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Caregiving Frequency and Physical Function: The Women's Health Initiative

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Background. Informal caregiving is common for older women and can negatively affect health, but its impact on physical function remains unclear. Using inverse probability weighting methods, we quantified the association of caregiving with physical function over 6 years.

Methods. Study participants were 5,649 women aged 65 years and older at baseline of the Woman's Health Initiative Clinical Trial (multicenter recruitment, 1993–1998) with complete caregiving data and function at baseline and at least one follow-up. Caregiving was self-reported (low-frequency if ≤2 times per week and high-frequency if ≥3 times per week). Performance-based measures of physical function including timed walk (meters/second), grip strength (kilograms), and chair stands (number) were measured at baseline and years 1, 3, and 6. Associations and 95% confidence intervals of baseline caregiving with physical function were estimated by generalized estimating equations with inverse probability weighting by propensity and attrition scores, calculated by logistic regression of baseline health and demographic characteristics.

Results. Over follow-up, low-frequency caregivers had higher grip strength when compared with noncaregivers (mean difference = 0.63 kg, confidence interval: 0.24, 1.01). There were no observed differences between high-frequency caregivers and noncaregivers on grip strength or for either caregiver group when compared with noncaregivers on walk speed or chair stands. Rates of change in physical function measures did not differ by caregiving status.

Conclusions. Caregiving was not associated with poorer physical function in this sample of older women. Low-frequency caregiving was associated with better grip strength at baseline which persisted through follow-up. This study supports the concept that informal caregiving may not have universally negative health consequences.

Key Words: Aging—Caregiving—Physical function—Women's health.

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CAREGIVING has been associated with an increased risk for poor mental health and quality of life, particularly when caregiving circumstances are stressful (1,2). Stressful conditions are often related to more frequent provision of care and to greater disability in the care recipient (2,3). The psychological and physical stresses of caregiving may lead to declines in physical health over time, and therefore, greater frequency of care provision may indicate greater risk for poor outcomes. However, studies have also reported a beneficial effect of caregiving on physical health, cognition, and mortality (4–8). Caregiving may promote the maintenance of physical function through regular physical activity as part of daily care activities (5,9) and may provide positive psychological benefits (10–12). Studies of informal caregiving have traditionally been grounded in stress frameworks that predict poor health outcomes from provision of caregiving and greater caregiving burden (13). In contrast, the Healthy Caregiver Hypothesis posits that individuals who become and remain caregivers may be healthier and more physically robust, resulting in better health outcomes for caregivers when compared with noncaregivers (4,9); this may be particularly true for those caregivers providing more frequent care. Longitudinal research is necessary to address this possibility (14).

Declines in physical function in older adults, particularly women, have been shown to negatively affect health and increase risk of disability (15,16). Assessments of the relation of caregiving with changes in physical function over time are sparse and findings are inconsistent (5,9,17,18). Low-frequency, but not high-frequency caregiving, was associated with poorer overall physical functioning over 2 years in a biracial cohort of older women (9). Caregiving was also associated with incident mobility limitations in older white, but not black, adults (5). In contrast, caregiving was not associated with walking speed over 1 year follow-up (17) or with incident frailty in a biracial cohort of adults aged 65 years or older (18). These inconsistencies may be due to different outcome measures, sample selection, or to the observational nature of these studies. Studies using population-based samples have generally found a smaller effect of caregiving on health outcomes relative to convenience samples (2). Further, as caregiving status is not randomized, differences in baseline characteristics of the caregivers and noncaregivers may lead to biased effect estimates (19). In addition, differential attrition through death or drop-out by caregiver status may affect estimates (20).

We assessed changes in performance-based measures of physical functioning among noncaregivers and low- or high-frequency caregivers over 6 years using data from the Women's Health Initiative clinical trials. We used weighting procedures to mitigate some of the inherent biases in observational studies of exposures such as caregiving that cannot be evaluated in intervention studies, including differences in baseline characteristics and in loss to follow-up (19,20). We hypothesized a decline in physical function among caregivers relative to noncaregivers after accounting for selection and attrition by weighting.

Materials and Methods

Study Population

Performance-based physical function tests were administered to a 25% subsample (n = 5,962) of women aged 65–80 years at baseline of the Women's Health Initiative clinical trial cohort (n = 27,427) (21). Women's Health Initiative clinical trial participants were recruited at 40 clinical centers across the United States from 1993 to 1998 to participate in either a hormone therapy trial or a dietary modification trial with an opportunity to join a calcium & vitamin D trial offered a year later, as described previously (22). Exclusion criteria were minimal, including conditions with predicted survival of <3 years or that would interfere with compliance (21). All women provided informed consent and protocols were approved by appropriate institutional review boards.

Women were excluded for incomplete data on caregiving or physical function at baseline (n = 144) or for no follow-up data on physical performance (n = 169). The final analytic sample included 5,649 women. Excluded women were more likely to be black (p < .001), less educated (p = .002), have more chronic conditions (p = .004), and be obese (p = .008) than those who were included. There were no differences between included and excluded women for age, marital status, income, or living alone (all p > .05). Excluded women who had data on caregiving status were as likely to be caregivers as included women (p = .3); however, excluded women who had baseline physical performance measures performed more poorly than included women (all $p \le .02$).

Caregiving

Caregiving was assessed at baseline by the question: "Are you now helping at least one sick, limited, or frail family member, or friend on a regular basis?" Women providing a "yes" answer to this question were defined as caregivers for these analyses.

Those who self-reported as caregivers were asked how many times a week care was provided. Participants could respond as less than once a week, 1–2 times a week, 3–4 times a week, or ≥5 times a week. Caregiving frequency was dichotomized at the median and defined as low-frequency if reported as two or fewer times per week and high-frequency if three or more times per week. A sensitivity analysis was conducted using caregiving frequency dichotomized as high if reported as ≥5 times a week (n = 553, 9.3% of the sample).

Physical Functioning

Standard performance-based measures of physical functioning were assessed at baseline and at years 1, 3, and 6. Timed walk, chair stand, and grip strength are reliable, sensitive to change, and have predictive validity (15,23,24).

The average of two assessments was used for each measurement. Timed walk was measured by stop watch in seconds for the subject to complete a 6-m course. Walking aids were used as necessary. Walking speed is reported in meters/second. Grip strength was measured by a hand-grip dynamometer with the dominant hand and was rounded up to the nearest kilogram (kg). The chair stand test counted the number of times the participant could rise in 15 seconds from a straight-backed chair with arms folded. For each, higher values indicate better physical function. In order to remove implausible assessments, the top 2.5% of timed walk and grip strength measurements were removed. Sensitivity analyses were performed which included these participants and results did not differ qualitatively from those presented here. Participants who attempted the measures but were unable to complete and participants who did not attempt due to health and safety concerns were assigned a 0 for grip strength and chair stands and the lowest observed value (0.1 m/s) for walk speed.

Assessment of Covariates

Demographic variables were self-reported at the screening or baseline visit and included age, self-identified race, current marital status, highest educational achievement, family income, and retirement status.

History of the following diseases was self-reported at screening or baseline visits: arthritis, asthma, any cancer, cardiovascular diseases, diabetes, hypertension, osteoporosis, stroke, and thyroid disease. Polypharmacy was defined as daily use of five or more prescription and over-the-counter assessed by in-person medication review. Body mass index (kg/m^2) was calculated using measured height and weight and categorized using the World Health Organization standards, regardless of race (25): <25 = normal and underweight, 25.0–29.9 = overweight, >29.9 = obese. Smoking was categorized as current, past or never based on ever smoking at least 100 cigarettes, and smoking now. Current alcohol was assessed as none, less than one drink per week, or at least one drink per week. Self-rated health was reported as excellent, very good, good, fair, or poor.

Because study enrollment among the different Women's Health Initiative trials was not mutually exclusive, three variables indicated enrollment in each: hormone therapy, dietary modification, and the calcium & vitamin D.

Statistical Analysis

Demographic and health characteristics by caregiver status were compared using analysis of variance for normally distributed, continuous variables, and by chi-square for categorical ones.

We used inverse probability of treatment weighting by propensity score to account for potential confounding on background characteristics that may differ significantly between caregivers and noncaregivers and that can predict physical functioning (26). The propensity score represents the probability of an individual receiving treatment (being a caregiver) based on baseline characteristics. Weighting by the inverse probability of treatment creates an artificial sample in which the measured baseline covariate distribution is independent of treatment assignment (27).

We used inverse probability of attrition weighting to account for additional bias that may arise if individuals who were missing a visit or died differed systematically in characteristics related to functional status (20,28). Individuals who remain in the study and are similar to those who do not continue are assigned higher weights to compensate loss to drop out or death. See Supplementary Material for details of treatment and attrition weight calculation.

Regression Analyses

We used separate generalized estimating equations to model the linear associations of each physical function measure with caregiving status over the 6-year follow-up (29). Analyses were weighted on the inverse probability of treatment and attrition and were adjusted for study enrollment. Interactions between caregiver status and time on study were assessed to determine whether the slope of change in physical function differed by caregiver status. In a sensitivity analysis, high-frequency caregiving was defined as only providing care ≥5 times per week. All analyses were completed using SAS 9.3.

Results

Noncaregivers, low-frequency caregivers, and high-frequency caregivers differed on a number of demographic and health characteristics. Low-frequency caregivers were less likely than noncaregivers to be married (50.7% vs 56.7%; $p < .001$), whereas high-frequency caregivers were more likely to be married (64.6%; $p < .001$) (Table 1). High-frequency caregivers had a higher prevalence of most chronic diseases (asthma, diabetes, hypertension, stroke, cancer, cardiovascular disease; some data shown in Table 1) when compared with noncaregivers or low-frequency caregivers. The notable exception was osteoporosis which was most common in noncaregivers. There were no differences ($p = .2$) in race by caregiver status with 86.2% of the sample being white.

Complete data for all follow-up visits was available for 3,910 women (69.2%). Follow-up on two of the three visits was available for an additional 1,210 women (21.4%). Attrition by death was low with 322 women (5.7%) dying during follow-up and did not differ by caregiver status ($p = .2$). Follow-up by caregiver status is detailed in Supplementary Table.

Physical Function

Unweighted baseline walking speed and chair stands did not differ by caregiver status (Table 1). Low-frequency caregivers had slightly higher grip strength at baseline (mean [*SD*] = 23.2 kg [5.4]) when compared with high-frequency caregivers (mean [*SD*] = 22.5 kg [5.5]; $p = .004$) or noncaregivers (mean [*SD*] = 22.9 kg [5.4]; $p = .05$). On average, women declined in all function measures over follow-up (mean for whole sample [*SD*]: walking speed = −0.1 m/s [0.3]; grip strength = −3.3 kg [5.3]; chair stands = −0.4 [1.9]).

In regression analyses with inverse probability weighting, we observed no differences in the average walking speed or number of chair stands between caregiver groups during the follow-up period (Table 2). Average grip strength also did not differ between noncaregivers and high-frequency caregivers over follow-up. However, low-frequency caregivers had significantly higher grip strength on average relative to noncaregivers over 6 years (mean difference = 0.63, 95% confidence interval: 0.24, 1.01). Caregiver status by time interactions were not significant, indicating that the rate of change from baseline in physical function did not differ by caregiver status (all $p \geq .2$). Sensitivity analyses demonstrated that our results were not qualitatively different using an alternate definition of high-frequency caregiving (≥5 per week; data not shown).

Discussion

In an analysis of change in performance-based measures of physical function over 6 years for over 5,600 women

Table 1. Selected Baseline Characteristics of Women Aged 65 Years and Older From the Women's Health Initiative Clinical Trials by Caregiver Status

	Total (*N* = 5,649)	Noncaregiver (*N* = 3,511)	Low-Frequency Caregiver (*N* = 1,381)	High-Frequency Caregiver (*N* = 757)	*p* Value
Mean age (*SD*)	69.9 (3.7)	69.8 (3.7)	70.1 (3.8)	70.1 (3.7)	.009
Mean walk speed (*SD*), m/s	1.09 (0.26)	1.09 (0.26)	1.08 (0.27)	1.10 (0.26)	.4
Mean grip strength (*SD*), kg	22.9 (5.4)	22.9 (5.4)	23.2 (5.4)	22.5 (5.5)	.01
Mean chair stands (*SD*), no.	6.4 (2.0)	6.4 (2.0)	6.4 (1.9)	6.4 (1.9)	.7
	N (%)	*N* (%)	*N* (%)	*N* (%)	
Marital status					<.001
Never married	220 (3.9)	122 (3.5)	86 (6.2)	12 (1.6)	
Divorced/separated	739 (13.1)	458 (13.1)	196 (14.2)	85 (11.2)	
Widowed	1,500 (26.7)	931 (26.7)	398 (28.8)	171 (22.6)	
Married/cohabitating	3,165 (56.3)	1,976 (56.7)	700 (50.7)	489 (64.6)	
Education					<.001
<High school	283 (5.0)	168 (4.8)	62 (4.5)	53 (7.0)	
High school diploma	990 (17.6)	652 (18.7)	201 (14.6)	137 (18.2)	
At least some college	4,341 (77.4)	2,659 (76.5)	1,117 (80.9)	565 (74.9)	
Income					<.001
<$50,000	3,974 (75.2)	2,432 (74.6)	1,032 (79.1)	510 (70.5)	
$50–74,999	827 (15.6)	520 (16.0)	180 (13.8)	127 (17.6)	
$75–99,999	263 (5.0)	178 (5.4)	57 (4.4)	28 (3.9)	
>$100,000	223 (4.2)	129 (4.0)	36 (2.7)	58 (8.0)	
Retired	4,035 (77.1)	2,442 (75.8)	1,033 (79.8)	560 (78.2)	.01
Smoking					<.001
Never	3,134 (56.1)	1,877 (54.0)	836 (61.6)	421 (56.4)	
Former	2,199 (39.4)	1,443 (41.5)	462 (34.0)	294 (39.4)	
Current	250 (4.5)	159 (4.6)	60 (4.4)	31 (4.2)	
Diabetes	329 (5.8)	241 (6.9)	35 (2.5)	53 (7.0)	<.001
Osteoporosis	506 (9.1)	353 (10.3)	95 (7.0)	58 (7.8)	<.001
Asthma	386 (7.0)	231 (6.7)	73 (5.4)	82 (11.0)	<.001
Obesity status					<.001
Underweight/normal	1,836 (32.8)	1,125 (32.3)	497 (36.4)	214 (28.5)	
Overweight	2,104 (37.6)	1,397 (40.2)	474 (34.7)	233 (31.1)	
Obese	1,655 (29.6)	957 (27.5)	395 (28.9)	303 (40.4)	

Note: *SD* = standard deviation.

Table 2. Mean Differences in Measures of Physical Function Over 6 Years for Women Aged 65 Years and Older in the Women's Health Initiative Clinical Trials (n = 5,649)

	Walk Speed (m/s)		Grip Strength (kg)		Chair Stands (no.)	
	Mean Difference	95% CI	Mean Difference	95% CI	Mean Difference	95% CI
Noncaregiver	Ref		Ref		Ref	
Low-frequency caregiver	0.0032	−0.12, 0.019	0.63	0.24, 1.01	−0.12	−0.26, 0.028
High-frequency caregiver	0.013	−0.0060, 0.033	−0.11	−0.57, 0.35	0.022	−0.17, 0.22

Notes: Analyses used inverse proportional weights from propensity scores of caregiving at baseline and for differential attrition and were adjusted for study enrollment. CI = confidence interval.

aged 65 years and older, we found no differences in walking speed or chair stands by caregiver status. In contrast, grip strength was slightly higher on average at baseline in low-frequency caregivers when compared with noncaregivers which persisted throughout follow-up. Rate of change for physical function was not associated with caregiver status.

Consistent with the healthy caregiver hypothesis, we observed higher grip strength for low-frequency caregivers when compared with noncaregivers. We do not have data to determine whether physical function differed prior to onset of caregiving. If low-frequency caregiving has a true positive association with grip strength, it may be that this benefit was experienced by the time of enrollment in our study, resulting in the observed baseline differences. Notably, no other measures of physical function were associated with low- or high-frequency caregiving; we did not hypothesize differential effects on upper and lower extremity function. However, upper and lower extremity function do not necessarily track together. The absence of associations between high-frequency caregiving and greater declines in physical function indicate that a higher dose of caregiving, at least as measured by frequency, may not result in poorer functional outcomes. High-frequency caregivers had a higher baseline burden of chronic diseases, and it may be this higher disease burden, rather than caregiving itself, that has led to the positive associations seen in previous cross-sectional analyses (2). Alternatively, the lack of association with high-frequency caregiving may be the result of attenuation associated with changes in caregiving status during follow-up or effect modification by baseline health status.

In contrast to our results, a previous study reported declines in physical performance over 2 years among caregivers to individuals with low levels of disability when compared with noncaregivers (9). At baseline, they also reported higher function for both low- and high-intensity caregivers when compared with noncaregivers (9), whereas in this sample only grip strength was significantly higher in low-frequency caregivers, but not in high-frequency caregivers. Fredman and colleagues (9) observed no significant association between caregiving and functional decline when considering only baseline caregiver status, but did observe a decline among low-frequency caregivers when changes in caregiver status over time were considered. Other studies have indicated that caregiving does not increase frailty (18) but is associated with incident mobility limitations (5), both of which are related to poor physical function (30,31). In another study, stressful caregiving situations were not associated with changes in walking speed over time, except among those with high metabolic risk scores (17). We did not assess differences by baseline risk for functional declines, but it is possible that declines occur only among caregivers already at high risk.

Our analyses attempted to account for potential biases inherent in observational data. We accounted for nonrandomization of caregiving status by use of propensity score weighting on baseline characteristics which might predispose healthier individuals to take on the caregiver role, thus influencing the association of caregiving and physical function (32). We also attempted to account for differential attrition, noting that previous studies have suggested that caregivers may differ in mortality risk as compared to noncaregivers (5,7,8). Caregiving duties may also reduce the likelihood of returning for follow-up visits. Mortality and attrition did not differ by caregiver status in this sample, but differential mortality and loss to follow-up are common in studies of older populations and the associated biases are not trivial (28). Mortality may not have differed by caregiving status due to the low overall mortality rate in this study (5.7%) when compared with other studies (20%–27%) (5,7). The lower rate observed here may be due to a lower age threshold for inclusion and a shorter follow-up.

This study was limited by a lack of data on the care recipient and the type of care provided. For example, previous literature suggests that caring for those with dementia may be more detrimental to physical health and functioning than caring for nondemented individuals (2,17). In addition, frequency of caregiving measured as times per week may not reflect actual caregiver strain and/or stress which may be a more relevant measure with regard to functional outcomes (33). Previous studies have suggested that provision of more frequent care is actually more representative of better health of the caregiver rather than the stress of the caregiving situation (1,7). If high-frequency provision of care does indicate better health of the caregiver, then, consistent with our findings, we would not have expected differences in physical function outcomes for high-frequency caregivers once baseline health was accounted for. Caregiver status was not updated at follow-up; therefore, we could not assess functional change in relation to changing caregiver status (9). Changes in caregiver status may be positively associated with the outcome (32); thus, it is difficult to predict the direction of any biases. Prior research evaluated baseline as well as updated caregiver status and found associations only with the updated status, but results for baseline status were of similar magnitude as updated status and trended towards significance (9). In contrast, we observed effect sizes close to 0 in most of our models.

Furthermore, we did not assess possible psychological, social, or cognitive effect modifiers or mechanisms by which caregiving might influence physical function. Caregiving may have measurable psychological and physiologic impacts which could negatively affect physical function (2). However, caregiving may also generate feelings of usefulness and altruism and may increase physical activity during routine caregiving duties (34), all of which may improve mobility and physical function (10). Our analytic sample was healthier and had higher baseline physical function when compared with excluded women; these associations may differ by baseline health status (17). Finally, this study was limited to women and may not apply to men. However, the majority of caregivers are women (35) and women are at increased risk for functional declines when compared with men (16).

Informal caregiving is common with approximately 61.6 million individuals providing care to someone with a disability in the United States in 2009 (35). Determining the effects that this may have on the individuals who provide care is important in preventing adverse outcomes for both the caregiver and the care recipient. In general, studies assessing physical health and mortality in longitudinal analyses of representative populations have found either no differences or findings have been in favor of caregivers (2,5,7,8). This study adds to the growing body of literature assessing the relation of caregiving and physical function in older adults and supports the concept that informal caregiving may not have universally negative health consequences (2,36).

Supplementary Material

Supplementary material can be found at: http://biomedgerontology.oxfordjournals.org/

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Conflict of Interest

None of the authors have any conflicts of interest to report.

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