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Caregiving and Cognitive Function in Older Women: Evidence for the Healthy Caregiver Hypothesis

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Abstract

Objectives—Recent findings of better health outcomes in older caregivers than noncaregivers suggest a healthy caregiver hypothesis (HCH) model may be more appropriate than the stress process model for evaluating the health effects of caregiving. In a cross-sectional study, we tested the HCH on two cognitive domains: verbal memory and processing speed.

Method—Participants from the Caregiver Study of Osteoporotic Fractures who had a 2-year follow-up interview were categorized as continuous caregivers ($n = 194$), former caregivers ($n = 148$), or continuous noncaregivers ($n = 574$). The Hopkins Verbal Learning Test (HVLT; memory) and Digit Symbol Substitution Task (DSST; processing speed) were administered at the follow-up interview.

Results—Continuous caregivers had better memory performance and processing speed than continuous noncaregivers: adjusted mean scores for HVLT were 18.38 versus 15.80 ($p < .0001$), and for DSST were 35.91 versus 34.38 ($p = .09$).

Discussion—Results support the HCH model for cognitive outcomes in older women caregivers; however, the relationship may be domain specific.

Keywords

caregiving; cognition; elderly women

The stress process model (Aneshensel, Pearlin, Mullan, Zarit, & Whitlatch, 1995) postulates that caregivers will have poorer health outcomes than noncaregivers because they

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experience higher rates of stress (Pinquart & Sorensen, 2003; Schulz et al., 2003), and chronic stress has deleterious effects on physical (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002; Lutgendorf & Costanzo, 2003) and cognitive (Lupien, McEwen, Gunnar, & Heim, 2009; Peavy, 2008) health. This model has been the theoretical basis for most caregiving research. However, neither studies of physical health decline (Pinquart & Sorensen, 2003) nor studies on cognitive outcomes (Caswell et al., 2003; Lee, Kawachi, & Grodstein, 2004; Leipold, Schacke, & Zank, 2008; Vitaliano et al., 2005) have provided consistent support for this model. In fact, recent studies (Brown et al., 2009; Fredman et al., 2008; Fredman, Doros, Ensrud, Hochberg, & Cauley, 2009; O'Reilly, Connolly, Rosato, & Patterson, 2008; Park-Lee, Fredman, Hochberg, & Faulkner, 2009) found better health outcomes in older caregivers than noncaregivers. The healthy caregiver hypothesis has been proposed as an alternative paradigm to explain these positive health outcomes (Fredman et al., 2008).

The healthy caregiver hypothesis proposes that older adults who are healthier become caregivers and remain caregivers, resulting in better health outcomes in caregivers than noncaregivers of similar age. Support for this hypothesis comes from studies that found that older adults who became care-givers were physically healthier than their noncaregiver counterparts (McCann, Hebert, Bienias, Morris, & Evans, 2004), and that caregivers had lower rates of mortality (Brown et al., 2009; Fredman, Cauley, Hochberg, Ensrud, & Doros, 2010; O'Reilly et al., 2008) and functional decline (Fredman et al., 2009). Moreover, older women who performed more caregiving activities (i.e., high-intensity caregivers) maintained the highest levels of physical functioning over a 2-year period compared to low-intensity caregivers and noncaregivers (Fredman et al., 2009).

In addition, the healthy caregiver hypothesis proposes that factors related to the caregiving role may help to preserve caregivers' physical and cognitive health. For example, greater physical activity, inherent in performing caregiving tasks, appeared to buffer the negative effects of intensive caregiving on physical health outcomes in older men and women (Fredman et al., 2008). The cognitive or physical demands of the caregiving role also may buffer the negative effects of caregiving stress on cognitive performance. For example, longer duration of caregiving was positively associated with increases in cognitive complexity (complex thought) among caregivers to persons with dementia (Leipold et al., 2008). However, some studies found that caregivers to a spouse performed worse (Caswell et al., 2003; de Vugt et al., 2006; Vitaliano et al., 2009), or declined more (Vitaliano et al., 2005) in cognitive functioning than married noncaregivers, but these associations disappeared when adjusted for psychological or metabolic variables (Caswell et al., 2003; Vitaliano et al., 2005; Vitaliano et al., 2009). Other studies found different associations between caregiving and cognitive status depending on the measure used (de Vugt et al., 2006; Lee et al., 2004; Mackenzie, Smith, Hasher, Leach, & Behl, 2007). Thus, the association between caregiving and cognitive functioning remains uncertain.

However, poorer cognitive functioning increases the risk of functional decline (Aguero-Torres et al., 1998; Dodge, Du, Saxton, & Ganguli, 2006) and mortality (Bassuk, Wypij, & Berkman, 2000; Bosworth, Schaie, & Willis, 1999) in older adults. Moreover, an increasing

number of older adults will become caregivers as the population ages. Thus, it is important to clarify the relationship between caregiving and cognitive functioning.

The current cross-sectional study evaluated the healthy caregiver hypothesis in two domains of cognitive functioning: memory (i.e., Hopkins Verbal Learning Test, HVL; Brandt, 1991) and speed of processing (i.e., Digit Symbol Substitution Task, DSST; Wechsler, 1955). These measures were included in the second annual follow-up interview of women participating in the Caregiving Study of Osteoporotic Fractures (described below). They are associated with caregiving responsibilities such as everyday problem solving as well as with functional health outcomes of gait speed, motor tasks, and falls risk (Gross, Rebok, Unverzagt, Willis, & Brandt, 2010; Inzitari et al., 2007; Rosano et al., 2005; Welmerink, Longstreth, Lyles, & Fitzpatrick, 2010). Specifically, the HVL is associated with everyday function and problem solving over a period as long as 5 years (Gross et al., 2010). Processing speed, measured by the DSST, is one of the most sensitive domains of cognitive function, often declining before impairments are apparent in executive function, memory, or global function, making this test important for detecting mild cognitive impairment (Lopez et al., 2003; O'Sullivan, Morris, & Markus, 2005; Thorvaldsson et al., 2008). Slower processing speed is also associated with functional outcomes including gait speed, motor tasks, and falls risk (Inzitari et al., 2007; Rosano et al., 2005; Welmerink et al., 2010). Caregiving status was assessed at each annual interview, allowing us to compare cognitive functioning in continuous caregivers to former caregivers and noncaregivers.

We hypothesized that continuous caregivers would demonstrate higher functioning in memory and speed of processing than women who stopped caregiving (i.e., former caregivers) or those who were never caregivers (i.e., continuous noncaregivers) during the study period.

Method

Sample

Participants in these analyses were enrolled in the Study of Osteoporotic Fractures (SOF; Cummings, Black, Michael, et al., 1990). The SOF sample included 9,704 women who were at least 65 years old and were recruited between 1986 and 1988 from population-based listings in four areas of the United States: Baltimore, MD; Minneapolis, MN; Portland, OR; and the Monongahela Valley, PA. Women were excluded if they could not walk without help or if they had a history of bilateral hip replacement. African American women were initially excluded because of their low incidence of hip fracture; however, 662 elderly African American women with similar characteristics were enrolled between 1996 and 1997. Approximately every 2 years, SOF participants have a comprehensive clinical evaluation. Participants in Caregiver-SOF included members of the original and African American SOF cohorts who participated in the sixth biennial comprehensive examination that took place from 1997 to 1999.

Caregiver-SOF subsample—In this manuscript, caregivers were defined as informal caregivers—that is, they are not paid for their caregiving services. This sample was identified in two phases, described in detail elsewhere (Fredman et al., 2004). The first

phase consisted of administering a caregiver screening questionnaire to 5,952 SOF participants who had their sixth biennial examination at their home or a SOF clinic and were not cognitively impaired or living in a long-term care facility. Beginning in 1999, the screening questionnaire was readministered by telephone to all caregivers and a subset of noncaregivers who had been identified by the initial screening questionnaire. The questionnaire asked SOF participants if they currently helped a relative or friend with each of seven instrumental activities of daily living (IADL) tasks (i.e., use the telephone, get to places out of walking distance, shop, prepare meals, manage medications, manage finances, do heavy housework; Duke University, 1978) and seven basic activities of daily living (ADL) tasks (i.e., walk across a room, groom, transfer from bed to chair, eat, dress, bathe, use the toilet; Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963) because that person was physically, cognitively, or emotionally unable to do that task independently. Participants were categorized as caregivers if they helped one or more persons with at least one task and as noncaregivers if they did not help anyone with these tasks.

In the telephone reevaluation phase, respondents who were currently caregiving were invited to participate in Caregiver-SOF; those who had stopped caregiving ($n = 493$) were excluded. For each caregiver participant, we matched one or two noncaregivers on SOF site, age, race, and zip code. The resulting baseline sample included 375 caregivers and 694 noncaregivers. The participation rates were 83.1% among caregivers and 69.7% among noncaregivers.

Face-to-face interviews were conducted with the respondent at her home within 2 weeks of the telephone reevaluation, and at two annual follow-up interviews. The sample for these analyses was restricted to nonproxy participants from the second annual follow-up interview (hereafter referred to as “follow-up interview”) who were caregivers at both this interview and at baseline, noncaregivers at this interview but caregivers at baseline, or noncaregivers at both interviews. Noncaregivers who became caregivers during the study period were excluded.

Caregiver-SOF was approved by the Institutional Review Boards at each SOF site and the Boston University Medical Center. All participants provided written informed consent.

Measures

Caregiving status—Caregiver status was based on the respondent's report at the baseline and follow-up interview that she assisted someone with at least one IADL/ADL task because that person was physically, cognitively, or emotionally unable to do that task independently, as described above. We created two summary measures of the total number of IADLs (0-7) and ADLs (0-7) with which the caregiver helped the care recipient. Caregivers were categorized as continuous caregivers (i.e., caregiver at baseline and follow-up interview), former caregivers (i.e., caregiver at baseline but noncaregiver at follow-up interview), or continuous noncaregivers (i.e., noncaregiver at baseline and follow-up interviews).

Care recipient characteristics—At each interview, caregivers reported on the main care recipient's age, number of medical conditions, and rated his or her health on a 4-point scale (1 = *excellent*, 4 = *poor*). Severity of the care recipient's memory and orientation to time, place, and people was assessed by Pearlin and colleagues' 8-item Cognitive Status (Pearlin,

Mullan, Semple, & Skaff, 1990). This scale measures the caregivers' report of their care recipient's cognitive status. Items include the caregivers' report of the care recipient's difficulty to remember recent events, recognize people she knows, and know the day of the week, scored on a 5-point Likert-type scale (not at all difficult to can't do at all); coefficient alpha is .86. Scores may range from 0-32; higher scores are associated with poorer well-being in the caregiver (Aneshensel et al., 1995).

Cognitive status—Two domains of cognitive functioning were measured. The Hopkins Verbal Learning Test (HVLT) measured verbal immediate recall memory (Brandt, 1991). Interviewers read a list of 12 words to participants and asked them to repeat the list. This process was repeated three times. The words represented three semantic categories, each including four words. For these analyses, we used the total number of correct words recalled over the three tries (possible range 0-36).

The Digit-Symbol Substitution Task (DSST) measured speed of processing (Wechsler, 1955). Respondents were shown a series of nine numbers, each with a corresponding nonsensical symbol. They were instructed to copy as many symbols as possible in 90 seconds in the box underneath each number. The total number of correctly-drawn symbols was analyzed for respondents who completed a short practice section.

Covariables—Sociodemographic variables included the respondent's age and marital status (married versus other) at the follow-up interview, self-reported race (White or African-American), and highest level of education (dichotomized as college educated or higher versus high school graduate or lower). At each interview, each respondent reported whether or not she had been told by her doctor that she had a stroke, hypertension, heart disease, diabetes, or cancer. We created a measure of prevalent medical conditions at the follow-up interview by summing the number of these conditions reported by the respondent at any interview: due to the skewed distribution of this measure, we categorized respondents into 0-1 versus 2-5 conditions.

The 20-item Center for Epidemiologic Studies-Depression (CES-D) Scale was used to measure depressive symptoms at follow-up interview (Radloff, 1977). Participants reported how frequently they had experienced each symptom in the past week with higher scores representing more depressive symptoms (possible range 0-60). At the follow-up interview, the 14-item Perceived Stress Scale (PSS) was used to measure general stress experienced in the past month (Cohen, Kamarck, & Mermelstein, 1983). Higher scores indicated more stress (possible range 0-56). Both the CES-D and the PSS were measured as continuous variables.

Statistical Methods

Characteristics of the three caregiver groups were compared using Analysis of Variance (ANOVA) for continuous variables and chi-square tests for categorical variables. Multivariable linear regression was used to test the association (beta coefficient and 95% confidence interval) between caregiver status and each cognitive performance measure. Noncaregivers served as the reference group for these analyses. For each cognitive outcome, we performed two sets of multivariable models: one including sociodemographic and health

variables, and another including these measures plus the CES-D and PSS scales. We assessed whether individual sociodemographic and health variables were confounders by determining whether its presence in a model changed the beta coefficient for caregiver status by 10% or more compared to a model that included only caregiver status (Rothman & Greenland, 1998). We retained these variables in the multivariable models, and also included prevalent medical conditions, although it did not meet this criterion, in order to adjust for current health status. All analyses were performed using SAS 9.1 (SAS, 2002-2003).

Results

Demographic Characteristics

Of the original 1,069 Caregiver-SOF participants, 968 had second follow-up interviews, conducted between 2002 and 2004. Twenty-eight caregivers (7.5%) and 73 noncaregivers (10.6%) died or were terminated from the study prior to this interview. An additional 52 participants were excluded from these analyses because they were caregivers at follow-up but noncaregivers at baseline ($n = 27$), had a proxy follow-up interview ($n = 10$), or were missing both the HVLIT and DSST measures ($n = 15$).

The resulting sample included 916 participants; 194 (21%) were continuous caregivers, 148 (16%) were former caregivers and 574 (63%) were continuous noncaregivers. The main reasons why caregivers ceased caregiving were that the care recipient died (53.4%) or was placed in a long-term care facility (21.6%). Only 6.8% reported that they stopped caregiving because of their own health problems. Other reasons why caregivers ceased caregiving (18.2%) included improvement in the care recipient's health, care recipient moving to live with another caregiver, or the caregiver moved. Caregiver status was not associated with these additional exclusions.

Compared to continuous noncaregivers, continuous caregivers were significantly younger, more likely to be college educated, married, and to have a history of cancer (Table 1). Former caregivers were significantly more likely than other respondents to have two or more comorbid conditions, and also more like than continuous noncaregivers to have a history of hypertension and cancer but did not differ with respect to the other factors. Continuous caregivers demonstrated the highest level of performance in memory (HVLIT) and processing speed (DSST) followed by former caregivers, though this difference was not statistically significant for DSST. Continuous noncaregivers had the poorest performance on both measures. A parallel association was observed with perceived stress: continuous caregivers reported the most stress, and continuous noncaregivers reported the least.

With regard to care recipient characteristics, care recipients to continuous caregivers were significantly younger at baseline and required more help with IADLs than those to former caregivers (see Table 2). None of the other care recipient characteristics differed between continuous and former caregivers.

Caregiving Status and Cognitive Performance

Compared to continuous noncaregivers, continuous caregivers had significantly better performance in memory and processing speed in unadjusted models (Tables 3 and 4). Continuous caregivers also scored significantly higher on memory performance than continuous noncaregivers, adjusting for demographic factors, medical comorbidities, depression, and perceived stress. Specifically, continuous caregivers recalled, on average, 2.6 more words than continuous noncaregivers over the three tries of the HVLT: mean adjusted HVLT scores were 18.38 versus 15.80 ($p < .0001$; Figure 1). Word recall increased by approximately three words from the first to the third trial for all participants: 3.4 words for continuous caregivers, 3.3 words for former care-givers, and 3.2 words for continuous noncaregivers. Based on the parameter estimate for age, the difference in performance on the HVLT between continuous caregivers and continuous noncaregivers is analogous to approximately 10 years, suggesting that continuous caregivers perform at a level similar to that of someone who is 10 years younger.

By comparison, differences in processing speed between continuous care-givers and continuous noncaregivers were attenuated and no longer significant when adjusted for these covariables (Table 4, and Figure 1). In the fully adjusted model, continuous caregivers correctly coded an average of 1.5 additional symbols than continuous noncaregivers: adjusted mean DSST scores were 35.91 versus 34.38 ($p = .09$). Based on the parameter estimate for age, this is analogous to approximately 2 years suggesting that in this sample continuous caregivers' performance was comparable to a person 2 years younger. Former caregivers did not differ significantly from continuous noncaregivers in either tasks of memory or processing speed.

Secondary Analysis

To evaluate whether sample characteristics accounted for these differences, we repeated our analyses in a subsample of 287 respondents who were caregivers to a spouse ($n = 95$) or married noncaregivers at both interviews ($n = 131$), or former caregivers to a spouse ($n = 61$). Continuous caregivers still performed better than noncaregivers. Adjusted mean HVLT scores were significantly higher for continuous caregivers (mean = 17.97) than continuous noncaregivers (mean = 15.97, $p = .05$) but not for former caregivers (mean = 16.48, $p = .22$). Adjusted mean DSST scores were 37.2, 37.6, and 35.6 for continuous caregivers, former caregivers and continuous noncaregivers, respectively (all p values $> .20$).

Discussion

In this sample of older women, continuous caregivers performed the best on cognitive tests of memory and processing speed while continuous noncaregivers performed the poorest on both measures. All groups scored slightly below the HVLT age-gender norm of 19.31 (Vanderploeg et al., 2000). Nonetheless, these results suggest that caregiving will not result in cognitive decline since the performance of long-term caregivers was equivalent to that of participants 2 to 10 years younger, depending on the cognitive test.

These results are consistent with one previous study (Leipold et al., 2008), but conflict with other studies that found poorer cognitive functioning in spouse caregivers versus married noncaregivers (Caswell et al., 2003; de Vugt et al., 2006; Vitaliano et al., 2009). Our secondary analyses restricted to spouse caregivers and married noncaregivers confirmed the findings in the overall sample that continuous caregivers performed better than noncaregivers.

These results extend support for the healthy caregiver hypothesis to cognitive functioning. The significantly higher perceived stress levels in continuous caregivers than noncaregivers would have predicted the poorest cognitive functioning in this group, according to the stress process model. Instead, cognitive performance results went in the opposite direction. These results were not due to confounding by comorbid conditions: there was no difference in number of comorbid conditions between continuous caregivers and continuous noncaregivers, although there may have been residual confounding by unmeasured health variables. Former caregivers reported significantly more comorbid conditions during the past 3 years than the other groups, but only 7% reported that they stopped providing care because of personal health issues.

Our results suggest two possible mechanisms by which caregiving may preserve cognitive health in older adults that should be tested directly in future studies. First, caregivers are more physically active than noncaregivers (Fredman, Bertrand, Martire, Hochberg, & Harris, 2006; Fredman et al., 2008) and greater physical activity reduces the risk of functional (Buchman et al., 2007) and cognitive decline (Colcombe & Kramer, 2003; Kramer et al., 2001; Lachman, Neupert, Bertrand, & Jette, 2006), potentially through increased oxygenation or blood flow to the brain (Kramer et al., 2001).

Second, caregiving requires engagement in tasks that are cognitively complex such as managing medications, arranging appointments and transportation, and juggling conflicting demands. Exercising and challenging cognitive skills slow the rate of cognitive decline (Hall et al., 2009; Wilson et al., 2002).

We found a domain-specific difference in the association between caregiving status and cognitive outcomes. Although the relationship between caregiver status and memory remained significant even after potentially confounding factors were considered, the relationship was attenuated for speed of processing. The stronger association with memory performance compared with processing speed suggests that the tasks inherent in caregiving may preserve memory function, which often declines early in Alzheimer's disease (Small, Fratiglioni, Viitanen, Winblad, & Backman, 2000), to a greater extent than attention and processing speed, cognitive domains associated with vascular cognitive impairment (Hachinski et al., 2006). Future work may examine whether there are structural or functional brain differences among caregiving groups.

This study has several potential weaknesses. Cognitive performance was not assessed until the second annual follow-up interview. It is unknown whether these results reflect cognitive functioning at previous interviews, or whether caregivers experienced more decline than noncaregivers, as seen in other studies (Vitaliano et al., 2005, Vitaliano et al., 2009). In

addition, although the difference by caregiver group for the HVLT was statistically significant, we cannot report on the clinical significance of these findings, thus results should be interpreted with caution. Caregiving status was based on helping a care recipient with one or more IADLs or ADLs. Thus, women who performed few caregiving tasks could be classified as caregivers. This would most likely dilute the effect of caregiving on cognitive performance, suggesting that our observed results may underestimate the effect of continuous caregiving on cognitive performance.

The sample was predominately White, high-functioning older women. Their average age was 83 years old, which is at least 10 years older than samples from other studies. It is possible that our findings apply to this age group, rather than adults in their 60's (de Vugt et al., 2006) or 70's (Caswell et al., 2003; Vitaliano et al., 2009), or non-White or male caregivers. However, since women comprise the majority of caregivers, this sample represents the gender distribution of caregivers in the population (National Alliance for Caregiving, 2004).

Selective survival is another possible limitation. Participants who were most physically and/or cognitively impaired were less likely to have a follow-up interview. However, only 6.8% of former caregivers said that they stopped caregiving because of their own health, whereas 21.6% reported that they stopped caregiving because their care recipient entered a nursing facility. It is possible that these latter transitions also may have occurred because the care-giver could no longer provide adequate care. Likewise, although we adjusted for medical conditions and depressive symptoms in the multivariable analyses, the results may have been confounded by physical or psychological health variables that were not measured.

Finally, this study did not include a measure of executive reasoning. Although verbal memory is indeed important for cognitively complex tasks, executive reasoning is equally, if not more, important in relation to cognitively complex tasks. Future studies that explore the impact of caregiving on cognitive functioning should include the domain of executive function.

Nonetheless, this study has several strengths. The data were collected in a large, multisite sample that was well characterized so that potentially confounding factors such as physical and psychological health conditions could be controlled. Caregivers were identified according to ADL/IADL tasks performed for the care recipient, thereby reducing the likelihood of misclassifying caregiver status. Finally, follow-up data was obtained on participants who stopped caregiving allowing us to examine how former caregiving status related to cognitive functioning.

In conclusion, this study is the first to our knowledge to apply the healthy caregiver hypothesis to cognitive functioning in older adult caregivers. Although based on cross-sectional results, the results suggest that caregivers who leave the role may be at greater risk for cognitive decline, while demands intrinsic to long-term caregiving may preserve specific domains of cognitive functioning and/or buffer its negative impact on cognitive functioning.

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Figure 1. Adjusted mean HVLt and DSST in continuous noncaregivers, former caregivers, and continuous caregivers

Table 1
Respondent Characteristics by Caregiver Status

	Total sample (<i>n</i> = 916)	Continuous caregiver (<i>n</i> = 194)	Former caregiver (<i>n</i> = 148)	Continuous noncaregiver (<i>n</i> = 574)
<i>HVLT^a</i>				
Mean <i>SD</i>	16.5 ± 7.3	18.4 ± 6.6***	16.6 ± 7.0**	15.8 ± 7.6
<i>DSST^a</i>				
Mean <i>SD</i>	34.9 ± 11.2	36.6 ± 11.2	34.9 ± 10.4	34.3 ± 11.4
<i>Age^b</i>				
Mean <i>SD</i>	83.6 ± 3.6	83.2 ± 3.3**	83.6 ± 3.8	83.8 ± 3.7
<i>Education^b</i>				
% College	53.9	59.8**	55.4	51.6
<i>Race^b</i>				
% White	87.6	90.2	83.8	87.8
<i>Marital status^a</i>				
% Married	29.0	58.3****	14.2*	23.0
<i>Medical conditions^b</i> 2 % 2	41.3	40.0	55.4****	38.0
Cancer	10.2	19.1****	31.1****	1.7
Diabetes	11.1	8.8	13.5	11.3
Heart disease	38.4	38.1	42.6	37.5
Hypertension	61.8	57.7	73.0***	60.3
Stroke	11.4	9.8	10.8	12.0
<i>PSS^a</i>				
Mean <i>SD</i>	16.0 ± 6.9	17.7 ± 7.0, <i>p</i> < .0001	16.5 ± 7.5, <i>p</i> = .08	15.3 ± 6.6
<i>CES-D^a</i>				
Mean <i>SD</i>	8.0 ± 6.5	8.1 ± 6.7, <i>p</i> = .02	9.0 ± 7.4, <i>p</i> = .08	7.8 ± 6.2

^aData collected at follow-up.

^bData reported at baseline, or follow-up.

Note. *p* values compare caregiver groups (i.e., continuous caregivers and former caregivers) to continuous noncaregivers.

*
p < .10.

**
p < .05.

p < .01.

p < .001.

Table 2
Care Recipient Characteristics at Baseline and Follow-Up: Comparisons of Continuous and Former Caregivers

Care recipient characteristic	Continuous caregivers, mean (SD)	Former caregivers, mean (SD)
Baseline age	80.14 (12.46)	83.57 (9.63) ***
No. of medical conditions	3.10 (1.58)	3.16 (1.68)
Reported health (1 = excellent, 4 = poor)	2.96 (0.84)	3.09 (0.90)
No. of cognitive problems	5.64 (7.06)	6.73 (8.10)
No. of IADL tasks caregiver helps	4.11 (1.94)	3.58 (2.12) **
No. of ADL tasks caregiver helps	1.47 (1.68)	1.59 (1.83)
Follow-up		
Age	82.87 (12.01)	
No. of medical conditions	2.57 (1.54)	
Reported health (1 = excellent, 4 = poor)	2.90 (0.83)	
No. of cognitive problems	7.30 (8.85)	
No. of IADL tasks caregiver helps	3.83 (2.13)	
No. of ADL tasks caregiver helps	1.75 (1.73)	

*
 $p < .10$.

**
 $p < .05$.

 $p < .01$.

 $p < .001$.

Table 3
Association Between Caregiver Status and Hopkins Verbal Learning Test

	Standardized beta regression coefficients		
	Unadjusted model	Model A ^a	Model B ^b
	β [95% CI], ρ	β [95% CI], ρ	β [95% CI], ρ
Caregiver status			
Continuous NCG (referent group)	0.00	0.00	0.00
Continuous CG	2.61 [1.42–3.80] ****	2.36 [1.17–3.54] ***	2.58 [1.38–3.78] ****
Former CG	0.77 [–0.56,2.10]	0.69 [–0.64,2.02]	0.83 [–0.49,2.16]
Covariates			
Age in years		–0.27 [–0.41–0.13] ***	–0.25 [–0.39–0.11] ***
Education		0.97 [0.02,1.92] *	0.90 [–0.05,1.85]
Race		–0.86 [–2.38,0.67]	–0.78 [–2.30,0.74]
2 Medical conditions ^c		0.23 [–0.74,1.20]	0.34 [–0.63,1.31]
CES-D score			–0.06 [–0.16,0.03]
PSS score			–0.06 [–0.15,0.03]
Model R^2	0.02	0.04	0.05

^aModel A: Adjusted for sociodemographic variables and medical conditions.

^bModel B: Adjusted for sociodemographic variables, medical conditions; depression and stress.

^cMedical conditions include stroke, hypertension, heart disease, diabetes, and cancer.

*
 $p < .10$.

**
 $p < .05$.

 $p < .01$.

 $p < .001$.

Table 4
Association Between Caregiver Status and Digit Symbol Substitution Task

	Standardized beta regression coefficients		
	Unadjusted model	Model A ^a	Model B ^b
	β [95% CI]	β [95% CI]	β [95% CI]
Caregiver status			
Continuous NCG (referent group)	0.00	0.00	0.00
Continuous CG	2.19 [0.30,4.07]**	1.35 [-0.42,3.12]	1.53 [-0.23,3.30]*
Former CG	0.56 [-1.54,2.66]	0.74 [-1.24,2.73]	1.17 [-0.80,3.13]
Covariates			
Age in years		-0.87 [-1.08,-0.66]****	-0.82 [-1.03,-0.61]****
Education		3.97 [2.55,5.39]****	3.55 [2.14,4.97]****
Race		-7.85 [10.12,-5.58]****	-7.73 [-9.97,-5.48]****
2 medical conditions ^c		-1.06 [-2.51,0.39],	-0.74 [-2.18,0.69]
CES-D score			-0.27 [0.41,-0.13]****
PSS score			-0.01 [-0.14,0.12]
Model R ²	0.006	0.14	0.16

^aModel A: Adjusted for sociodemographic variables and medical conditions.

^bModel B: Adjusted for sociodemographic variables, medical conditions; depression and stress.

^cMedical conditions include stroke, hypertension, heart disease, diabetes, and cancer.

*
 $p < .10$.

**
 $p < .05$.

 $p < .01$.

 $p < .001$.