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Current and Long-Term Spousal Caregiving and Onset of Cardiovascular Disease

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Abstract

Background—Prior evidence suggests caregiving may increase risk of cardiovascular disease (CVD) onset. This association has never been examined in a nationally representative sample and prior studies could not fully control for socioeconomic confounders. This paper seeks to estimate the association between spousal caregiving and incident CVD in older Americans.

Methods—Married, CVD-free, Health and Retirement Study respondents aged 50+, (n=8,472) were followed up to 8 years (1,669 new stroke or heart disease diagnoses). Current caregiving exposure was defined as assisting a spouse with basic or instrumental activities of daily living 14 hours/week according to the care recipients' report in the most recent prior biennial survey; we define providing 14 hours/week of care at two consecutive biennial surveys as "long-term caregiving." Inverse probability weighted discrete-time hazard models with time-updated exposure and covariate information (including socioeconomic and cardiovascular risk factors) were used to estimate the effect of caregiving on incident CVD.

Results—Caregiving significantly predicted CVD incidence (HR=1.35; 95% CI: 1.06, 1.68) in the population overall. Long-term caregiving was associated with double the risk of CVD onset (HR=1.95; 95% CI: 1.19, 3.18). This association for long-term caregivers varied significantly by race (p<0.01): caregiving predicted CVD onset for whites (HR=2.37; 95% CI: 1.43, 3.92) but not non-whites (HR=0.28; 95% CI: 0.06, 1.28).

Conclusions—Spousal caregiving independently predicted risk of CVD in a large sample of US adults. There was significant evidence that the effect for long-term caregivers differs for blacks and whites.

INTRODUCTION

Caregiving for an ill or disabled spouse is extremely common: among older adult caregivers, about 25% of them provide care to a spouse (1). Caregiving frequently entails substantial

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COMPETING INTERESTS

None declared.

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physical, emotional, or financial burdens (2). Caregiving demands can also adversely affect the health of caregivers directly through stress (3,4) and physical strain, or indirectly through behavioral changes like lack of exercise (5,6) and self-management of chronic conditions (7). Caregiving has been shown to predict elevated levels of physiologic indicators of cardiovascular risk (8,9); Framingham risk scores (10,11); as well as increased risk of hypertension (12), CVD (13) and coronary heart disease (CHD) (14,15) onset; and increased mortality (16).

Despite the potentially large public health impact of this exposure, there are important gaps in our understanding of the health risks associated with caregiving. After searching MEDLINE using relevant MeSH topics for literature in this area, we are not aware of any longitudinal study that has assessed the association of caregiving with risk of incident CVD in a nationally (U.S.) representative sample. Although chronicity of caregiving is important, there are no estimates of CVD for both current and long-term caregivers. Furthermore, few studies have followed potential caregivers prospectively or invoked special regression approaches necessary (17) to address time-varying variables that may confound or also partially mediate the association between caregiving and CVD (e.g., depression and caregiver health behaviors). Also, there is still little known about the risk of CVD onset associated with caregiving among racial minorities.

Using follow-up data from the Health and Retirement Study (HRS) (18), this study addresses two research questions. First, is either current or long-term caregiving associated with CVD incidence in a nationally representative sample of middle and older-age men and women? Second, are those associations modified by race, gender, or depressive symptoms?

METHODS

Study Population

HRS is a longitudinal survey of a national sample of US adults aged 50+ years and their spouses. Details of the study are provided elsewhere (18,19). Enrollments occurred in 1992, 1993, or 1998 (based on respondent's and spouse's birth years) with biennial interviews (or proxy interviews for decedent participants) through 2008. Retention rates through 2008 were above 80%. HRS was approved by the University of Michigan Health Sciences Human Subjects Committee and these analyses were determined exempt by Harvard School of Public Health Office of Human Research Administration.

This study was restricted to married or partnered HRS participants born 1900 to 1947 and interviewed in 2000, which was the earliest year when caregiving assessments were consistently worded and asked with respect to spouses, and to individuals with no reported history of CVD as of the 2000 interview.

The weighted HRS sample included 11,474 respondents who were age-eligible and married with both spouses in the study in 2000; persons were excluded on the basis of prevalent events at baseline and missing key covariate information. Of the 2,831 (24.7%) respondents excluded because of a prior diagnosis of CVD in 2000, 38% were female and 17% were non-whites. An additional 171 (1.5%) were excluded due to missing information on basic demographic factors (age, sex, race, and ethnicity), leaving 8,472 individuals contributing person-time to the primary analyses.

Spousal Caregiving

Spousal caregiving demand was calculated in each biennial interview wave (2000–2006), based on the care recipient's report regarding assistance with activities of daily living (ADLs; including help with getting across a room, dressing, bathing, eating, getting in and

out of bed, and using the toilet) and instrumental activities of daily living (IADLs; prepare meals, shop for groceries, make telephone calls, take medications). HRS respondents listed the people who provided them assistance in the last month and the number of days and hours of care they provided. An indicator variable was generated for whether a spouse was a listed caregiver and we calculated amount of care provided per week for these analyses.

After examining the distribution of weekly hours of care among caregivers, we did not identify any clear threshold of hours of care provided. Thus, to be consistent with other studies of caregiving using these data (20,21), the hours of care were dichotomized to <14 and ≥14 hours of care per week as the primary exposure classification (hereafter referred to as “current high caregiving”). To assess the validity of this measure of caregiving, we examined a subsample of 4,648 respondents who reported on spousal demands for a supplemental psychosocial questionnaire given in the 2008 wave of HRS. Respondents who provided ≥14 hours/week of spousal care were 1.7 times as likely as respondents who provided <14 hours/week of care and 3.2 times as likely as respondents who did not provide any care to report their spouse made too many demands of them ($p<0.001$ for differences between groups; details available from authors).

For analyses of the effects of long-term caregiving, we considered any respondent who was classed as a high caregiver during both the most recent two prior interview waves (separated by approximately two years) as a long-term caregiver.

Incident CVD

Onset of CVD between 2000 and 2008 was assessed biennially by the caregiver’s self-report of a doctor’s diagnosis of either stroke or heart disease. For participants who had died and those unavailable for a direct interview, interviews were conducted with proxy informants, typically spouses. Incident strokes were assessed based on self- or proxy-report of a doctor’s diagnosis of the event (“Has a doctor ever told you that you had a stroke?”). No information on stroke subtypes was obtained; temporary ischemic attacks were not coded as strokes. Heart disease was assessed similarly: “Has a doctor ever told you that you had a heart attack, CHD, angina, congestive heart failure, or other heart problems?” These responses were combined from these two questions into a single variable measuring CVD, coded “yes” if a respondent reported either a stroke or heart disease in a given wave and “no” if they reported neither. The combined results are presented, because the results of stroke and heart disease separately were qualitatively similar with wider confidence intervals (CIs).

Covariates

Six sets of covariates—demographic, SES, health risk factors, comorbid conditions, self-assessed health, and care recipient memory illness—that likely confound the effect of caregiving on risk of CVD onset were considered. The demographic characteristics comprised baseline age and age-squared (22), non-white race (white/non-white), Hispanic ethnicity (23), and female sex. SES variables included: years of education; Southern place of birth (yes/no) (24); per capita income at baseline (household income divided by square root of household members) (25); and maternal education (<8, ≥8 years) (26). Caregiver health risk factors consisted of vigorous physical activity (“On average over the last 12 months have you participated in vigorous physical activity or exercise three times a week or more?”, yes/no) (28); alcohol use (in the last 2 weeks, any/none) (29); ever smoker status and current smoker status (30); body mass index (BMI) in kg/m^2 (31). Comorbid conditions include self-reported diagnoses of hypertension and diabetes (22). Self-assessed health measures include elevated depressive symptoms (32,33) (measured with a modified 8-item Center for Epidemiological Studies Depression (CES-D) Scale, Cronbach’s $\alpha=0.81$ (34), dichotomized at <3, ≥3 (35)); fair/poor self-rated health (36); caregiver ADL and IADL limitations (1/0,

respectively) (37). Care recipient's memory illness was defined a self-reported doctor's diagnosis of a memory illness. For observations with missing values, continuous variables were set to the mean and categorical variables to the referent group and included a missing indicator variable in the weighting models.

Several of the covariates are potentially affected by caregiving (e.g., all caregiver and care recipient health characteristics) and may thus mediate the effects of past caregiving on CVD. To avoid adjusting for variables downstream of the primary exposure, we used the values of these covariates as assessed in the wave *prior* to the caregiving assessment (e.g., 1998 covariates to control for caregiving demands in 2000) in weighting models to adjust for confounding (detailed below). Demographic and SES covariates are time-constant and the values reported in 2000 were considered as baseline.

Methods of Analysis

Elevation in hazard of CVD associated with high caregiving was estimated with discrete-time hazard models. Individuals contributed person-time to the models if they remained alive, married and had not yet reported a diagnosis of CVD. Participants were censored after the dissolution of the marriage to avoid conflating caregiving strain with bereavement effects (38,39).

Unadjusted and adjusted hazard ratios (HRs) are presented that added the groups of covariates defined above to the models sequentially consistent with the likely temporal ordering of the confounders. We estimate current caregiving models from 2000 as the first exposure year, and long-term caregiving models with 2002 as the first exposure year to calculate an exposure that includes both the 2000 and 2002 caregiving behavior. Primary analyses were conducted in SAS 9.2 with PROC GENMOD using a *logit* link, robust variance estimates, and weights as described below.

Time-varying confounders were adjusted for by using inverse probability of treatment weights (17,40). This approach allowed adjusting for variables likely to be both mediators and confounders, e.g., health behaviors that may be affected by high caregiving and may also impair a spouse's ability to provide care. Time-lagged values of the time-varying covariates were used to avoid bias from adjusting for mediators. A similar approach to handle possible bias resulting from selective drop-out or survival was used. Thus, each observation was weighted by the product of: 1. the inverse of the probability that individual was alive at the exposure wave, 2. the inverse of the probability that individual (conditional on having survived) was in the sample at both exposure and outcome waves, and 3. the inverse of the probability that the individual received the treatment he or she actually received. Stabilized weights were calculated using previously described protocols (40,41). The weights were truncated at the value of 99th percentile to address the weights' skewed distribution.

Possible modifiers of the association between caregiving and CVD risk were also tested: sex, race, and elevation in depressive symptoms for the caregiver. Both the stratified effect estimates and a test of interaction in the pooled model are presented; the model was a multiplicative model, so the interactions tested differences in effect sizes on a multiplicative scale, rather than an additive scale.

HRS used a multistage, clustered sample. The HRS sampling weights were applied to make the population representative of the 2000 US population aged 50+ years. Models that do not account for clustering are presented, as no difference between models that account for clustering at the household level and those that did not was found.

RESULTS

Participant characteristics are summarized in Table 1. There were 1,669 total new CVD diagnoses during 50,138 person years of follow-up. At baseline, current and long-term caregivers differed from the total sample in terms of demographics (older, more non-white and Hispanic respondents), socioeconomic position (lower education, mother's education, and per capita income), self-rated health (higher depressive symptoms, fair/poor health rating, functional disabilities), and prevalence of spouses with memory illnesses (higher among caregivers). Over follow-up, 3.7% (person-years=1,822) were "exposed" as current caregivers and 1.3% (person-years=652) as long-term caregivers.

In the unadjusted model, current high caregiving was associated with 87% excess risk of CVD (HR, 1.87; 95% CI, 1.48–2.36; Table 2). Once adjusted for demographics, SES and all health risk factors, current high caregiving remained significantly associated with a 35% increased risk onset of CVD (HR=1.35; 95% CI, 1.06, 1.68). For long-term caregiving, there was a nearly twofold excess risk of CVD onset in the fully adjusted model (HR=1.95; 95% CI, 1.19, 3.18).

The risk of CVD onset associated with current caregiving did not vary significantly by race, gender or caregiver depression (Table 3). While there was a significant excess risk of CVD onset for white caregivers, (HR=1.45; 95% CI: 1.12, 1.88), non-white caregivers had a non-significant, decreased estimated risk (HR=0.85; 95% CI: 0.37, 1.94) and the test of the interactions by race was not significant ($p>0.10$).

The estimated risk of CVD onset associated with long-term caregiving varied significantly by race, but not by gender or depressive symptomatology. Among long-term caregivers, whites had a significant excess risk (HR=2.37; 95% CI: 1.43, 3.92) and non-whites had a reduced risk (HR=0.28; 95% CI: 0.06, 1.28, $p<0.01$ for test of interaction); non-whites had relatively few events ($n=121$) and the CI included the null. There was a significant, elevated risk among male caregivers (HR=2.37; 95% CI: 1.43, 3.92) and depressed caregivers (HR=2.67; 95% CI: 1.14, 6.23), but the test for the interactions by these factors were all not significant ($p>0.10$).

DISCUSSION

In this nationally representative sample of Americans age 50+ years, both current and long-term high caregiving predicted onset of CVD, even after a number of covariates related to demographics, SES, and health status were introduced. The relationship among long-term caregivers differed by race, with significant evidence of a harmful relationship among whites and suggestive evidence of a protective relationship among non-whites.

Comparisons with prior literature

The largest of the prior studies using cardiovascular diagnoses as outcomes (14) found providing a spouse 9 hours of care per week was associated with a near doubling of risk of CHD onset (RR=1.82; 95% CI: 1.08, 3.05) among women in the Nurses' Health Study (NHS). While our findings suggest a more modest excess risk of CVD associated with current caregiving (HR=1.31 v. 1.82), our estimates of the effects of long-term caregiving were higher than the NHS estimates (HR=1.91 v. 1.82), suggesting the chronicity of the care may be an important aspect of caregiving to model explicitly. For example, the NHS population (predominantly white female nurses) may be more affected by the strain of chronic caregiving than a general population sample. These results are also consistent with the wider literature of studies about strain (13) and distress and depression (47) among spouses and caregivers predicting elevated CVD risk.

This study also differs with the literature that finds caregiving provides a beneficial health effect (48). Brown *et al.*, found that among the oldest participants in the HRS cohort, caregiving at baseline predicted reduced mortality risk over 7 years of follow-up (21). Differences in the population age, the outcome examined, the control variables used, or the analytic approach may explain this divergence, although the qualitative difference in sign, even in unadjusted models, is surprising.

Prior research also suggests differences in the health effects of caregiving by race, specifically that non-whites often are less impacted by caregiving burdens than whites (21). In this study, risk of CVD onset varied significantly by race among long-term caregivers; whites had a significant, excess risk and non-whites had a decreased, non-significant risk. Other studies found positive caregiving attitudes among non-white caregivers were predicted by religiosity, lower perceived burden, lower socioeconomic status, and differences in social support (49,50), such as greater quantity (51) and diversity (52) of support sources. It is also important to contextualize the differences between the magnitudes of the effect of caregiving in light of absolute racial disparities in health.

Stress may directly modify the risk of CVD(3,53,54) associated with caregiving. For example, increased HPA activity and cortisol levels resulting in increased C-reactive protein, platelet activation and atherogenesis (9); increased fibrinogen (4); and documented increases in blood pressure and inflammatory markers among caregivers (10,11,55–57) further suggest this stress pathway to CVD may be applicable among caregivers. However, other mechanisms, such as health behaviors may also contribute to the health risks associated with caregiving.

Study Limitations

Although the HRS is well-suited to investigate spousal caregiving, some limitations should be considered. Self-reported outcome events were subject to misclassification and have been shown to be imperfectly correlated with clinically verified outcomes in other studies (42–45). However, misclassification is substantially reduced by use of a broadly classified outcome as done here, and prior analyses of self-reported stroke in HRS indicated that results were consistent with other studies using medically verified events (46).

Exposures were also subject to misclassification. In HRS, the care recipient, not the caregiver, reported the amount of care provided. This may have led to misclassification of care from the recipient, though it is difficult to anticipate the direction of this potential bias. This design, however, avoids same-response bias which may arise if the same person reports the exposure and the outcome. Also, other literature suggests caregiving burden is modified by the strain or perceived stress of caregiving. HRS does not routinely include questions about perceived stress; however, there is evidence of elevated hazard of CVD onset among caregivers with higher depressive symptoms, although the test for the interaction by depressive symptomology was not significant.

While HRS is one of the largest longitudinal studies of older US adults, CIs in many cases were relatively wide; only a small number of events were observed in several substrata, especially among long-term caregivers. As more research on this topic becomes available, meta-analyses may be valuable.

Despite these limitations, these findings have several methodological advantages and build importantly on prior research. A major challenge in research on the health effects of caregiving has been avoiding the potential confounding introduced by selection into caregiving, in which healthier individuals may be more likely to take on caregiving roles. By using a longitudinal analysis with time-varying exposures, this study could model selection

into caregiving roles without biasing the effect estimates by controlling mediating pathways. Though many studies of caregiving are cross-sectional, this longitudinal design facilitated modeling the chronicity of caregiving with respect to risk of CVD onset.

Implications for Future Research, Policy and Practice

Caregiving burdens often multiply at approximately the same age when risk for cardiovascular disease onset is increasingly rapidly. Studies investigating subgroup variations in the health effects of caregiving—and particularly research on factors that may exacerbate or remediate these effects—are needed. Studies need to extend beyond using race/ethnicity alone to understand the divergent CVD risk by race; race/ethnicity may be a proxy for values, attitudes, and resources of the caregivers (58). Research should also examine mechanisms about the duration of care that may vary by these factors, as the risk for CVD differed in this study by race among long-term, but not current, caregivers. Additional longitudinal studies that explicitly model chronicity of caregiving are also needed.

Conclusion

Many US adults provide care for their spouses. This care was associated with a modest, significant elevation in risk of CVD onset among current spousal caregivers overall and a near-doubling of risk of CVD onset among spousal caregivers who report providing high caregiving over two survey waves. There was also a significant difference in this relationship by race for long-term caregivers. More research is necessary to elucidate sources of resilience and types of support that could reduce the detrimental health-related risks of caregiving.

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What was already known?

Spousal caregiving has been associated with biological markers of stress and inflammation, hypertension, deleterious health behaviors, mortality, and, among women, risk of coronary heart disease onset. No study to date has estimated the association between caregiving and cardiovascular disease onset in a nationally (US) representative sample of older adults followed longitudinally, nor whether this association varies by socio-demographic or health factors.

What does this study add?

This study offers the first nationally representative longitudinal estimates of the risk of cardiovascular disease onset associated with providing care for one's spouse, both currently and consistently over a 2+-year period. We estimate a modest effect estimate of current caregiving (31% excess risk), but an almost two-fold increase in risk of CVD associated with longer-term provision of care. Furthermore, this study finds evidence that this association varies significantly by race among long-term caregivers, with an excess risk for CVD onset among white caregivers only.

Table 1

Sample Characteristics among Study Participants by Current and Long-Term Caregiving Status: Health and Retirement Study, United States, 2000

Characteristics	All Participants (n=8,472) No. (%)	Current Caregivers (n=265) No. (%)	Long-Term Caregivers^a (n=52) No. (%)
<i>Predictor and Outcome Variables</i>			
Years of follow-up, mean (SD)	4.6 (1.1)	3.8 (1.1)	4.1 (1.0)
Total person-years of follow-up	50,138	1,174	550
Provided any care during follow-up	2,222 (8.86)	952 (81.1)	210 (93.3)
Incident events	1,669	63	25
Crude rate/1000 person-years	33.3	53.7	45.5
<i>Demographic Variables</i>			
Age, mean (SD), years	63.9 (7.8)	69.1 (9.0)	68.1 (8.9)
Female	13,105 (52.28)	150 (56.6)	26 (50)
Non-white race	3,099 (12.36)	48 (18.1)	9 (17.3)
Hispanic ethnicity	2,073 (8.27)	34 (12.8)	7 (13.5)
<i>Socioeconomic Variables</i>			
Education, mean (SD), years	12.6 (3.1)	10.9 (3.8)	10.8 (3.2)
Maternal education 8 years	15,895 (63.4)	150 (56.6)	26 (50)
Height, mean (SD), meters	1.7 (0.1)	1.7 (0.1)	1.7 (0.1)
Income, per capita, median (IQR), \$	32,608.7 (37,193.8)	15,273 (15,202.8)	14,943.9 (14,258.1)
Southern Birthplace	3,395 (13.5)	45 (16.9)	12 (23.1)
<i>Health Risk Factors</i>			
Vigorous Activity	13,112 (52.3)	131 (49.4)	25 (48.1)
Current drinking	8,952 (35.7)	57 (21.5)	12 (23.1)
Ever smoker	14,116 (56.3)	151 (56.9)	31 (59.6)
Current smoker	3,268 (13.0)	43 (16.2)	7 (13.5)
BMI, mean (SD), kg/m ²	27.1 (4.7)	26.8 (4.9)	27.3 (5.7)
<i>Comorbid Conditions</i>			
Hypertension	10,816 (43.1)	109 (41.1)	18 (34.6)
Diabetes	3,016 (12.0)	30 (11.3)	9 (17.3)
Elevated Depressive Symptoms	3,276 (13.1)	65 (24.5)	12 (23.1)
<i>Self Assessed Health</i>			
Fair/Poor Self-Rated Health	4,133 (16.5)	92 (34.7)	15 (28.9)
ADL (1 limitation)	1,906 (7.6)	33 (12.5)	5 (9.6)
IADL (1 limitation)	474 (1.9)	12 (4.5)	1 (1.9)
<i>Recipient Memory Illness</i>			
Impaired	345 (1.4)	31 (11.7)	8 (15.4)

Note: CES-D = Centers for Epidemiologic Studies Depression scale. SD indicates standard deviation. IQR indicates inter-quartile range. BMI indicates Body Mass Index (kg/m²).

^aSince 2000 is the first full exposure year, long-term caregivers here refers to those who were high caregivers in both 2000 and 2002. Their baseline values (2000) are reported here.

Hazard Ratios for First Incident CVD for High Current (14 hours per week) and Long-term (14 hours per week over two years) Caregiving Status: Health and Retirement Study, United States, 2000–2008

Table 2

	Current Caregiving Hazard Ratio (95% CI)	Long-term Caregiving Hazard Ratio (95% CI)
Unadjusted	1.87 (1.48–2.36)	2.37 (1.49–3.77)
Demographics Adjusted ^a	1.43 (1.12–1.82)	1.95 (1.21–3.15)
Socioeconomic Status Adjusted ^b	1.37 (1.08–1.75)	1.88 (1.17–3.02)
Health Risk Factor Weighted ^c	1.35 (1.06–1.71)	1.85 (1.15–2.97)
Comorbid Conditions Weighted ^d	1.36 (1.07–1.74)	1.91 (1.18–3.09)
Self-Assessed Health Weighted ^e	1.32 (1.04–1.69)	1.83 (1.13–2.96)
Recipient Memory Illness Weighted ^f	1.35 (1.06–1.68)	1.95 (1.19–3.18)

Each model used all 8,472 eligible HRS sample members. The current caregiving models assess the risk associated with =14 hours per week in a given survey waves for CVD outcome at the next wave compared to those who provided <14 hours per week; they had 1,669 events and 50,138 person-years of follow-up. The long-term caregiving models assess the risk associated with 14 hours per week in two consecutive survey waves for CVD outcome at the next wave; they had 1,095 events and 34,430 person-years of follow-up. CI: Confidence Interval

^a Adjusted for demographic covariates: race, Hispanic ethnicity, baseline age and age-squared, and gender

^b Adjusted for demographic, socioeconomic status (SES), and recipient's cognitive status covariates: mother's education, missing indicator for mother's education, own education, baseline per capita income, Southern region of birth

^c Adjusted for demographic and SES and inverse probability weighted for health risk factors: vigorous physical activity, current drinking, current smoking, ever smoking, missing indicator for ever smoking status, body mass index.

^d Adjusted for demographic and SES and inverse probability weighted for health risk factors and comorbid conditions: self-reported history of hypertension and diabetes

^e Adjusted for demographic and SES and inverse probability weighted for health risk factors, comorbid conditions and self-assessed health: self-rated health, CES-D score over 3, missing indicator for CES-D score, own IADL, and own ADL limitation.

^f Adjusted for demographic and SES and inverse probability weighted for health risk factors, comorbid conditions, self-assessed health, and recipient's memory illness diagnosis.

Hazard Ratios (HR) for First Incident CVD for High Current (14 hours per week) and Long-term (14 hours per week over two years) Caregiving Status Stratified by Gender, Race, Depressive Symptoms, and Care Recipient's Cognitive Status: Health and Retirement Study, United States, 2000–2008

Table 3

	Current Caregiving			Long-term Caregiving		
	Events/Person-Years	HR (95% CI)	P	Events/Person-Years	HR (95% CI)	P
Race						
White	1,491/43,940	1.45 (1.12–1.88)	0.19	974/30,184	2.37 (1.43–3.92)	0.006
Non-white	178/6,198	0.85 (0.37–1.94)		121/4,246	0.28 (0.06–1.28)	
Gender			0.76			0.99
Men	998/23,928	1.32 (0.95–1.85)		643/16,366	2.02 (1.01–4.03)	
Women	671/26,210	1.39 (0.97–1.98)		452/18,064	1.93 (0.98–3.81)	
Depressive symptoms			0.86			0.43
Non-elevated	1,410/49,448	1.33 (1.00–1.77)		945/30,156	1.80 (0.99–3.27)	
Elevated	259/6,552	1.48 (0.91–2.41)		150/4,274	2.67 (1.14–6.23)	

Each model used all 8,472 eligible HRS sample members. The current caregiving models assess the risk associated with 14 hours per week in a given survey waves for CVD outcome at the next wave compared to those who provided <14 hours per week; they had 1,669 events and 50,138 person-years of follow-up. The long-term caregiving models assess the risk associated with 14 hours per week in two consecutive survey waves for CVD outcome at the next wave; they had 1,095 events and 34,430 person-years of follow-up.

Note: CI: Confidence Interval. The reported P value reflects the test of an interaction term of the covariate by which the reported models are stratified with high caregiving (e.g., gender x caregiving) included in the regression models.

All models are adjusted for race, Hispanic ethnicity, baseline age and age-squared, and gender, own education, maternal education, missing indicator for maternal education, per capita income, Southern region of birth, and inverse probability weighted for vigorous physical activity, current drinking, current smoking, ever smoking, missing indicator for ever smoking, body mass index, self-reported history of hypertension and diabetes, self-rated health, CES-D score over 3, missing indicator for CES-D, own IADL, own ADL, and recipient's diagnosis of a memory illness.