

# Associations Between Psychological Distress, Learning, and Memory in Spouse Caregivers of Older Adults

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**Family caregivers of older adults experience high levels of chronic stress and psychological distress, which are known to impair cognition. Very little research, however, has assessed the impact of caregiving on key cognitive outcomes such as learning and memory. This study compared 16 spouse caregivers with 16 matched controls using standardized neuropsychological measures of learning, episodic memory, and working memory. Analyses compared groups on these cognitive outcomes and examined whether psychological distress mediated group differences in cognition. Results indicated that caregivers were significantly more distressed than non-caregivers and exhibited deficits in learning, recall of episodic information after short and long delays, and working memory. Furthermore, the majority of group differences in cognitive outcomes were mediated by psychological distress. This study adds to a small body of literature demonstrating impaired cognitive functioning among family caregivers. It also suggests that distress is one of a number of possible underlying mechanisms leading to disruptions in learning and memory in this population.**

**Key Words:** Caregiver stress—Cognition—Distress—Mediation—Memory.

CARING for older adults who are no longer able to live independently can be a chronically stressful experience. Not surprisingly, relatives and friends who provide care are known to be at increased risk for a variety of negative health outcomes, including anxiety, depression, physical illness, and even premature mortality (Schulz & Martire, 2004; Vitaliano, Zhang, & Scanlan, 2003).

In contrast to the well-known health risks associated with caregiving, little is known about caregivers' cognitive functioning despite its important influence on effective self and other care and despite an extensive literature outlining the effects of chronic stress, depression, and anxiety on cognition. Research with animal (e.g., Mendl, 1999) and human (e.g., Lupien, Maheu, Tu, Fiocco, & Schramek, 2007) populations shows that living in chronically stressful situations can have a detrimental influence on fundamental cognitive abilities, including attention, memory, and executive functioning.

Only a handful of studies have examined caregivers' cognitive functioning. This work suggests that caregivers experience cognitive slowing that is mediated by depression (Vitaliano et al., 2009) and declines in vocabulary that are mediated by metabolic risk factors and hostility (Vitaliano et al., 2005). As well, caregivers show immediate memory deficits (Lee, Kawachi, & Grodstein, 2004), along with deficits in attention and aspects of episodic memory that require attentional processes, including learning and memory monitoring (Mackenzie, Smith, Hasher, Leach, & Behl, 2007). This last study was limited in that it compared caregiver performance with population norms rather than with matched controls, as was done in the present study. Furthermore, although Vitaliano and colleagues (2005, 2009) have

examined mediators of vocabulary and cognitive speed, research has not yet examined possible mediators of memory impairment in caregivers.

The primary purpose of this study was to determine whether caregivers perform more poorly than matched controls on neuropsychological measures of learning, episodic memory, and working memory. We hypothesized that caregivers would exhibit impairments in each of these outcomes. A secondary purpose was to begin to examine possible underlying mechanisms for disruptions in learning and memory. We hypothesized that distress would mediate group differences in learning and memory given the mediating effect of depression on caregiver cognitive speed (Vitaliano et al., 2009).

## METHODS

### Participants

Caregiver participants were drawn from a writing intervention study that included health and cognitive outcomes in a preintervention assessment (Mackenzie, Wiprzycka, Hasher, & Goldstein, 2007). We limited the current study to 16 spouse caregivers of older adults attending a seniors day care center 2 days/week. These individuals met inclusion criteria if they: (a) were a primary spouse caregiver for 6+ months, (b) provided care for 5+ hours per day, and (c) had no known neurological or incapacitating health problems. On average, participants had been caregiving for 48.93 (*SD* = 29.56; range = 12–120) months at the time of testing. We compared caregivers with 16 demographically matched non-caregivers who: (a) were married, (b) did not provide

Table 1. Participant Sociodemographic Characteristics and Distress

Variable	Caregivers (n = 16)	Controls (n = 16)	Group <i>t</i> or $\chi^2$	<i>p</i> Value
<b>Sociodemographic characteristics</b>				
Mean (SD; range) age	78.94 (4.70; 68–86)	79.37 (4.67; 68–86)	.07	.79
Female (%)	11 (68.75)	11 (68.75)	.00	1.00
Mean (SD; range) years of education	12.75 (2.93; 8–19)	13.25 (3.04; 7–19)	.22	.64
Work status (%)			3.36	.19
Full-time or part-time	2 (12.5)	2 (12.5)		
Homemaker	3 (18.75)	0 (0.0)		
Retired	11 (68.75)	14 (87.5)		
English as primary language (%)	14 (87.5)	16 (100)	2.13	.14
Mean (SD; range) secondary languages	1.06 (1.00; 0–4)	0.31 (0.60; 0–2)	6.63	.02
White race (%)	16 (100)	15 (93.75)	1.03	.31
Mean (SD; range) hours spent with spouse per day	19.54 (7.52; 20–24)	21.89 (4.45; 8–24)	1.16	.29
<b>Psychological distress</b>				
Zarit Burden Interview (SD; range)	26.31 (5.72; 19–40)	—		
GHQ total (SD; range)	18.62 (6.87; 10–36)	12.75 (5.84; 3–26)	2.61	.01

Note: GHQ = General Health Questionnaire.

care for another person, (c) spent 5+ hours per day with their spouse, and (d) had no significant health problems. Table 1 provides participants’ demographic information.

**Procedures**

Participants were recruited by telephone, and the caregiver and control groups were matched for age, gender, and education. Participants completed the assessment battery described in the following section in quiet individual laboratory rooms.

**Measures**

Details concerning the assessment battery, including descriptions of measures and their psychometric properties, can be found in Supplementary Appendix A. Only caregivers completed the 12-item short form of the Zarit Burden Interview (ZBI; Bedard et al., 2001) to measure perceived caregiving burden, which can range from 0 to 48, with scores

greater than 16 indicating clinically significant caregiver burden according to the authors. All participants completed a sociodemographic questionnaire and the 28-item General Health Questionnaire (GHQ-28; Goldberg & Williams, 1988), which can range from 0 to 84, with scores of 24 and above typically indicating clinically significant levels of psychological distress. Participants also completed two widely used neuropsychological tests of memory (Rabin, Barr, & Burton, 2005), the California Verbal Learning Test (CVLT-II; Delis, Kramer, Kaplan, & Ober, 2000) and the Working Memory Index (WMI) from the Wechsler Adult Intelligence Scale (WAIS-III; Wechsler, 1997). The CVLT-II is a word list task that provides numerous measures of learning and memory, with higher scores indicating better performance (with the exception of intrusion errors). We report the primary indicators in Table 2 and provide information on their intercorrelations with the GHQ total score, number of secondary languages spoken, and other cognitive outcomes in Supplementary Table 1. The WMI measures the

Table 2. Mean (SD) Unadjusted Learning and Memory Z-scores, Magnitude of Group Differences in Cognitive Outcomes, and the Mediating Effect of Psychological Distress on Group Differences in Cognition

Variable	Caregivers (n = 16)	Controls (n = 16)	Group <i>F</i>	Effect size ( $\eta_p^2$ )	Distress $\beta$	Distress $\beta$ 95% confidence limits
<b>Learning</b>						
CVLT Trial 1	−0.53 (0.92)	−0.28 (0.93)	0.96	.03	.42***	.0217 to .7749
CVLT Trials 1–5	−0.04 (1.11)	0.39 (0.88)	4.73**	.14	.51***	.0712 to .9472
CVLT learning slope	−0.50 (0.93)	0.19 (0.87)	8.67***	.23	.14	−.1728 to .4666
CVLT List B	−0.63 (0.87)	−0.09 (0.76)	3.35*	.08	.53***	.0745 to .8044
<b>Episodic memory recall</b>						
CVLT short delay free	−0.19 (1.08)	0.19 (1.03)	6.12**	.17	.44**	.0390 to .9080
CVLT long delay free	−0.59 (1.17)	0.22 (0.86)	10.98***	.28	.50***	.0838 to .9860
CVLT intrusions	−0.06 (0.85)	−0.50 (0.73)	7.43**	.20	.09	−.2048 to .3663
<b>Working memory</b>						
WAIS digit span	−0.02 (0.68)	0.58 (0.84)	4.96**	.14	.20	−.1053 to .5133
WAIS arithmetic	0.06 (0.69)	0.52 (0.85)	2.80	.09	.45**	.0423 to .7162
WAIS LNS	0.83 (0.54)	0.73 (0.65)	0.24	.01	.31	−.0343 to .4719

Notes: CVLT = California Verbal Learning Test-2nd edition; LNS = Letter Number Sequencing; WAIS = Wechsler Adult Intelligence Scale-3rd edition.  $\beta$  values represent the mediating effect of General Health Questionnaire total scores on cognitive outcomes, controlling for group differences.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

ability to attend to information, hold and manipulate it in memory, and formulate a response with three subtests: arithmetic, digit span, and letter-number-sequencing. Higher scores represent better working memory performance.

### Statistical Analyses

We converted CVLT-II and WAIS-III raw scores to age-corrected scores (*T*-scores, *Z*-scores, and Wechsler scaled scores) according to their respective test manuals. We then converted the *T*-scores and scaled scores to *Z*-scores to facilitate comparisons across outcomes. Univariate analyses of variance compared caregiver and control participants' demographic characteristics and distress. Multivariate analyses of variance (with non-language-based WAIS-III working memory outcomes) and covariance (with language-based CVLT-II learning and episodic memory outcomes) examined group differences in cognition. We covaried the number of secondary languages due to reports of cognitive benefits of bilingualism (e.g., Bialystok, Craik, & Ryan, 2006). We used partial eta squared ( $\eta_p^2$ ) as an indicator of effect size for these group comparisons, where values of .01, .06, and .14 are associated with small, medium, and large effects, respectively (Cohen, 1988).

We also explored whether psychological distress mediated group differences in cognitive outcomes. Given our modest sample size, we enhanced statistical power to detect mediation by using the GHQ total score, rather than its four subscales, because the total score has greater range and variability. We also used the asymmetric confidence limits approach to testing mediation, which has greater power and more accurate Type I error rates than other procedures, including Baron and Kenny's (1986) popular causal steps approach (MacKinnon, Fairchild, & Fritz, 2007). Briefly, this technique does not require establishing a significant relationship between the independent and dependent variable. Mediation is present if the independent variable predicts the mediator (path  $\alpha$ ) and if the mediator predicts the dependent variable after controlling for the influence of the independent variable (path  $\beta$ ). Asymmetric confidence limits for the mediated effect ( $\alpha\beta$ ) provide an estimate of the magnitude of this effect, where limits that do not include zero indicate significant mediation.

## RESULTS

### Demographic Characteristics and Mental Health

As shown in Table 1, caregivers and controls were similar demographically except for caregivers having significantly more secondary languages. Caregivers reported clinically significant levels of burden on the ZBI and, in comparison to controls, they exhibited significantly higher levels of distress on the GHQ total score,  $F(1,30) = 6.80$ ,  $p = .01$ ,  $\eta_p^2 = .19$ .

### Cognitive Functioning

Caregiver performance was significantly poorer than that of controls on the four learning outcomes in Table 2,  $F(4,26) = 3.23$ ,  $p = .03$ . Follow-up univariate tests (Table 2) demonstrate poorer learning by caregivers on the CVLT-II learning slope and total number of words recalled across the five List A trials. Caregivers also performed significantly more poorly than controls on the episodic memory outcomes,  $F(3,27) = 5.39$ ,  $p < .01$ . Univariate follow-up tests in Table 2 indicate significant deficits in caregivers' free recall from the primary List A after both a brief delay and 20 min later. As well, caregivers were more likely to make intrusion errors by recalling words that were not on the list. Finally, the influence of caregiving on working memory was modest,  $F(3,28) = 2.82$ ,  $p = .06$ , and reliable only on the Digit Span subtest.

### Mediation

As a result of the large difference between caregivers and controls on the mediator of interest (GHQ total), the only other criterion necessary for mediation, according to MacKinnon and colleagues (2007), is that the GHQ total predicts cognitive outcomes after controlling for group differences. As shown in the last two columns of Table 2, adjusted total GHQ  $\beta$  values were significant with 95% asymmetric confidence limits that do not include zero for five of seven learning and episodic memory outcomes and one of three working memory outcomes.

## DISCUSSION

A handful of previous studies have demonstrated that, in addition to physical and mental health problems, caregivers also exhibit cognitive deficits. Ours is the first study to examine caregiver learning and memory in a comprehensive manner with carefully matched non-caregiver controls. As predicted, we found that primary spouse caregivers of physically frail and cognitively impaired older adults, who all had clinically elevated caregiver burden scores, performed more poorly than non-caregiver spouses on neuropsychological outcome measures. What we did not expect was the extent of the impairment on these outcomes. Despite our modest sample size which limited statistical power, differences on the majority of outcomes reached significance, the overall partial  $\eta_p^2$  value of .14 across the 10 outcomes represents a large effect, and the average episodic memory effect size of .22 was particularly large. Importantly, these differences were reliably shown across numerous learning, episodic memory, and working memory outcomes, and they were not the result of outliers.

Consistent with previous research (Lee et al., 2004; Mackenzie, Smith, Hasher, Leach, & Behl, 2007), caregivers in this study experienced more difficulty in comparison to controls on learning and episodic memory tasks than on tests of working memory. Although this may be a

reliable finding, it is possible that the effects of caregiver stress on working memory would have been stronger using more demanding measures, such as complex span tasks common in the cognitive literature (e.g., Darowski, Helder, Zacks, Hasher, & Hambrick, 2008).

This study clearly documents learning and memory impairments among caregivers that were not due to age, education, or the effects of bilingualism. A secondary objective of this study was to examine whether psychological distress mediated group differences in cognition. Although our cross-sectional data cannot examine mediation causally, our results supported this hypothesis. It is noteworthy that three of six significant mediating effects were for cognitive outcomes where we did not find significant group differences. This may be due to statistical power limitations or because of mediator or suppressor variables dampening the direct effects of group differences on cognitive outcomes (MacKinnon et al., 2007).

Of course, a variety of factors in addition to distress very likely contribute to caregivers' ability to learn and remember information. For example, Vitaliano and colleagues (2005) found that physiological risk factors, such as obesity and insulin resistance, and personality variables, such as hostility, mediated caregivers' vocabulary performance. Furthermore, in addition to the clear effects of stress hormones on cognition (Lupien et al., 2007), memory impairments are associated with stress-related cognitive interference (Stawski, Sliwinski, & Smyth, 2006) and sleep problems (Gamaldo, Allaire, & Whitfield, 2008). Finally, factors unrelated to stress, such as the time caregivers have available for cognitively stimulating activities, may reduce cognitive vitality. In order to develop a sophisticated understanding of how health behaviors, mood, and acute and chronic stress affect caregiver cognition, research must move toward examining complex models involving multiple mediators and moderators (MacKinnon et al., 2007). Doing so will also clarify the extent to which our findings generalize to other caregiver populations.

Regardless of the reasons for cognitive impairments, their existence has important implications given that family caregivers perform complex and cognitively demanding tasks similar to those carried out by paid health providers (Schulz & Martire, 2004). For example, when individuals with Alzheimer's disease require changes to their medical treatment, spouse caregivers are often responsible for learning, implementing, and monitoring them. Any stress-related learning and memory impairments caregivers may be experiencing could compromise the treatment and management of the care recipient. Memory impairments may also affect caregivers' own health and other care-related medical, financial, psychosocial, and legal decisions that caregivers often face.

This study adds to a small body of literature suggesting that caregivers are cognitively impaired compared with their

non-caregiving peers and that one factor contributing to their learning and memory problems is psychological distress. Our findings also highlight the need for further investigation of this critical topic, including theory-guided examinations of other cognitive domains that may be affected by caregiver distress, explorations of other mechanisms of action underlying cognitive impairment, and the addition of cognitive outcomes to intervention studies to determine whether cognitive deficits are reversible if caregiver distress is reduced.

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#### SUPPLEMENTARY MATERIAL

Supplementary material can be found at: <http://psychogerontology.oxfordjournals.org/>

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