

Health-Related Quality of Life in a National Sample of Caregivers: Findings from the Behavioral Risk Factor Surveillance System

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Published online: 29 February 2008
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Abstract *Purpose* Recent national public health agendas, such as *Healthy People 2010*, call for improved public health surveillance and health promotion programs for people with disabilities and their caregivers. The goal of this study was to understand the public health impact of caregiving on health-related quality of life (HRQoL) using population-level data. *Design & Methods* A cross-sectional study design was used. 184,450 adults surveyed during the 2000 national Behavioral Risk Factor Surveillance System survey formed the sample. Binary logistic regression models ascertained differences between caregivers and non-caregivers in reporting reduced (“fair” or “poor”) health. Ordinary least squares regression (OLS) and multinomial logistic regression models examined the influence of caregiving status on HRQoL, measured as categories of healthy days reported in the last 30 days and the number of days reported as physical and mental health not good in the last 30 days. *Results* Sixteen percent (16%) of the survey respondents were caregivers. There was an interaction effect between caregiving status and age of the caregiver. In the fully adjusted models, caregivers <55 years old had a 35% increased risk of having fair or poor health (odds ratio [OR] = 1.35, 95% confidence interval [CI] 1.28, 1.43) as compared to non-caregivers in that age group, while caregivers 55 years and older had a 3% decreased risk in having fair or poor health (OR = 0.97, 95% confidence interval [CI] 0.92, 1.03) compared

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to non-caregivers of the same age. In the adjusted models that examined the association of caregiving and healthy days, younger caregivers similarly showed larger deficits in both mental and physical HRQoL compared to older caregivers. For example combining mental and physical days, caregivers <55 had 1.44 fewer healthy days ($\beta = -1.44$, standard error (SE) = 0.07), while caregivers 55+ had 0.55 fewer days ($\beta = -0.55$, standard error (SE) = 0.13 (compared to non-caregivers in their respective age groups). *Implications* With increasing population age and the projected increase in caregivers, it is important that we understand the social and public health burden of caregiving and begin to identify interventions to sustain the HRQoL of caregivers. We found that caregivers have a slight to modest decline in HRQoL compared to non-caregivers, and that caregiving affects the HRQoL of younger adults more than older adults. Further research at the population level as to the type and level of burden of caregiving is needed.

Keywords Epidemiology · Family care · Health status · Surveillance

1 Introduction

Informal caregivers in the United States benefit not only the care recipient, but society as well. Informal caregivers afford an immense economic savings to society. Family caregivers provide an estimated \$257 billion/year in informal care services (National Family Caregivers Association [NFCA] 2005). Most community-dwelling people with chronic and disabling diseases rely on informal caregivers, usually family members, for most of their personal care and general assistance needs. Based on 18 states and the District of Columbia adding questions to their Behavioral Risk Factor Surveillance System (BRFSS) surveys in 2000, only 13% of the people with disability (PWD) who reported needing personal care assistance were using paid caregivers (North Carolina Family Caregiver Support Program 2005).

A rise in the number of older adults will heighten the demand for informal caregivers because chronic and disabling diseases increase with age. The number of Americans 65 years and older is expected to climb from 35 million in 2000 to over 71 million in 2030 (Centers for Disease Control and Prevention [CDC] 2003). The number of older adults with disabling conditions also is expected to rise precipitously, while younger family members who might provide informal support will decline (Friedman 2006; Institute of Medicine 2007). Other factors will also change the demand for informal caregivers. People with disabilities now live longer (Kemp and Krause 1999; McGlinchey-Berroth et al. 1996) and they often want to remain in their homes (Klingbeil et al. 2004). Reimbursement issues also play a role, because the services of paid caregivers are often not reimbursable. With the expected increase in the number of people with disability and the corresponding need for informal caregivers, the Nation's public health agenda increasingly needs to address the needs of people with disability and their informal caregivers (White House Conference on Aging 2005).

A caregiver's health and health related quality of life (HRQoL) might directly affect the quality of care provided to the care recipient. It is possible if a caregiver has poor HRQoL, the caregiver may be less able or willing to confer a high quality of care to the care recipient, and worsening HRQoL or increasing physical impairment of caregivers could increase the likelihood that a care recipient might be transferred to a congregate care facility. In tandem, caregivers have been described as "hidden patients" (Brown et al. 1990), because of the evidence that there can be a substantial burden on people who are in

a caregiving role. The stress of caregiving may have a detrimental effect on caregiver HRQoL (Argimon et al. 2004; Bell et al. 2001; Carter 2008; Li et al. 2004; Markowitz et al. 2003; Martinez-Martin et al. 2005; Meyers and Gray 2001; Morimoto et al. 2003; Weitzenkamp et al. 1997), morbidity and mortality (Jacobi et al. 2003; Scholte op Reimer et al. 1998; Schulz and Beach 1999; Scott 2000), social and economic outcomes (Covinsky et al. 1994; Scott 2000), and preventive health behavior (Burton et al. 1997). Adverse outcomes may increase with the increasing time and level of activities needed by the care recipient (National Alliance for Caregiving [NAC] and AARP 2004). However, positive outcomes of caregiving also are reported (Boerner et al. 2004; Rabkin et al. 2000; Tarlow et al. 2004). It is imperative that the health and well-being of caregivers be evaluated at the population level, given the increasing importance of their role in caring for people with disabilities.

Part of the national public health objectives set forth in *Healthy People 2010* (U.S. Department of Health and Human Services [DHHS] 2000) includes health promotion and disease prevention in people with disabilities (Focus Area 6: Disability and Secondary Conditions). *Healthy People 2010* calls for the reduction in people with disability in congregate care and emphasizes the importance of supporting people with disabilities by providing more personal assistance and support to caregivers. Further, *Healthy People 2010* appeals for improved public health surveillance and health promotion programs for people with disabilities and their caregivers. To meet the public health agenda, there must be population-level surveillance data on caregivers. Unfortunately, there is very little information available at the broader public health level regarding the impact of caregiving.

Most prior research has been conducted on small, non-representative, convenience samples of caregivers. As a result, participants in caregiver studies tend to be systematically different from those studied in community surveys, and those, in turn, are different—in unknown ways—from the total population of caregivers (Toseland and Rossiter 1989). Caregiver studies have often been very focused on specific impairments, or have been relationship-specific, rather than focusing on population issues in caregiving (Anderson et al. 2002; das Chagas et al. 2000; Green et al. 2002; Lawrence et al. 1998; Rabkin et al. 2000; Teri 1997), even when based on surveillance or national samples (Kramer and Lambert 1999; Langa et al. 2002; Samsa et al. 2001; Schulz and Beach 1999). An important new population-level report from the National Alliance for Caregiving and AARP (NAC and AARP 2004) provides prevalence information on caregiving in the United States. Although the survey was geographically representative of the United States, it was conducted on a relatively small sample of 6,139 adults, and surveyed only caregivers who provided at least one of a list of support activities.

The purpose of the research presented herein is to provide estimates of the impact of caregiving in order to meet the *Healthy People 2010* disability population goals based on a large national sample. By using a large representative national sample, we aim to provide information on the public health impact of caregiving that has not been previously well-researched, in particular the public health impact of caregiving using population-level data. The focus of this study is to evaluate the health-related quality of life (HRQoL) of caregivers. We hypothesized that the HRQoL of caregivers would show a decrement compared to non-caregivers, and that there would be differences in the HRQoL of caregivers based on the gender and age of the caregiver, further, we expected that there was an interaction between gender and caregiving, with women having lower HRQoL than men. We also speculated that there would be differences in HRQoL between older and younger caregivers, however without knowing the direction of the interaction. Specifically, we expected

that three measures of HRQoL from national USA surveys were lower among caregivers. For completeness, these measures are described below.

2 Design and Methods

The study protocol was approved by the local Institutional Review Board (IRB) at the University of Florida. The Behavioral Risk Factor Surveillance System (BRFSS) 2000, the data source for this study (CDC 1994, 1998, 2005), is a nation-wide survey conducted annually in all American states and territories by the CDC (Gentry et al. 1985; Remington et al. 1988; <http://www.cdc.gov/brfss>). Data from the BRFSS are in the public domain, maintained by the CDC and accessible to the public (CDC 1994, 1998, 2005). The non-institutionalized adult population (aged 18 and older) in the United States is surveyed using random digit-dialed telephone interviews. The survey includes questions concerning issues such as health behaviors, medical conditions, access to health care, geographic and demographic information, use of preventive health care, and health-related quality (HRQoL). In 2000, a question identifying caregivers for people aged 60 and older was added to the BRFSS in all 50 states, the District of Columbia, and Puerto Rico, providing a representative sample of the United States.

HRQoL core module questions are asked in all states and have been on the BRFSS survey since 1993. The BRFSS' HRQoL questions (also called the "Healthy Days" module) have standardized survey and scoring methods, and established comparative population norms (CDC 1994, 1995, 1998; Hennessy et al. 1994; Moriarty et al. 2003). The HRQoL core module includes a global assessment question that measures Self-Reported Health (i.e., "Would you say that in general your health is excellent, very good, good, fair, or poor?"). This single question has a substantial research track for its usefulness in community studies (Idler and Benyamini 1997). Also included in the HRQoL Core are two questions reporting the number of days during the previous 30 days in which the respondent's physical or mental health was not good. The sum of these two measures results in the total number of "unhealthy days" (ranging from 0 to 30 days). In contrast, the Healthy Days measure estimates the number of recent days in which both the respondent's physical and mental health were good, and is calculated by subtracting the number of "unhealthy days" from 30. The validity of the BRFSS' HRQoL measures have been compared to the Sickness Impact Profile and Short Form 36 (SF-36) in a special population (Andresen et al. 1999) as well as in a general population compared to the SF-36 and a depression screening measure (Newschaffer 1998). The retest reliability of these questions has been found to be excellent in a population sample (Andresen et al. 2003).

2.1 Dependent Variables

We used several different measures of HRQoL as dependent variables. First, a dichotomous variable for poor health was created. Responses of poor health were coded as "1" if the person responded that he or she was in "fair" or "poor" health. Responses of "excellent," "very good," or "good" health were coded as "0." The second dependent variable used in this study was a continuous variable, the Healthy Days index (the number of recent days in which both the respondent's physical and mental health were good). We also measured physical and mental health as separate dependent variables (# of days during the past 30 days when physical or mental health was not good). Finally, a three-level

categorization of the Healthy Days index was created because of strongly positive skewed responses. The categorization was classified as (1) 0 healthy days (2) 1–29 healthy days; and (3) 30 healthy days.

2.2 Independent Variables

Respondents were asked the following question: “There are situations where people provide regular care or assistance to a family member or friend who is elderly or has a long-term illness or disability. During the past month, did you provide any such care or assistance to a family member or friend who is 60 years of age or older?” (coded as “1” for caregivers, “0” for non-caregivers). Also included as independent variables in the models were measures that were available for all states, including demographic characteristics such as age, gender, annual income (\leq \$25,000/yr vs. \$25,000/yr or more) marital status (married vs. not married), education level (more than high school vs. high school or less), as well as health status characteristics such as body mass index (BMI) [BMI of 25.0–29.9 is overweight; BMI of 30.0 and above is obese (National Heart, Lung, and Blood Institute 1998)], exercise (any exercise vs. no exercise), and presence or absence of diabetes. Classification of the independent variables was based on typical public health reporting and analyses of BRFSS data.

2.3 Data Analysis

Primary analyses were conducted using SPSS, version 13.0. Descriptive statistics were weighted using SAS, version 8.2, to provide information on the characteristics of caregivers and non-caregivers. Given the extremely large sample size and multiple comparisons, a more conservative p -value was used. For descriptive statistics, we provide comparisons with statistical significance at $p < 0.001$. Binary logistic regression models examined the effect of caregiver status on poor or fair health. Odds ratios (OR) for these associations are provided with 95 percent confidence intervals (95% CI). We stratified the data to run separate binary logistic regression, OLS, and multinomial logistic regression models by examining married vs. non-married caregivers, male vs. female caregivers, and caregivers 55 years or older vs. caregivers less than 55 years of age. The comparison of 55 years older and less than 55 years older was made with special consideration of the decade between 50 and 60 as key to changes in functional outcomes (Miller et al. 2005). The subgroup analyses examined if these variables may have modified associations between caregiving and HRQoL.

We used two techniques to model the effect of caregiving status on Healthy Days. First, we conducted ordinary least squares (OLS) regression with the same independent variables listed above. Because of the kurtotic distribution that showed two separate peaks at each end of the distribution (48% of respondents reported no mental or physical poor health days and were scored as having 30 healthy days), we also investigated the relationship between healthy days and caregiving status using multinomial logistic regression models. For the multinomial logistic regression models, 1–29 and 30 days were compared to the reference category of 30 healthy days. We also conducted OLS models that examined physical days and mental days separately to determine if caregiving had the same effect on both physical and mental status.

All analyses were adjusted for demographic confounding variables of age, education, gender, marital status, and income. Other potential confounders, such as the presence of a

chronic condition, were chosen if they were thought to be associated with HRQoL and entered into the models if they changed the odds ratio associated with caregiving status by 5% or more. There was no multicollinearity among variables. The analyses are presented in tables. The first model is the unadjusted model which examines the association between caregiving status and the dependent variable only; the second model adds demographic cofounders; and the third model adds other risk factor cofounders.

3 Results

In calendar year 2000, 184,450 adults over age 18 participated in the BRFSS survey.

Table 1 shows the characteristics of caregivers, non-caregivers, and the overall survey sample. Due to the large sample size, there were statistically significant differences at the $p < .001$ levels between caregivers and non-caregivers in all factors. Caregivers were more likely to be women, older, married, and unemployed.

3.1 Fair or Poor Health

We examined the possibility that the relationship between HRQoL and caregiver status may have been modified by gender, age, and marital status. Only the interaction between caregiving status and age was statistically significant and, therefore, the results of the HRQoL were stratified by age categories (<55 years old vs. 55 years and older). In the unadjusted binary logistic regression model (as shown in Table 2) caregivers <55 years old had a 36% higher relative odds of rating their health as “fair” or “poor” compared to non-caregivers in their age cohort (OR = 1.36, 95% CI 1.36, 1.43, $p < 0.001$). This was not strongly confounded by any of the demographic covariates, and the adjusted value was 1.39 (95% CI 1.32, 1.47, $p < 0.001$). We also entered other risk factors into the model, such as exercise, as well as the participant’s BMI and presence or absence of diabetes. Only presence or absence of diabetes remained in the model because it changed the odds ratio associated with caregiving status by 5% or more. In the fully-adjusted model, the caregivers <55 remained at an increased risk of poor or fair health (OR = 1.35, 95% CI 1.28, 1.43, $p < 0.001$) compared to non-caregivers their age. On the contrary, caregivers aged 55+ showed a slightly reduced risk of rating their health as “fair” or “poor” compared to non-caregivers in their age group. While they had a 13% reduced risk in the unadjusted model (OR = 0.87, 95% CI 0.83, 0.92, $p < 0.001$), they had only a 3% reduced risk in the fully adjusted model (OR = 0.97, 95% CI 0.92, 1.03, $p < 0.001$) (See Table 2).

The results of the OLS models suggest that being a caregiver is associated with a decreased number of healthy days (Table 3a–c). The tables provide the unstandardized coefficients and standard errors for number of healthy days, physically unhealthy days, and mentally unhealthy days models. In the unadjusted healthy days model, caregivers <55 years of age had a decrease of 1.73 healthy days compared to non-caregivers their age ($p < .001$). The decrease in the number of health days persisted after controlling for demographic characteristics ($\beta = -1.51$, $p < .001$). After adding risk factors to the model, caregiver status was still associated with a reduction of 1.44 healthy days ($\beta = -1.44$, $p < 0.001$). There was also a decrease noted in the number of healthy days in caregivers 55 years and older, however, the magnitude of the decline was not as great as those <55 years of age. In the unadjusted models, caregivers 55+ had a decrease of 0.38 healthy days compared to non-caregivers their age ($\beta = -0.38$, $p < 0.001$) and in the fully

Table 1 Characteristics of caregivers and non-caregivers in a national sample of 184,450 adults*

	Caregiver <i>N</i> = 29,277	Non-caregiver <i>N</i> = 155,173	Total <i>N</i> = 184,450
Age (mean \pm SD [†])	47.62 \pm 16.24	44.92 \pm 17.65	45.35 \pm 17.47
65 and older (%)	17.71	17.39	17.44
Gender (% women)	59.97	50.37	51.87
Race (%)			
Non Hispanic White	73.89	72.74	72.92
Hispanic White	7.81	9.20	8.98
Non Hispanic African American	10.85	9.28	9.52
Hispanic African American	1.03	0.75	0.79
Hispanic other race	2.84	3.50	3.40
Asian/Pacific Islander	1.64	2.71	2.54
Native American/Alaskan Native	1.16	0.94	0.97
Other non Hispanic	0.79	0.89	0.88
Marital status (%)			
Married/coupled	64.54	61.18	61.71
Divorced/separated	13.03	12.13	12.27
Widowed	5.99	7.47	7.24
Never been married	16.43	19.21	18.78
Education (%)			
No formal education/grades 1–8	3.53	5.53	5.22
\leq HS	7.56	8.20	8.10
HS graduate	31.24	30.96	31.00
\geq HS	57.67	55.31	55.68
Employment (%)			
Employed for wages/self-employed	62.32	64.46	64.12
Out of work	4.17	3.67	3.74
Homemaker	7.96	7.40	7.48
Student	3.35	4.10	3.99
Retired	18.06	16.35	16.61
Unable to work	4.14	4.03	4.05
Income (%)			
<\$25,000	29.32	30.14	30.01
\$25,000–\$34,999	15.73	15.51	15.55
\$35,000–\$49,999	19.16	18.59	18.68
\$50,000–\$74,999	17.96	17.30	17.41
\$75,000 or more	17.83	18.45	18.35
Have healthcare coverage (%)	86.91	85.63	85.82
Have personal doctor/health care provider (%)	89.88	85.49	86.16
Seen health profession in last 12 months (% yes)	73.66	70.62	71.10
Body mass index (%)			
Underweight	1.81	2.12	2.07
Normal weight	36.61	39.23	38.82
Overweight	35.18	35.51	35.46
Obese	26.39	23.14	23.65

Table 1 continued

	Caregiver <i>N</i> = 29,277	Non-caregiver <i>N</i> = 155,173	Total <i>N</i> = 184,450
Ever had high blood pressure (% yes)	27.98	25.05	25.52
Flu shot (% receiving last 12 months)	37.04	31.08	31.99
Smoking frequency (% yes)			
Everyday	37.51	36.23	36.44
Sometimes	10.94	11.33	11.26
Not at all	51.55	52.44	52.30
Number times in past month consumed ≥ 5 alcoholic beverages (mean \pm SD)	1.36 \pm 3.97	1.36 \pm 3.67	1.34 \pm 3.69
Number of alcoholic beverages consumed (mean)	2.62 \pm 2.62	2.79 \pm 2.87	2.76 \pm 2.81
>5 fruits and vegetables per day (% yes)	2.80	4.39	4.14
Participate in physical activity (% yes)	73.92	71.86	72.18
Healthy days (mean \pm SD)	22.98 \pm 10.29	24.41 \pm 9.40	24.2 \pm 9.55
Days physical health not good (mean \pm SD)	3.80 \pm 8.03	3.27 \pm 7.64	3.34 \pm 7.70
Days mental health not good (mean \pm SD)	4.16 \pm 8.24	3.02 \pm 7.04	3.19 \pm 7.23
0 healthy days (%)	12.20	9.50	9.90
1–29 healthy days (%)	44.40	40.10	40.80
30 healthy days (%)	43.40	50.40	49.30
Provide care for someone 60 or older (% yes)	na	15.57	
Self reported health			
Excellent/very good/good	83.24	84.51	84.26
Fair/poor	16.59	15.27	15.52

*The sample weight is the number of population members whom the respondent represents as a member of the sample (see Gentry et al. 1985). Due to the large sample, there were statistically significant differences at $p < 0.001$ between the caregiver and the non-caregiver in all factors listed in Table 1

*SD = standard deviation

Behavioral Risk Factor Surveillance System (BRFSS) 2000

adjusted models, they had a decrease of 0.55 healthy days ($\beta = -0.55$, $p < 0.001$). (See Table 3a).

The OLS models also showed that there were different effect sizes between physical and mental HRQoL in caregivers, and among age groups. In the fully adjusted model, caregivers <55 had an increase of 0.63 days not good physical health days ($\beta = 0.63$, $p < 0.001$), while caregivers 55+ had a decrease of 0.38 days not good physical health days ($\beta = -0.38$, $p < 0.001$) (See Table 3b). In contrast, while in the fully adjusted models, caregivers <55 had a 1.09 days increase in not good mental health days ($\beta = 1.09$, $p < 0.001$), and caregivers 55+ had a 1.01 days increase in not good mental health days ($\beta = 1.01$, $p < 0.001$) (see Table 3c). Therefore, it appears that the mental strain on caregivers affects both the younger and older caregivers the same, yet the younger caregivers experience more decline in their physical health than older caregivers.

Table 4 represents the results from the multinomial logistic regression models using three categories of healthy days. The relationship between caregiver status and healthy days persisted after adjustment. In the unadjusted model, caregivers <55 years old had a higher likelihood of having zero healthy days and 1–29 healthy days compared to non-caregivers their age (reference category is 30 healthy days). After adjusting for both

Table 2 Logistic regression model: association between caregiving status and health status stratified by age (<55 years old vs. ≥55 years old)

Model variables	Model 1 (unadjusted) ^a		Model 2 ^b (partial adjustment)		Model 3 ^c (full adjustment)	
	OR	95% CI	OR	95% CI	OR	95% CI
<i>Age of caregiver 55+</i>						
	<i>N</i> = 57,019		<i>N</i> = 44,957		<i>N</i> = 44,705	
Caregiver versus non	0.87	0.83, 0.92	0.96	0.97, 1.02	0.97	0.92, 1.03
Female versus male			0.88	0.85, 0.93	0.92	0.88, 0.97
Married versus not married			0.97	0.92, 1.01	0.98	0.93, 1.03
More than high school versus high school or less			0.55	0.52, 0.57	0.55	0.53, 0.58
Income of \$25,000/year+ versus <\$25,000/year			0.32	0.30, 0.33	0.33	0.31, 0.35
Diabetes (yes vs. no)					3.46	3.33, 3.67
<i>Age of caregiver <55 years old</i>						
	<i>N</i> = 123,939		<i>N</i> = 125,475		<i>N</i> = 108,975	
Caregiver versus non	1.36	1.36, 1.43	1.39	1.32, 1.47	1.35	1.28, 1.43
Female versus male			1.02	0.98, 1.06	1.02	0.98, 1.02
Married versus not married			1.02	0.98, 1.07	1.02	0.97, 1.06
More than high school versus high school or less			0.50	0.48, 0.52	0.52	0.48, 0.52
Income of \$25,000/year+ versus <\$25,000/year			0.28	0.27, 0.29	0.28	0.27, 0.29
Diabetes (yes vs. no)					7.29	6.76, 7.85

^aUnadjusted model^bPartially adjusted model including demographics^cFully adjusted model including demographics and health conditions*p*-value for interaction between age group and caregiving status <0.001

demographic and other risk factors, the effect of caregiver status on healthy days remained the same, with a 68% increased risk of having no healthy days compared to non-caregivers their age (OR = 1.68, 95% CI 1.52, 1.71), and a 27% increase in having 1–29 healthy days compared to 30 (OR = 1.27, 95% CI 1.23, 1.32). The caregivers 55 years and older had a lower risk of having reduced healthy days. After adjusting for both demographic and other risk factors, the 55+ had only a 15% increased risk of having no healthy days compared to non-caregivers their age (OR = 1.15, 95% CI 1.07, 1.25), and a 25% increase in having 1–29 healthy days compared to 30 (OR = 1.25, 95% CI 1.18, 1.32).

4 Discussion

Understanding the relationship between caregiving status and HRQoL is an important step in delineating the public health implications of caregiving. This study evaluated the HRQoL of caregivers using a large national sample. Respondents from 50 states, the District of Columbia, and Puerto Rico answered a question on caregiving on the BRFSS 2000. This is one of the few reports of HRQoL in caregivers that is not disease specific; however, it mirrors studies of specific impairments demonstrating reduced HRQoL (Jacobi et al. 2003; Martinez-Martin et al. 2005; Weitzenkamp et al. 1997). We found a decrement of HRQoL for caregivers, one that was different in magnitude based on the age of

Table 3 Linear regression ordinary least squares (OLS) associations of caregiving status to healthy days stratified by age

Independent variables	Model 1 (unadjusted) ^a		Model 2 ^b (partial adjustment)		Model 3 ^c (full adjustment)	
	β	SE ⁺	β	SE ⁺	β	SE ⁺
(a) Regression (OLS) association of caregiving and healthy day index						
<i>Age of caregiver 55+</i>						
	<i>N</i> = 54,550		<i>N</i> = 43,347		<i>N</i> = 43,107	
Caregiver versus non	-0.38*	0.12	-0.52*	0.13	-0.55*	0.13
Female versus male			-0.79*	0.11	-0.91*	0.12
Married versus not married			0.58*	0.11	0.55*	0.11
More than high school versus high school or less			1.04*	0.11	0.92*	0.11
Income of \$25,000/year+ versus <\$25,000/year			3.42*	0.12	3.20*	0.12
Diabetes (yes vs. no)					-3.84*	0.15
<i>Age of caregiver <55</i>						
	<i>N</i> = 121,787		<i>N</i> = 108,713		<i>N</i> = 107,314	
Caregiver versus non	-1.73*	0.07	-1.51*	0.07	-1.44	0.07
Female versus male			-1.68*	0.06	-1.68*	0.06
Married versus not married			1.00*	0.06	1.01*	0.06
More than high school versus high school or less			0.93*	0.06	0.89	0.06
Income of \$25,000/year+ versus <\$25,000/year			2.75*	0.07	2.65	0.07
Diabetes (yes vs. no)					4.87	0.15
(b) Regression (OLS) association of caregiving and not good physical health days						
<i>Age of caregiver 55+</i>						
	<i>N</i> = 54,497		<i>N</i> = 44,029		<i>N</i> = 43,783	
Caregiver versus non	-0.54*	0.11	-0.42*	0.12	-0.38*	0.12
Female versus male			0.31*	0.09	0.42*	0.09
More than high school versus high school or less			-0.97*	0.10	-0.87*	0.09
Income of \$25,000/year+ versus <\$25,000/year			-3.41*	0.10	-3.17*	0.10
Diabetes (yes vs. no)					3.81*	0.14
<i>Age of caregiver <55</i>						
	<i>N</i> = 123,024		<i>N</i> = 109,849		<i>N</i> = 108,433	
Caregiver versus non	0.79*	0.05	0.69*	0.05	0.63*	0.05
Female versus male			0.53*	0.04	0.54*	0.04
More than high school versus high school or less			-0.48*	0.04	-0.45*	0.04
Income of \$25,000/year+ versus <\$25,000/year			-2.05*	0.05	-1.95*	0.05
Diabetes (yes vs. no)					4.82*	0.11
(c) Regression (OLS) association of caregiving and not good mental health days						
<i>Age of caregiver 55+</i>						
	<i>N</i> = 55,911		<i>N</i> = 44,241		<i>N</i> = 43,996	
Caregiver versus non	0.93	0.08	1.00*	0.86	1.01*	0.09
Female versus male			0.63*	0.07	0.66*	0.07
Married versus not married			-0.49*	0.07	-0.48*	0.07
More than high school versus high school or less			-0.33*	0.07	-0.29*	0.07
Income of \$25,000/year+ versus <\$25,000/year			-1.13*	0.08	-1.07*	0.08
Diabetes (yes vs. no)					0.89*	0.09

Table 3 continued

Independent variables	Model 1 (unadjusted) ^a		Model 2 ^b (partial adjustment)		Model 3 ^c (full adjustment)	
	β	SE ⁺	β	SE ⁺	β	SE ⁺
<i>Age of caregiver <55</i>						
	<i>N</i> = 122,595		<i>N</i> = 109,367		<i>N</i> = 108,433	
Caregiver versus non	1.27*	0.06	1.12*	0.63	1.09*	0.63
Female versus male			1.32*	0.46	1.31*	0.46
Married versus not married			-1.05*	0.48	-1.05	0.48
More than high school versus high school or less			-0.73*	0.05	-0.72*	0.49
Income of \$25,000/year+ versus <\$25,000/year			-1.79*	0.56	-1.75*	0.56
Diabetes (yes vs. no)					1.95*	0.13

* $p < .01$ ^aUnadjusted model^bPartially adjusted model including demographics^cFully adjusted model including demographics and health conditions

+SE = standard error

 p -value for interaction between age group and caregiving status <0.001

caregiver. Our fully adjusted models may provide a conservative estimate of this relationship, because we adjusted for factors that were prevalent with caregiving (e.g., lower income, lifestyle habits) and these could be outcomes of caregiving itself. Other variables that may have been potential confounders were either not available in the dataset (psychological factors) or were not collected in all states and therefore could not be analyzed with national-level data (e.g. smoking status, alcohol abuse, presence of asthma, arthritis, and hypertension). However we did test for one factor that may be linked to life-style factors and chronic conditions (e.g., arthritis, hypertension, smoking). Body mass index (BMI) was entered into all of the models, but it was not retained in the models because it had no effect on the association with the dependent variables. One strength of the current research is that representative samples may be less likely to be biased in evaluating the impact of caregiving. Research has found that non-representative samples of caregiving over-represent distressed caregivers (Schulz et al. 1995). BRFSS sampling is representative of community-dwelling adults nationally, and therefore the effect size (e.g., odds ratio) may be smaller than a non-representative sample may have reported.

We found a stronger association with mental HRQoL, suggesting that caregivers' mental health is affected more than their physical health from caregiving duties. These results support findings of two previous meta analyses that examined the difference between caregivers and non-caregivers in psychological and physical health (Pinquart and Sørensen 2003; Schulz et al. 1995). In these meta-analyses, caregivers were found to have more of a decrease in psychological health as compared to physical health. Caregivers also have been reported to be at increased risk for depression and have higher use of psychotropic drugs (Schulz et al. 1995).

In addition to the impact on the caregiver themselves, the burden of caregiving may hold several potential policy implications, such as the possibility that caregivers with reduced HRQoL may be less likely to be able to provide care services. Society benefits economically from the provision of informal caregiving. Informal caregivers reduce the

Table 4 Relation of caregiver status to number of healthy days: results from multinomial logistic regression

Caregivers aged <55				
Independent variables	Model 1 ^a N = 54,551	Model 2 ^b N = 43,348	Model 3 ^c N = 43,108	
Odds ratios (and 95% confidence intervals). Reference category for each model is 30 healthy days				
0 healthy days versus 30	1-29 healthy days versus 30	0 healthy days versus 30	1-29 healthy days versus 30	0 healthy days versus 30
Caregiver versus non	1.09* (1.03, 1.17)	1.29* (1.23, 1.37)	1.14* (1.06, 1.23)	1.25* (1.18, 1.32)
Female versus male			1.25* (1.07, 1.25)	1.25* (1.18, 1.32)
Married versus not married			1.51* (1.44, 1.58)	1.53* (1.46, 1.61)
More than high school versus high school or less			0.98 (0.94, 1.03)	0.98 (0.94, 1.03)
Annual income ≥\$25,000/year versus <\$25,000/year			1.07* (1.02, 1.11)	1.08* (1.03, 1.13)
Diabetes (yes vs. no)			0.42* (0.39, 0.45)	0.93* (0.88, 0.97)
			2.37* (2.20, 2.55)	1.59* (1.49, 1.71)
Independent variables				
	Model 1 ^a N = 121,788	Model 2 ^b N = 108,714	Model 3 ^c N = 107,315	
Odds ratios (and 95% confidence intervals). Reference category for each model is 30 healthy days				
0 healthy days versus 30	1-29 healthy days versus 30	0 healthy days versus 30	1-29 healthy days versus 30	0 healthy days versus 30
Caregivers aged 55+	1.72* (1.63, 1.82)	1.33* (1.29, 1.38)	1.65* (1.55, 1.74)	1.68* (1.52, 1.71)
Caregiver versus non			1.28* (1.24, 1.33)	1.27* (1.23, 1.32)

Table 4 continued

Independent variables	Model 1 ^a N = 121,788		Model 2 ^b N = 108,714		Model 3 ^c N = 107,315	
	0 healthy days versus 30	1–29 healthy days versus 30	0 healthy days versus 30	1–29 healthy days versus 30	0 healthy days versus 30	1–29 healthy days versus 30
Female versus male			1.69* (1.61, 1.77)	1.63*(1.58, 1.66)	1.69*(1.61, 1.77)	1.62* (1.58, 1.67)
Married versus not married			0.70* (0.67, 0.74)	0.79* (0.77, 0.82)	0.69* (0.66, 0.73)	0.79* (0.77, 0.82)
More than high school versus high school or less			0.76* (0.72, 0.79)	1.19* (1.16, 1.22)	0.77* (0.73, 0.81)	1.19* (1.16, 1.22)
Annual income ≥\$25,000/year versus <\$25,000/year			0.42* (0.40, 0.44)	0.92* (0.89, 0.94)	0.43* (0.41, 0.46)	0.92* (0.89, 0.95)
Diabetes (yes vs. no)					3.79* (3.45, 4.17)	1.37* (1.27, 1.48)

* Statistically significant at $p < 0.001$

^aUnadjusted model

^bPartially adjusted model including demographics

^cFully adjusted model including demographics and behavioral factors

p-value for interaction between age group and caregiving status, <.001

amount of paid care that is provided in the hospital and skilled care facilities and allows care recipients to be discharged sooner (Gibson and Hauser 2007). Caregiving also allows care recipients to receive care in the home, as opposed to a skilled care facility. There is also the danger that if the caregiver's HRQoL is poor, the care recipient may receive a lower quality of care or may be at increased risk for physical abuse by the caregiver (Beach et al. 2005).

Public health interventions may be needed to reduce the burden of caregivers (Talley and Crews 2007). Prior research in studies of specific impairments of care recipients suggests that interventions are beneficial (Akkerman and Ostwald 2004; Brodaty et al. 2003; Gitlin et al. 2003; Mahoney et al. 2003; Pierce et al. 2004; Salfi et al. 2005). One such intervention might entail a policy change to provide more services that assist in caregiving duties, such as the provision of paid personal care assistants (White House Conference on Aging 2005). Education of caregivers might also be useful: in prior research, caregivers who were found to be least prepared for their role as a caregiver were found to have more problems maintaining their health (Scott 2000). Increased social support has been found to have positive associations with caregivers' mental and physical health (Markowitz et al. 2003) and professional support was found to reduce caregiver burden of families of mentally ill persons (Reinhard 1994). However, interventions on a public health scale will need to follow additional studies of caregiving with more specific measures of caregiving, the recipient, and the intensity of the caregiving tasks. The BRFSS could serve as a possible source of more detailed data based on a more comprehensive module on caregiving and caregiving impact (Neugaard et al. 2007).

Several of the study limitations should be addressed here. As with survey research in general, the BRFSS response rate has declined to about 53% nationwide, and varies by state (CDC 2004). As such, we cannot confirm that the results we report here are not biased in some way. For example, response is higher among women than men on the BRFSS (CDC 2004). In addition, the simple question of caregiving used on the 2000 BRFSS may be interpreted differently by respondents, and does not include a clear definition of caregiving or duration of caregiving. It specifically excluded caregivers of care recipients under aged 60.

The intensity of the care recipient's care needs, and the relationship to care recipient also are likely to have an effect on the HRQoL of caregivers. Future research will need to include a measure of intensity or burden to fully explore the effect of HRQoL. Other aspects of these data may be affected by reporting bias or misclassification. For example, people might telescope in distant caregiving experiences not related to current HRQoL, or include caregiving of brief episodes of family illnesses. Overall these concerns are similar to the broad questions about self-reported data from population surveys. Caregivers may be underrepresented in the sample as respondents because of their time constraints and/or the burden of caregiving activities. These aspects of misclassification may under-estimate the difference in HRQoL between caregivers and others, and the results reported here might be modest in part by bias to the null. The National Alliance for Caregiving, for example, found a strong dose-response of distress by increasing intensity of caregiving (NAC and AARP 2004). Finally, the data are cross-sectional in nature. While it would be difficult to argue that caregiving followed a change in HRQoL, the temporal sequence is somewhat ambiguous.

In conclusion, these results suggest that caregivers experience reduced HRQoL. More detailed population-level research will be needed to confirm these results and provide a more explicit understanding of the extent and risks for this decrement.

Acknowledgements The funding for this study was provided by the Centers for Disease Control and Prevention (CDC) and the Association of Teachers of Preventative Medicine (ATPM project TS 1339). We would like to thank Ziya Gizlice, who was employed by the North Carolina BRFS during this project, and John Crews at the CDC, for their assistance on this study.

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