6.5% of younger adults, 4.9% of middle-aged adults, and 4.6% of older adults).

For our control variables, 61.2% of participants had university education (80% of younger adults, 63.5% of middle-aged adults, and 45.2% of older adults). In terms of the memory concern question, 30.2% of participants indicated they had concerns about their memory (16.8% of younger adults, 29.3% of middle-aged adults, and 40.5% of older adults).

The relationships between TOTs and predictor variables can be seen in the bivariate correlations between raw scores in Table 2. Increased TOTs were related to increased age,

presence of memory concerns, and absence of university education. The relationship between the subscale scores for anxiety and depression on the HADS was robust, and similar in magnitude to findings of Crawford et al.'s (2001) norming study of the HADS (r = .53). Anxiety showed a negative correlation with age but depression had a small positive correlation with age. Finally, both anxiety and depression symptoms had a positive relationship with memory concerns, and depression had a negative relationship with university education.

[Table 2 here]

Regression analyses

Table 3 shows the results of our first regression analysis examining how age interacts with anxiety and depression symptoms in predicting TOTs. Model 1 contains the control variables university education and memory concerns, and in keeping with Table 2, both control variables independently predicted TOTs. Participants with memory concerns (β = .12, p < .01) and without university education (β = -.21, p < .01) had more TOTs. Model 2 tests for the interaction of age with anxiety and depression symptoms, and includes linear and quadratic age interactions and all lower order terms (anxiety, depression, age, and age^2). Critical for the current study, there is evidence of a quadratic interaction between age and anxiety in predicting TOTs (β = .54, p =.05), whereas there is no evidence of an effect of depression on TOTs (see Table 3). This age^2 x anxiety interaction is independent of the significant effects of the control variables and both linear and quadratic expressions of age (see Table 3). These results indicate that the effect of anxiety on TOT rate is moderated by age, and this change is nonlinear.

[Table 3 here]

In order to interpret the nature of the age^2 x anxiety interaction, we conducted regressions within each age group. The results of three regression analyses are shown in

Table 4 and reveal that while younger adults did not have a significant effect of anxiety (p = .67), middle-aged adults demonstrated a negative effect (β =- .17, p < .05), and older adults demonstrated a positive effect (β = .16, p < .05), which was of a similar magnitude but in the opposite direction to the effect in the middle-aged group. That is, middle-aged participants with more anxiety symptoms had fewer TOTs, while older adults with more anxiety symptoms had more TOTs. As with the regression models across all participants (see Table 3), there was no evidence for an effect of depression in any age group (see Table 4).

[Table 4 here]

Finally, in order to test whether the pattern of results within each age group was significantly different from the pattern in other age groups, we calculated regression models that tested for age interactions with anxiety between pairs of age groups: (1) young vs. middle-aged, (2) young vs. older, and (3) middle-aged vs. older. Each of the three regression models contained control variables (memory concerns and university education), depression symptoms, anxiety symptoms, age, and interaction terms between anxiety and dummy coded age group pairs (young/middle-aged, young/older, and middle-aged/older). The interaction between age group and anxiety was non-significant for the young vs middle-aged model (β = -.08, p =.27) and young vs. older model (β = .07, p =.30), but was significant for the middle-aged vs. older model (β = .13, p < .05).

Discussion

The current study examined whether affect, specifically self-reported anxiety and depression symptoms, predict TOT rate, and whether these relationships change across adulthood. Our main finding is that anxiety but not depression differentially predicts TOT rates across the lifespan: whereas anxiety and TOTs are unrelated in young adults, higher

anxiety is associated with lower TOT rates in middle-aged adults, and with higher TOT rates in older adults. It is worth noting that older adults' anxiety-related increase in TOTs occurred in spite of an age-related decrease in reported anxiety symptoms. The age-related decrease in anxiety is in keeping with previous findings that anxiety reduces from middle to old age (Lee, Gatz, Pedersen, & Prescott, 2016), and more broadly in keeping with findings that older adults are better than younger adults at regulating their emotions, including in response to stress (Diehl & Hay, 2010; Hay & Diehl, 2011).

Anxiety and TOTs

Although this study provides the first evidence that trait anxiety is associated with higher TOT rates in older adults, these results are in keeping with a suggested link between trait anxiety and speech production difficulties in other populations, which has been researched as far back as the 1950s. In particular, trait anxiety has been associated with more speech dysfluencies (Mahl, 1956; Murray, 1971; Saunders, 1974) and stuttering (e.g., Blumgart, Tran, & Craig, 2010; Ezrati-Vinacour & Levin, 2004). Additionally, while our study examined trait anxiety, there is some support for a role of situational anxiety, as participants in previous research report that TOTs were more likely to occur when they were "tired, stressed, or unwell" (Cohen & Faulkner, 1986 p. 189). Likewise, James, Schmank, Castro, and Buchanan (Lori E. James, Schmank, Castro, & Buchanan, 2018) found that for younger adults, TOTs were more frequent when participants were ostensibly being observed by an expert during testing, a manipulation designed to increase situational stress, although participants' self-rated anxiety was not significantly affected by the evaluative observation. Widner, Smith, and Graziano (1996) found a related effect of manipulating participants' expectations: TOTs increased when participants were told that a word retrieval task would be easy, although it was actually difficult. The authors framed their investigation in terms of

metacognitive response strategies, but they also raise the possibility that being told the task would be easy when it was not could have raised anxiety levels, leading to increased TOTs.

In assessing interactions with age, our findings are consistent with attentional control theory, which predicts that older adults' performance will be differentially impaired by the attentional load created by high anxiety (Beaudreau & O'Hara, 2009). In the context of TOTs, previous research has demonstrated the effect of this attentional demand via the increased recruitment of neural systems involved in cognitive control during TOTs; the impact of age is evident from older adults' inability to recruit these systems efficiently (Shafto et al., 2010). Age-related declines in attentional control may therefore leave older adults' performance vulnerable to the attentional load created by increased anxiety symptoms.

Whereas increased anxiety was associated with poorer performance in older adults, it was associated with better performance (fewer TOTs) in middle-aged adults. A curvilinear relationship between anxiety and performance is consistent with the Yerkes Dodson model (Yerkes & Dodson, 1908), where moderate levels of arousal optimize performance while high levels of arousal impair performance. However, as noted in the Introduction and supported in the Results, the shift from facilitation to impairment in our participants is unlikely to reflect age-related increases in anxiety from middle age to old age, as a previous norming study found little evidence for a strong age effect (Crawford et al., 2001), and our results suggest that anxiety *decreases* from middle-aged to older participants. Instead, the facilitatory effect of anxiety for middle-aged adults is best explained in the context of the attentional control theory as discussed above: moderate anxiety-related arousal (as found in our largely subclinical sample) may have a beneficial effect on middle-aged adults who have unimpaired attentional control; anxiety-induced arousal may prove interfering only once age-related declines in attentional control manifest during older adulthood.

Depression and TOTs

Our results replicate studies showing age-related increases in depressive symptoms from middle to old age (Sutin et al., 2013; but see Salthouse, 2012), but we found no evidence that depressive symptoms independently predict TOT rates, suggesting that depression does not affect key cognitive processes that underpin TOTs. This may seem unexpected given previous evidence linking depression symptoms with impaired delayed memory (Mantella et al., 2007), executive function, working memory, and speed (Dotson et al., 2014). However, our results are in keeping with other studies that found relationships between anxiety (but not depression) and a range of cognitive functions including measures of learning and recall (Bierman et al., 2005; Mantella et al., 2007; Williams et al., 2016), speed (Beaudreau & O'Hara, 2009), and working memory and attention (Dotson et al., 2014). The lack of effect of depression symptoms on TOTs support our conclusion that elevated anxiety specifically compromises the component processes that are important for TOT occurrence and resolution.

Limitations and future directions

Our results support the explanation that age-related declines in attentional control underpin the interfering effects of anxiety on TOTs. However, the Cam-CAN dataset does not provide a direct measure of attentional control, so future research should assess the role of individual differences in attentional control, in particular, the prediction that individuals with lower attentional control at any age should be more impacted by the demands of higher anxiety. Measures of individual differences in attentional control could also be directly related to performance on TOT tasks, where the role of cognitive control has thus far been supported by the activation of neural regions involved in cognitive control during TOT tasks (Maril et al., 2001; Shafto et al., 2010). In addition to relating TOT performance to independent measures of attentional control, future research should directly compare

performance on tasks that make high attentional control demands (such as word or name retrieval tasks in which TOTs can result) with others that have lower demands, in order to test hypotheses such as whether older adults may be facilitated by moderate anxiety levels when attentional control demands are lower. Using the same logic, tasks that place even *higher* demands on attentional control than the TOT task could reveal reasons why younger adults showed no relationship of anxiety with TOT rate, despite younger adults reporting more anxiety symptoms than middle-aged or older adults. It may be that this null result reflects younger adults' lower TOT rate and relatively robust attentional control capacity compared to older adults.

Conclusions

In sum, we found a relationship between anxiety symptoms and TOTs that varies across the lifespan, and found that anxiety can be a help or a hindrance to word retrieval performance at different ages. We have explained our results by invoking attentional control theory in the context of current models of TOTs.

Although TOTs are an everyday cognitive experience, they represent a complex interaction between component cognitive processes including phonological retrieval and attentional control; these component processes appear to be differentially affected by the unique cognitive demands of anxiety and depression symptoms, and these effects may not be linear. Measures of affect, as well as the component cognitive processes involved in TOTs, may also interact with the effects of normal cognitive aging. Whether anxiety affects phonological retrieval directly or only affects TOT rates via the attentional control demands of TOT resolution remains to be determined. While our results raise a number of questions for future research, what is clear is that these complex relationships must be unpacked using well-specified theoretical models if we are to understand the link between affect and cognition across the lifespan.

Disclosure statement

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Table 1

Descriptive statistics for TOT ratio, anxiety symptoms, depression symptoms, and age

		N	***M***	**Range**	***SD***
Age	All	643	54.62	18-87	18.04
	Younger	155	30.76	18-39	5.65
	Middle	266	51.60	40-64	7.26
	Older	222	74.91	65-87	6.00
TOT ratio	All	643	.46	0-1.00	.24
	Younger	155	.39	0-0.84	.20
	Middle	266	.42	0-1.00	.21
	Older	222	.56	0-1.00	.26
Anxiety	All	642	4.95	0-20	3.24
	Younger	155	5.85	0-17	3.51
	Middle	265	5.06	0-17	3.01
	Older	222	4.18	0-20	3.15
Depression	All	641	2.75	0-17	2.55
	Younger	155	2.62	0-13	2.49
	Middle	266	2.59	0-17	2.66
	Older	220	3.04	0-12	2.43

Table 2

Correlations between TOT ratio, control variables (memory concerns, university education), and predictor variables (anxiety symptoms, depression symptoms, age)

Variable	TOTs	Age	Memory concerns	University education	Anxiety symptoms
Age	.31**				
Memory concerns	.14**	.21**			
University education	-.22**	-.27**	-.11**		
Anxiety symptoms	-.07	-.21**	.14**	-.02	
Depression symptoms	.02	.09*	.21**	-.11**	.50**

*$p < .05$; **$p < .01$

Table 3.

Regression results predicting TOT ratio. Standardized β values (SDs in parentheses), explained variance (R^2), change in explained variance (ΔR^2), and F values for each model.

	Control variables		**Predictors**								**R^2**	**ΔR^2**	**F**
	University education	Memory concerns	Age	Age^2	Anxiety symptoms	Depression symptoms	Age x Anxiety symptoms	Age x Depression symptoms	Age^2 x Anxiety symptoms	Age^2 x Depression symptoms			
Model 1	-.21** (.49)	.12** (.46)									.06	.06	21.78**
Model 2	-.13** (.49)	.08* (.46)	-.86** (18.04)	1.15** (1971.96)	-.003 (3.24)	-.03 (2.55)	-.46 (58.96)	.18 (43.38)	.54* (6331.84)	-.24 (4791.38)	.16	.09	11.72**

*$p \leq .05$; **$p < .01$

Table 4.

Regression results by age group predicting TOT ratio. Standardized β values (SDs in parentheses), explained variance (R^2), change in explained variance (ΔR^2), and F values for each model.

		Control variables		**Predictors**			**R^2**	**ΔR^2**	**F**
		University education	Memory concerns	Age	Anxiety Symptoms	Depression Symptoms			
Young	Model 1	-.11 (.40)	.15 (.37)				.04	.04	3.30*
	Model 2	-.09 (.40)	.17* (.37)	-.08 (5.65)	-.04 (3.51)	-.02 (2.49)	.05	.01	1.58
Middle	Model 1	-.20** (.48)	.05 (.46)				.04	.04	5.80**
	Model 2	-.21** (.48)	.07 (.46)	.0003 (7.26)	-.17* (3.01)	.07 (2.66)	.06	.02	3.44**
Older	Model 1	-.12	.08				.02	.02	2.38

		(.50)	(.49)						
	Model 2	-.10 (.50)	.07 (.49)	.25** (6.00)	.16* (3.15)	-.14 (2.43)	.09	.07**	4.32**

*$p < .05$; **$p < .01$