

## Examining Health Behaviors of Chronic Disease Caregivers in the United States

Ekin Secinti, M.S.,<sup>1</sup> Wei Wu, Ph.D.,<sup>1</sup> Erin E. Kent, Ph.D., M.S.,<sup>2</sup> Wendy Demark-Wahnefried, Ph.D., R.D.,<sup>3</sup> Ashley B. Lewson, B.S.,<sup>1</sup> and Catherine E. Mosher, Ph.D.<sup>1</sup>

<sup>1</sup>Department of Psychology, Indiana University–Purdue University Indianapolis

<sup>2</sup>Department of Health Policy and Management, Gillings School of Global Public Health,  
University of North Carolina, Chapel Hill

<sup>3</sup>Department of Nutrition Sciences, School of Health Professions, University of Alabama at  
Birmingham

Correspondence concerning this article should be addressed to Ekin Secinti, M.S., Department of Psychology, Indiana University-Purdue University Indianapolis, 402 North Blackford Street, LD 124, Indianapolis, IN 46202, USA. Phone: 1-317-278-2989. Fax: 1-317-274-6756. E-mail: [esecinti@iupui.edu](mailto:esecinti@iupui.edu)

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Financial Disclosure:** No financial disclosures were reported by the authors of this paper.

---

This is the author's manuscript of the article published in final edited form as:

Secinti, E., Wu, W., Kent, E. E., Demark-Wahnefried, W., Lewson, A. B., & Mosher, C. E. (2022). Examining Health Behaviors of Chronic Disease Caregivers in the U.S. *American Journal of Preventive Medicine*, 62(3), e145–e158. <https://doi.org/10.1016/j.amepre.2021.07.004>

## Abstract

**Introduction:** Many informal caregivers experience significant caregiving burden which may interfere with their health behaviors. Caregiver health behaviors may vary by disease context, but this has rarely been studied. This study compared health behaviors of prevalent groups of chronic illness caregivers (i.e., dementia, cancer, chronic obstructive pulmonary disease [COPD]/emphysema, diabetes) and non-caregivers and examined whether caregiving intensity was associated with these behaviors.

**Methods:** In 2021, using pooled cross-sectional 2015-2019 Behavioral Risk Factor Surveillance System data, health behaviors (i.e., physical activity, diet, alcohol use, smoking, sleep, and influenza immunization) of dementia ( $n=5,525$ ), cancer ( $n=4,246$ ), COPD/emphysema ( $n=1,959$ ), and diabetes ( $n=2,853$ ) caregivers and non-caregivers ( $n=203,848$ ) were compared. Relations between caregiving intensity (e.g., hours, type of tasks) and caregiver health behaviors also were examined. Regression analyses were used to compare groups.

**Results:** Compared to non-caregivers, caregiver groups were more likely to report engaging in both risky (i.e., smoking, shorter sleep duration) and health-promoting behaviors (i.e., physical activity, vegetable consumption, abstaining from heavy drinking), whereas non-significant differences were observed for influenza immunization. Longer caregiving hours and providing help with personal care were associated with poorer health behaviors (e.g., shorter sleep duration). Few differences in health behaviors were observed between dementia and other caregiver groups.

**Conclusions:** Results suggest that caregivers are more likely to engage in both risky and health-promoting behaviors compared to non-caregivers. Further, findings suggest that greater caregiving responsibilities are associated with certain risky health behaviors. Findings support

the development and implementation of strategies to improve caregivers' health behaviors across disease contexts.

*Keywords:* informal caregivers, dementia, cancer, COPD, diabetes, health behaviors

## Introduction

Informal caregivers provide significant unpaid care to a family member or friend with a chronic illness or disability.<sup>1,2</sup> In the U.S., between 7.7—21.3% of adults are estimated to be caregivers, reflecting differences in sample characteristics and definitions of caregiving.<sup>1,3,4</sup> These individuals often experience emotional, physical, and economic hardships related to caregiving (i.e., caregiving burden)<sup>5-10</sup> which may interfere with health-promoting behaviors.<sup>11</sup> Caregiving burden and intensity (e.g., greater duration, hours of care, or caregiving tasks) have been correlated with adverse health behaviors including lack of regular physical activity,<sup>12-15</sup> poor dietary habits,<sup>12,13</sup> problematic alcohol use,<sup>16</sup> smoking,<sup>14</sup> and inadequate sleep.<sup>17</sup>

Overall, studies have yielded mixed associations between caregiving status and health behaviors. When comparing caregivers of people with various conditions to non-caregivers, some studies found that caregivers were less likely to engage in health-promoting behaviors (i.e., physical activity,<sup>18-20</sup> fruit consumption<sup>21</sup>) and more likely to engage in risky behaviors (i.e., alcohol use,<sup>22</sup> smoking,<sup>14,22-28</sup> and shorter sleep duration<sup>17,26,27,29</sup>), whereas other studies found no differences between these groups (i.e., physical activity,<sup>23</sup> fruit and vegetable consumption,<sup>30</sup> alcohol use,<sup>23,25,30</sup> smoking,<sup>21,30</sup> and influenza immunization<sup>30</sup>). Furthermore, some studies found that caregivers were more likely to engage in health-promoting behaviors (i.e., physical activity,<sup>14,21,25,28,30</sup> influenza immunization<sup>31</sup>) and less likely to engage in risky behaviors (i.e., binge drinking and moderate-to-heavy alcohol use<sup>14,32</sup>) than non-caregivers. Potential explanations for these results include the hypothesis that healthier individuals are more likely to assume caregiving duties (i.e., Healthy Caregiver hypothesis)<sup>33-35</sup> and the health benefits of helping others through enriched social support, life purpose, and well-being.<sup>36-38</sup> The mixed results may reflect differences in measurement, analytic approaches, and sample characteristics

including disease contexts. Indeed, patient characteristics (e.g., functional impairments) and caregiving intensity vary by disease context.<sup>39-42</sup> However, scarce research has compared caregivers' health behaviors by disease context. For example, in a population-based U.S. study, dementia caregivers reported more interrupted sleep compared to non-dementia caregivers.<sup>43</sup> Dementia caregivers may have worse health behaviors than other caregivers due to unique challenges (e.g., continual patient monitoring).

The primary aim of this study was to compare caregivers' health behaviors (i.e., physical activity, diet, alcohol use, smoking, sleep duration, influenza immunization) across four patient disease contexts (i.e., dementia, cancer, COPD/emphysema, and diabetes) to those of non-caregivers using a U.S. population-based dataset, the Behavioral Risk Factor Surveillance System (BRFSS). Caregivers of people with highly prevalent chronic conditions associated with significant symptom burden and varying caregiving intensity were selected.<sup>39-42,44-48</sup> Comparing caregivers' health behaviors by patient condition may inform the provision and tailoring of services for caregivers across disease contexts. Based on prior research,<sup>14,17-29</sup> all caregiver groups were hypothesized to report worse health behaviors than non-caregivers with regards to diet, smoking, and sleep duration. Comparisons of caregiver groups and non-caregivers concerning physical activity, alcohol use, and influenza immunization were exploratory given prior mixed findings. Secondary aims were to examine relationships between caregiving intensity (i.e., caregiving hours, duration, and types of care) and health behaviors, and compare these outcomes between dementia and other caregiver groups. Based on prior research,<sup>12-14,16-18,49</sup> greater caregiving intensity was hypothesized to be associated with worse health behaviors across caregiver groups. Dementia caregivers were hypothesized to report worse health behaviors than other caregiver groups.

## Methods

### Data and Sample

Data from the BRFSS, an annual, nationally representative telephone survey of U.S. adults (aged  $\geq 18$ ) were used.<sup>50,51</sup> The BRFSS includes standardized questions on demographics, medical conditions, health behaviors, and caregiving. BRFSS data collection and sampling information are available online (<https://www.cdc.gov/brfss/index.html>). BRFSS data are publicly available with no individual identifiers; thus, IRB approval and informed consent were not sought.

To maximize the caregiver sample size, BRFSS data from the five most recent cross-sectional waves were combined: 2015 (24 states), 2016 (21 states and territories), 2017 (12 states), 2018 (5 states), and 2019 (10 states). Overall, data from all locations that administered the optional caregiving module, including 44 states, the District of Columbia, and Puerto Rico, were analyzed. Some modules were only included in certain cross-sectional waves; thus, analyses for these variables were conducted using subsamples (see Table S1). Analyses focused on dementia, cancer, COPD/emphysema, and diabetes caregivers, and non-caregivers.

### Measures

BRFSS measures have evidence of good test-retest reliability, convergent validity, and responsiveness.<sup>52-54</sup>

Caregiving status was categorized based on the following questions: “During the past 30 days, did you provide regular care or assistance to a friend or family member who has a health problem or disability?” and “What is the main health problem, long-term illness, or disability that the person you care for has?” Five groups were selected: 1) non-caregivers (i.e., individuals who reported not being a caregiver over the past month), 2) dementia caregivers, 3) cancer

caregivers, 4) COPD/emphysema caregivers, and 5) diabetes caregivers. Respondents chose one main chronic health problem for the patient. Disease type or stage information was not collected.

Caregivers of people with any other main health problem were excluded from analyses.

Respondents reported their relationship to the patient (e.g., spouse, friend).

Caregiving intensity was assessed with four measures: 1) *Caregiving hours per week* ( $\leq 8$  hours, 9-19 hours, 20-39 hours,  $\geq 40$  hours); 2) *Caregiving duration* ( $< 1$  month, 1 month to less than 6 months, 6 months to less than 2 years, 2 years to less than 5 years,  $> 5$  years); 3) *Providing help with household tasks* (yes vs. no); and 4) *Providing personal care* (yes vs. no). Caregiving hours and duration were treated as continuous variables.

Dichotomized measures were used to assess adherence to national guidelines<sup>55-59</sup> (see Table S2 for detailed information on measures). Physical activity during the past month was assessed with two measures: 1) *Meeting aerobic activity recommendations* (i.e.,  $\geq 150$  minutes of moderate-to-vigorous intensity aerobic activity each week such as walking) (yes vs. no);<sup>55</sup> and 2) *Meeting muscle-strengthening recommendations* (i.e., muscle-strengthening activity such as strength training at least 2 days per week) (yes vs. no).<sup>55</sup>

Average dietary behaviors during the past month were assessed with three measures: 1) *Daily fruit consumption* (i.e., daily servings of whole fruit and 100% fruit juice) (continuous); 2) *Daily vegetable consumption* (e.g., daily servings of green and orange vegetables) (continuous); and 3) *Meeting dietary recommendations* (i.e., eating  $\geq 5$  servings of fruit and vegetables daily) (yes vs. no).<sup>56</sup>

Alcohol use during the past month was assessed with three measures: 1) *Binge drinking* (i.e., men who reported having  $\geq 5$  drinks, or women who reported having  $\geq 4$  drinks on at least one occasion in the past month) (yes vs. no);<sup>56</sup> 2) *Average drinks per week* (continuous); and 3)

*Heavy drinking* (i.e., men who reported having >14 drinks per week, or women who reported having >7 drinks per week) (yes vs. no).<sup>56</sup>

Smoking status was assessed with a single measure of smoking history, which was dichotomized as current vs. former/never smoking.<sup>57</sup>

Sleep duration was assessed as average hours of sleep per night. This measure was dichotomized as sleeping  $\geq 7$  hours per night (yes vs. no).<sup>58</sup>

Influenza immunization during the past year was assessed with an item on whether respondents received a flu shot/vaccine in the past 12 months (yes vs. no).<sup>59</sup>

Based on the literature,<sup>11,13,14,16,20,23,24,30,43,60</sup> the following caregiver variables were included as covariates: age (continuous in years, with 80+ coded as 80); sex (female = 0, male = 1); race/ethnicity (non-Hispanic White = 0, other = 1); income (<\$10,000, \$10,000-\$14,999, \$15,000-\$19,999, \$20,000-\$24,999, \$25,000-\$34,999, \$35,000-\$49,999, \$50,000-\$74,999, and  $\geq$ \$75,000); education (never attended school or only kindergarten, elementary school, some high school, high school graduate, some college or technical school, college graduate); employment status (retired/unemployed = 0, employed = 1); marital status (not married/not partnered = 0, married/partnered = 1); children/minors at home (no = 0, yes = 1); BMI (underweight/normal weight = 0, overweight/obese = 1) and number of chronic conditions (total of 0-9, e.g., arthritis, COPD). Income and education were treated as continuous variables.

## **Statistical Analyses**

In 2021, data analyses were conducted using R v.3.6.2. Sampling weights were incorporated in all analyses, accounting for the complex survey design to generate population-based estimates. When combining multiple years of BRFSS data, sampling weights were adjusted based on the sample size of each year.<sup>61</sup> All reported percentages are weighted. Codes

for missing data do not differentiate between participants who were not administered certain items vs. those who declined to answer. Consistent with published BRFSS analyses,<sup>17,25,27,62</sup> analysis of complete cases was employed.

Descriptive statistics were computed for all study variables for each of the four caregiving groups and non-caregivers. Overall group effects on health behaviors and caregiving intensity were examined using Rao-Scott design-adjusted Chi-square tests, binary logistic regression, or Poisson regression, depending on the nature of the corresponding outcome variable.

For the primary aim, each health behavior was compared between the caregiver groups and non-caregivers using hierarchical regression analyses with two steps (see Table S1). Logistic regression was used to estimate physical activity, diet (meeting dietary recommendations), alcohol use, smoking status, sleeping 7+ hours each night, and influenza immunization. Poisson regression was used to estimate count variables of daily fruit and vegetable consumption. In the analysis models, covariates were entered in step 1, and the grouping variable (dummy-coded with non-caregivers as the reference) was then entered in step 2.

For the secondary aims, relationships between caregiving intensity and each health behavior were examined in the caregiver samples using hierarchical binary logistic or Poisson regression with three steps. Covariates were entered in step 1, caregiving intensity variables in step 2, and caregiver groups (dummy-coded with dementia caregivers as the reference) in step 3. Ten covariates noted above were included in all models. Post-hoc analyses were conducted to compare each caregiver group and non-caregivers if omnibus tests were significant. *P-values* <.05 were considered significant.

## Results

From 2015-2019, 258,856 BRFSS respondents completed the optional module on caregiving. This study focused on dementia ( $n=5,525$ ), cancer ( $n=4,246$ ), COPD/emphysema ( $n=1,959$ ), and diabetes ( $n=2,853$ ) caregivers and non-caregivers ( $n=203,848$ ). Table 1 presents descriptive statistics and omnibus tests for all study variables. Omnibus tests showed statistically significant overall group differences in almost all variables. Caregiving duration, hours, and relationship type by caregiver group are presented in Figures S1-3. Multicollinearity was not detected.

Table 2 and Figure 1 show results for the primary aim (see Tables S3-4 for average marginal means). Regarding physical activity, all except for diabetes caregivers were more likely to report meeting aerobic activity recommendations than non-caregivers ( $ORs=1.20$  to  $1.30$ ,  $ps<.05$ ). Similarly, dementia and cancer caregivers were more likely to report meeting muscle-strengthening recommendations than non-caregivers ( $ORs=1.21$  to  $1.35$ ,  $ps<.05$ ). Concerning diet, daily servings of fruit did not differ between caregiver groups and non-caregivers. On the other hand, dementia, cancer, and diabetes caregivers reported consuming more daily servings of vegetables than non-caregivers (Relative Risk Ratios [ $RRRs$ ]= $1.05$  to  $1.09$ ,  $ps<.05$ ), and dementia caregivers were more likely to meet dietary recommendations (5+ daily servings of fruit and vegetables) than non-caregivers ( $OR=1.22$ ,  $p<.05$ ).

Concerning alcohol use, binge drinking did not differ between caregiver groups and non-caregivers; only dementia caregivers were less likely to report heavy drinking than non-caregivers ( $OR=.73$ ,  $p<.05$ ). Regarding smoking, all caregiver groups were more likely to be currently smoking than non-caregivers ( $ORs=1.32$  to  $2.20$ ,  $ps<.001$ ).

Regarding sleep, all caregiver groups were less likely to report sleeping 7+ hours per night compared to non-caregivers ( $ORs=.64$  to  $.74$ ,  $ps<.05$ ). Additionally, influenza immunization in the past 12 months did not differ between caregiver groups and non-caregivers.

Table 3 shows results for the secondary aim. Across caregiver groups, greater hours of caregiving per week were associated with a reduced likelihood of meeting muscle-strengthening guidelines ( $OR=.90$ ,  $p<.05$ ) and sleeping 7+ hours per night ( $OR=.86$ ,  $p<.05$ ), as well as a greater likelihood of current smoking ( $OR=1.10$ ,  $p<.05$ ). Providing help with personal care was associated with a reduced likelihood of sleeping 7+ hours per night ( $OR=.74$ ,  $p<.05$ ) and current smoking ( $OR=.72$ ,  $p<.01$ ). Caregiving duration and providing help with household tasks were not associated with health behaviors.

When comparing health behaviors between dementia and other caregiver groups, diabetes caregivers were less likely to report meeting muscle-strengthening recommendations than dementia caregivers ( $OR=.63$ ,  $p<.01$ ). Cancer and diabetes caregivers were more likely to report heavy drinking than dementia caregivers ( $ORs=1.68$  to  $1.86$ ,  $ps<.01$ ). Additionally, COPD/emphysema and diabetes caregivers were more likely to be currently smoking than dementia caregivers ( $ORs=1.38$  to  $1.55$ ,  $ps<.05$ ). Other health behaviors did not differ between dementia and other caregiver groups.

## **Discussion**

This study is one of the first to compare the health behaviors of caregivers across chronic illness contexts and non-caregivers in a representative U.S. sample. Caregiving status was related to both risky and health-promoting behaviors. Compared to non-caregivers, all caregiver groups were more likely to report smoking and shorter sleep duration. Partially consistent with the Healthy Caregiver hypothesis,<sup>35</sup> certain caregiver groups reported more health-promoting

behaviors (e.g., physical activity). Greater caregiving intensity was associated with smoking and decrements in certain health behaviors (e.g., sleep), and few differences in health behaviors were found between caregiver groups. Overall, results challenge the notion that caregiving has a uniformly negative impact on health behaviors.

Whereas most studies have included heterogeneous caregivers, this study focused on caregivers of people with dementia, cancer, COPD/emphysema, and diabetes—prevalent chronic conditions associated with symptom burden.<sup>40-42,44,45</sup> The current caregiving samples' demographic and medical characteristics mirror those of prior U.S. population-based studies of caregivers.<sup>3,40-42,60</sup> Studies on caregivers' health behaviors have yielded mixed results,<sup>14,17-29</sup> reflecting differences in measurement (e.g., single- vs. multiple-items), covariates, changes in healthcare, and sample characteristics including caregiving definitions and relationships.

In this study, all caregiver groups except for diabetes caregivers were more likely to meet aerobic activity recommendations than non-caregivers, and dementia and cancer caregivers were more likely to meet muscle-strengthening recommendations than non-caregivers. Caregiving activities can be physically intensive; thus, results, especially for aerobic activity, may reflect overall physical activity rather than leisure-time exercise. One study found that older female caregivers reported similar overall physical activity but less leisure-time exercise than non-caregivers.<sup>19</sup> Additionally, caregivers' increased physical activity may reflect coping to relieve stress<sup>63</sup> or prosocial behaviors (e.g., participating in for-cause physical activity events).<sup>38</sup> Another possibility is that healthier, physically active adults assume caregiving roles.<sup>35</sup>

Contrary to hypotheses, only dementia caregivers were more likely to meet dietary recommendations than non-caregivers; other caregivers were just as likely as non-caregivers to consume suboptimal amounts (<5 servings) of fruits and vegetables (82-85% vs. 85%).

Dementia, cancer, and diabetes caregivers reported consuming more daily servings of vegetables than non-caregivers, which may reflect reciprocal influences of patients and caregivers on each other's diet.<sup>64</sup> However, these small differences may have limited clinical significance. Barriers to fruit and vegetable consumption (e.g., costs, poor availability in some areas) impact people regardless of caregiving status.<sup>65</sup>

Consistent with some studies,<sup>23,25,30</sup> binge and heavy drinking did not differ between caregivers and non-caregivers, except that dementia caregivers were less likely to report heavy drinking. Dementia caregivers' lower likelihood of heavy drinking may be related to their older age,<sup>66</sup> the need for continual surveillance of patient activities,<sup>41</sup> and healthier relatives assuming caregiving responsibilities.<sup>35</sup> However, this small difference may have limited clinical significance.

Consistent with most prior research,<sup>14,22-28</sup> caregivers were more likely to smoke than non-caregivers. Smoking is a risk factor for some illnesses included in this study,<sup>67-70</sup> and thus, findings may reflect higher rates of smoking within families.<sup>71,72</sup> Additionally, smoking can be a coping strategy to reduce stress,<sup>73</sup> and higher rates of mental health problems among caregivers may help explain this finding.<sup>74</sup>

Also consistent with most prior research,<sup>17,26,27,29</sup> caregivers were less likely to sleep 7+ hours per night compared to non-caregivers. Potential explanations for this result include caregivers' higher rates of mental and physical health problems<sup>5,6,8,75</sup> and smoking<sup>14,22-28</sup> than non-caregivers as well as the interference of caregiving with sleep (e.g., nighttime intervention or vigilance).<sup>40,41,44</sup> Caregiving status was unrelated to influenza immunization, with all caregiver groups and non-caregivers having similarly low rates of immunization (38%-46%).

This study extends the caregiving literature by examining caregivers' health behaviors across disease contexts. Given the unique challenges of dementia caregiving,<sup>39,76,77</sup> these caregivers were expected to report worse health behaviors than other caregivers. Instead, dementia caregivers were less likely to engage in certain risky health behaviors (i.e., heavy drinking, smoking) compared to some caregiver groups, and all caregiver groups engaged in similar levels of health-promoting behaviors. A prior BRFSS study found decrements in caregivers' mental and physical health compared to non-caregivers did not significantly vary by patient disease group (e.g., cancer, dementia).<sup>62</sup> Thus, limited research suggests that caregivers' health behaviors and outcomes may be similar across disease contexts.

Results partially supported the hypothesis that greater caregiving intensity would be associated with worse health behaviors. Greater caregiving hours were associated with risky health behaviors (e.g., smoking, shorter sleep duration), and providing personal care was also associated with shorter sleep duration. A few longitudinal studies found that individuals who became caregivers reported poorer health behaviors (e.g., decreased physical activity, increased drinking).<sup>78,79</sup> As caregiving demands increase, caregivers may neglect their own self-care or employ maladaptive coping strategies through risky health behaviors.<sup>12-14,17,18,80</sup>

## **Limitations**

Limitations of this study warrant mention. BRFSS data are self-reported, and most measures are single items that were dichotomized to assess adherence to national guidelines. Results based on overlapping measures (e.g., alcohol use) should be cautiously interpreted. Although most caregivers were providing long-term care, 10-24% had only provided care for the past month. Caregivers only reported the patient's main health condition and did not report condition type (e.g., type 1 or 2 diabetes), illness severity, or comorbidities. Caregivers did not

report cohabitation with the patient or subjective caregiving burden. Caregiver anxiety and depressive symptom data were only available for a small subsample; thus, these factors were not analyzed. Finally, given the cross-sectional design, temporal relationships cannot be inferred.

### **Conclusions**

Results of this population-based U.S. study suggest that caregiving for people with chronic illness is associated with both risky (i.e., smoking, shorter sleep duration) and health-promoting behaviors (e.g., physical activity). Caregivers providing high intensity care may be especially vulnerable to risky health behaviors. Across illness contexts, caregivers may benefit from public health strategies and clinical interventions to address certain health behaviors (e.g., smoking, sleep) and factors underlying these behaviors (e.g., stress, financial or care coordination challenges). Further research is needed to examine clusters of health behaviors, identify caregivers at higher risk for poor health behaviors and outcomes, and determine how best to intervene with caregivers across illness contexts.

## **Acknowledgements**

ES and CEM conceptualized the study. ES led the drafting of the article and conducted the data analyses with the guidance of WW. All authors contributed to the interpretation of the findings, reviewed and edited drafts of the article, and approved the final version.

A portion of the findings were presented as a poster at the International Congress of Behavioral Medicine in June 2021.

No financial disclosures were reported by the authors of this paper.

## References

1. Schulz R, Tompkins CA. Informal caregivers in the United States: prevalence, caregiver characteristics, and ability to provide care. In: Olson S, ed. *The Role of Human Factors in Home Health Care: Workshop Summary*. Washington, DC: National Academies Press; 2010:117-145.
2. Reinhard SC, Feinberg LF, Houser A, Choula R, Evans M. Valuing the invaluable: 2019 update – charting a path forward. Washington, DC: AARP Publishing Institute.  
<https://www.aarp.org/content/dam/aarp/ppi/2019/11/valuing-the-invaluable-2019-update-charting-a-path-forward.doi.10.26419-2Fppi.00082.001.pdf>. Published 2019. Accessed March 15, 2021.
3. AARP, National Alliance for Caregiving. Caregiving in the United States 2020 report. Washington, DC: AARP Publishing Institute.  
<https://www.aarp.org/content/dam/aarp/ppi/2020/05/full-report-caregiving-in-the-united-states.doi.10.26419-2Fppi.00103.001.pdf>. Published 2020. Accessed March 15, 2021.
4. Wolff JL, Spillman BC, Freedman VA, Kasper JD. A national profile of family and unpaid caregivers who assist older adults with health care activities. *JAMA Intern Med*. 2016;176(3):372-379. <https://doi.org/10.1001/jamainternmed.2015.7664>.
5. Adelman RD, Tmanova LL, Delgado D, Dion S, Lachs MS. Caregiver burden: a clinical review. *JAMA*. 2014;311(10):1052-1060. <https://doi.org/10.1001/jama.2014.304>.
6. Schulz R, Sherwood PR. Physical and mental health effects of family caregiving. *Am J Nurs*. 2008;108(9 Suppl):23-27. <https://doi.org/10.1097/01.NAJ.0000336406.45248.4c>.

7. Riffin C, Van Ness PH, Wolff JL, Fried T. Multifactorial examination of caregiver burden in a national sample of family and unpaid caregivers. *J Am Geriatr Soc*. 2019;67(2):277-283. <https://doi.org/10.1111/jgs.15664>.
8. Anderson LA, Edwards VJ, Pearson WS, Talley RC, McGuire LC, Andresen EM. Adult caregivers in the United States: characteristics and differences in well-being, by caregiver age and caregiving status. *Prev Chronic Dis*. 2013;10. <https://doi.org/10.5888/pcd10.130090>.
9. Edwards VJ, Bouldin ED, Taylor CA, Olivari BS, McGuire LC. Characteristics and health status of informal unpaid caregivers - 44 states, District of Columbia, and Puerto Rico, 2015-2017. *MMWR Morb Mortal Wkly Rep*. 2020;69(7):183-188. <https://doi.org/10.15585/mmwr.mm6907a2>.
10. Halpern M, Fiero M, Bell M, Halpern MT, Fiero MH, Bell ML. Impact of caregiver activities and social supports on multidimensional caregiver burden: analyses from nationally-representative surveys of cancer patients and their caregivers. *Qual Life Res*. 2017;26(6):1587-1595. <https://doi.org/10.1007/s11136-017-1505-9>.
11. Acton GJ. Health-promoting self-care in family caregivers. *West J Nurs Res*. 2002;24(1):73-86. <https://doi.org/10.1177/01939450222045716>.
12. Mochari-Greenberger H, Mosca L. Caregiver burden and nonachievement of healthy lifestyle behaviors among family caregivers of cardiovascular disease patients. *Am J Health Promot*. 2012;27(2):84-89. <https://doi.org/10.4278/ajhp.110606-QUAN-241>.
13. Sisk RJ. Caregiver burden and health promotion. *Int J Nurs Stud*. 2000;37(1):37-43. [https://doi.org/10.1016/S0020-7489\(99\)00053-X](https://doi.org/10.1016/S0020-7489(99)00053-X).

14. Gottschalk S, König HH, Brettschneider C. The association between informal caregiving and behavioral risk factors: a cross-sectional study. *Int J Public Health*. 2020;54(6):911-921. <https://doi.org/10.1007/s00038-020-01402-6>.
15. King A, Ringel JB, Safford MM, et al. Association between caregiver strain and self-care among caregivers with diabetes. *JAMA Netw Open*. 2021;4(2):e2036676-e2036676. <https://doi.org/10.1001/jamanetworkopen.2020.36676>.
16. Rospenda KM, Minich LM, Milner LA, Richman JA. Caregiver burden and alcohol use in a community sample. *J Addict Dis*. 2010;29(3):314-324. <https://doi.org/10.1080/10550887.2010.489450>.
17. Liu Y, Wheaton AG, Edwards VJ, Xu F, Greenlund KJ, Croft JB. Short self-reported sleep duration among caregivers and non-caregivers in 2016. *Sleep Health*. 2020;6(5):651-656. <https://doi.org/10.1016/j.sleh.2020.01.015>.
18. Burton LC, Newsom JT, Schulz R, Hirsch CH, German PS. Preventive health behaviors among spousal caregivers. *Prev Med*. 1997;26(2):162-169. <https://doi.org/10.1006/pmed.1996.0129>.
19. Fredman L, Bertrand RM, Martire LM, Hochberg M, Harris EL. Leisure-time exercise and overall physical activity in older women caregivers and non-caregivers from the Caregiver-SOF Study. *Prev Med*. 2006;43(3):226-229. <https://doi.org/10.1016/j.ypped.2006.04.009>.
20. Jacob L, Smith L, Jackson SE, et al. Informal caregiving and physical activity among 204,315 adults in 38 low- and middle-income countries: a cross-sectional study. *Prev Med*. 2020;132. <https://doi.org/10.1016/j.ypped.2020.106007>.

21. Castro CM, King AC, Housemann R, Bacak SJ, McMullen KM, Brownson RC. Rural family caregivers and health behaviors: results from an epidemiologic survey. *J Aging Health*. 2007;19(1):87-105. <https://doi.org/10.1177/0898264306296870>.
22. Hopps M, Iadeluca L, McDonald M, Makinson GT. The burden of family caregiving in the United States: work productivity, health care resource utilization, and mental health among employed adults. *J Multidiscip Healthc*. 2017;10:437-444. <https://doi.org/10.2147/JMDH.S135372>.
23. Goren A, Gilloteau I, Lees M, DaCosta Dibonaventura M. Quantifying the burden of informal caregiving for patients with cancer in Europe. *Support Care Cancer*. 2014;22(6):1637-1646. <https://doi.org/10.1007/s00520-014-2122-6>.
24. Hoffman GJ, Lee J, Mendez-Luck CA. Health behaviors among baby boomer informal caregivers. *Gerontologist*. 2012;52(2):219-230. <https://doi.org/10.1093/geront/gns003>.
25. Reeves KW, Bacon K, Fredman L. Caregiving associated with selected cancer risk behaviors and screening utilization among women: cross-sectional results of the 2009 BRFSS. *BMC Public Health*. 2012;12(1):685-692. <https://doi.org/10.1186/1471-2458-12-685>.
26. Laks J, Goren A, Dueñas H, Novick D, Kahle-Wroblewski K. Caregiving for patients with Alzheimer's disease or dementia and its association with psychiatric and clinical comorbidities and other health outcomes in Brazil. *Int J Geriatr Psychiatry*. 2016;31(2):176-185. <https://doi.org/10.1002/gps.4309>.
27. Manley NA, Hicken BL, Rupper RW. Veterans caregiving for others: caregiving as a factor in the health of America's military veterans. *Mil Med*. 2019;184(1-2):e162-e168. <https://doi.org/10.1093/milmed/usy131>.

28. Shiue I, Sand M. Quality of life in caregivers with and without chronic disease: Welsh Health Survey, 2013. *J Public Health (Oxf)*. 2017;39(1):34-44.  
<https://doi.org/10.1093/pubmed/fdv210>.
29. Trivedi R, Beaver K, Bouldin ED, et al. Characteristics and well-being of informal caregivers: results from a nationally-representative US survey. *Chronic Illn*. 2014;10(3):167-179. <https://doi.org/10.1177/1742395313506947>.
30. McGuire L, Bouldin EL, Andresen EM, Anderson LA. Examining modifiable health behaviors, body weight, and use of preventive health services among caregivers and non-caregivers aged 65 years and older in Hawaii, Kansas, and Washington using 2007 BRFSS. *J Nutr Health Aging*. 2010;14(5):373-379. <https://doi.org/10.1007/s12603-010-0083-0>.
31. Song L, Guan T, Guo P, Keyserling TC, Van Houtven C, Tan X. Prevalence of cardiovascular disease and risk factors, quality of life, and health behaviors of cancer survivors and their spouses: findings from MEPS. *J Cancer Surviv*. 2019;13(5):739-748.  
<https://doi.org/10.1007/s11764-019-00792-8>.
32. Roth DL, Haley WE, Hovater M, Perkins M, Wadley VG, Judd S. Family caregiving and all-cause mortality: findings from a population-based propensity-matched analysis. *Am J Epidemiol*. 2013;178(10):1571-1578. <https://doi.org/10.1093/aje/kwt225>.
33. Fredman L, Lyons JG, Cauley JA, Hochberg M, Applebaum KM. The relationship between caregiving and mortality after accounting for time-varying caregiver status and addressing the healthy caregiver hypothesis. *J Gerontol A Biol Sci Med Sci*. 2015;70(9):1163-1168. <https://doi.org/10.1093/gerona/glv009>.

34. Fredman L, Ranker LR, Strunin L, Smith ML, Applebaum KM. Caregiving intensity and mortality in older women, accounting for time-varying and lagged caregiver status: The Caregiver-Study of Osteoporotic Fractures study. *Gerontologist*. 2019;59(5):e461-e469. <https://doi.org/10.1093/geront/gny135>.
35. Roth DL, Fredman L, Haley WE. Informal caregiving and its impact on health: a reappraisal from population-based studies. *Gerontologist*. 2015;55(2):309-319. <https://doi.org/10.1093/geront/gnu177>.
36. Roth DL, Brown SL, Rhodes JD, Haley WE. Reduced mortality rates among caregivers: Does family caregiving provide a stress-buffering effect? *Psychol Aging*. 2018;33(4):619-629. <https://doi.org/10.1037/pag0000224>.
37. Hilbrand S, Coall DA, Meyer AH, Gerstorf D, Hertwig R. A prospective study of associations among helping, health, and longevity. *Soc Sci Med*. 2017;187:109-117. <https://doi.org/10.1016/j.socscimed.2017.06.035>.
38. Umstattd Meyer MR, Meyer AR, Wu C, Bernhart J. When helping helps: exploring health benefits of cancer survivors participating in for-cause physical activity events. *BMC Public Health*. 2018;18(1). <https://doi.org/10.1186/s12889-018-5559-6>.
39. Bertrand RM, Fredman L, Saczynski J. Are all caregivers created equal? Stress in caregivers to adults with and without dementia. *J Aging Health*. 2006;18(4):534-551. <https://doi.org/10.1177/0898264306289620>.
40. National Alliance for Caregiving. Cancer caregiving in the U.S. - an intense, episodic, and challenging care experience. National Alliance for Caregiving. <https://www.caregiving.org/wp->

- content/uploads/2020/05/CancerCaregivingReport\_FINAL\_June-17-2016.pdf. Published 2016. Accessed March 15, 2021.
41. National Alliance for Caregiving, the Alzheimer's Association. Dementia caregiving in the U.S.: [https://www.caregiving.org/wp-content/uploads/2020/05/Dementia-Caregiving-in-the-US\\_February-2017.pdf](https://www.caregiving.org/wp-content/uploads/2020/05/Dementia-Caregiving-in-the-US_February-2017.pdf). Published 2017. Accessed March 15, 2021.
  42. National Alliance for Caregiving, the Hormone Foundation. Diabetes caregivers needs assessment survey - executive summary. [https://www.caregiving.org/wp-content/uploads/2020/05/NAC\\_Diabetes-Caregivers-Needs-Assessment-Survey\\_Executive-Summary-3-25-10\\_Final.pdf](https://www.caregiving.org/wp-content/uploads/2020/05/NAC_Diabetes-Caregivers-Needs-Assessment-Survey_Executive-Summary-3-25-10_Final.pdf). Published 2010. Accessed March 15, 2021.
  43. Moon H, Dilworth-Anderson P. Baby boomer caregiver and dementia caregiving: findings from the National Study of Caregiving. *Age Ageing*. 2015;44(2):300-306. <https://doi.org/10.1093/ageing/afu119>.
  44. Farquhar M. Assessing carer needs in chronic obstructive pulmonary disease. *Chron Respir Dis*. 2018;15(1):26-35. <https://doi.org/10.1177/1479972317719086>.
  45. Mansfield E, Bryant J, Regan T, Waller A, Boyes A, Sanson-Fisher R. Burden and unmet needs of caregivers of chronic obstructive pulmonary disease patients: a systematic review of the volume and focus of research output. *COPD*. 2016;13(5):662-667. <https://doi.org/10.3109/15412555.2016.1151488>.
  46. Harding R, Gao W, Jackson D, Pearson C, Murray J, Higginson IJ. Comparative analysis of informal caregiver burden in advanced cancer, dementia, and acquired brain injury. *J Pain Symptom Manage*. 2015;50(4):445-452. <https://doi.org/10.1016/j.jpainsymman.2015.04.005>.

47. Peng LM, Chiu YC, Liang J, Chang TH. Risky wandering behaviors of persons with dementia predict family caregivers' health outcomes. *Aging Ment Health*. 2018;22(12):1650-1657. <https://doi.org/10.1080/13607863.2017.1387764>.
48. Nakken N, Janssen DJA, van den Bogaart EHA, et al. Informal caregivers of patients with COPD: Home sweet home? *Eur Respir Rev*. 2015;24(137):498-504. <https://doi.org/10.1183/16000617.00010114>.
49. Thorpe JM, Sleath BL, Thorpe CTK, et al. Caregiver psychological distress as a barrier to influenza vaccination among community-dwelling elderly with dementia. *Med Care*. 2006;44(8):713-721. <https://doi.org/10.1097/01.mlr.0000215905.36968.76>.
50. Mokdad AH. The Behavioral Risk Factors Surveillance System: past, present, and future. *Annu Rev Public Health*. 2009;30(1):43-54. <https://doi.org/10.1146/annurev.publhealth.031308.100226>.
51. Centers for Disease Control and Prevention. Behavioral risk factor surveillance system (BRFSS) caregiver module. <https://www.cdc.gov/aging/healthybrain/brfss-faq-caregiver.htm>. Published 2019. Accessed March 15, 2021.
52. Yore MM, Ham SA, Ainsworth BE, et al. Reliability and validity of the instrument used in BRFSS to assess physical activity. *Med Sci Sports Exerc*. 2007;39(8):1267-1274. <https://doi.org/10.1249/mss.0b013e3180618bbe>.
53. Nelson DE, Holtzman D, Bolen J, Stanwyck CA, Mack KA. Reliability and validity of measures from the behavioral risk factor surveillance system (BRFSS). *Soz Praventivmed*. 2001;46 Suppl 1:S3-42.

54. Pierannunzi C, Hu SS, Balluz L. A systematic review of publications assessing reliability and validity of the Behavioral Risk Factor Surveillance System (BRFSS), 2004–2011. *BMC Med Res Methodol.* 2013;13. <https://doi.org/10.1186/1471-2288-13-49>.
55. U.S. Department of Health and Human Services. *Physical activity guidelines for Americans.* 2nd ed. Washington, DC: U.S. Department of Health and Human Services; 2018.
56. U.S. Department of Health and Human Services and U.S. Department of Agriculture. *2015-2020 Dietary guidelines for Americans.* 8th ed. Washington, DC: U.S. Department of Health and Human Services; 2015.
57. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General.* Atlanta, GA: Centers for Disease Control and Prevention; 2014.
58. Watson NF, Badr MS, Belenky G, et al. Recommended amount of sleep for a healthy adult: a joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *Sleep.* 2015;38(6):843-844. <https://doi.org/10.5665/sleep.4716>.
59. Grohskopf LA, Sokolow LZ, Olsen SJ, Bresee JS, Broder KR, Karron RA. Prevention and control of influenza with vaccines: recommendations of the advisory committee on immunization practices, United States, 2015-16 influenza season. *MMWR Morb Mortal Wkly Rep.* 2015;64(30):818-825. <https://doi.org/10.15585/mmwr.mm6430a3>.
60. National Alliance for Caregiving, Caring Across Generations. Burning the candle at both ends: sandwich generation caregiving in the U.S.: <https://www.caregiving.org/wp->

content/uploads/2020/05/NAC-CAG\_SandwichCaregiving\_Report\_Digital-Nov-26-2019.pdf. Published 2019. Accessed May 15, 2021.

61. Centers for Disease Control and Prevention. The behavioral risk factor surveillance system complex sampling weights and preparing 2018 BRFSS module data for analysis. [https://www.cdc.gov/brfss/annual\\_data/2018/pdf/Complex-Smple-Weights-Prep-Module-Data-Analysis-2018-508.pdf](https://www.cdc.gov/brfss/annual_data/2018/pdf/Complex-Smple-Weights-Prep-Module-Data-Analysis-2018-508.pdf). Published 2019. Accessed May 15, 2021.
62. Secinti E, Lewson AB, Wu W, Kent EE, Mosher CE. Health-related quality of life: A comparative analysis of caregivers of people with dementia, cancer, COPD/emphysema, and diabetes, and non-caregivers, 2015-2018 BRFSS. *Ann Behav Med*. 2021. <https://doi.org/10.1093/abm/kaab007>.
63. Cairney J, Kwan MY, Veldhuizen S, Faulkner GE. Who uses exercise as a coping strategy for stress? Results from a national survey of Canadians. *J Phys Act Health*. 2014;11(5):908-916. <https://doi.org/10.1123/jpah.2012-0107>.
64. Homish GG, Leonard KE. Spousal influence on general health behaviors in a community sample. *Am J Health Behav*. 2008;32(6):754-763. <https://doi.org/10.5555/ajhb.2008.32.6.754>.
65. Yeh M-C, Glick-Bauer M, Wechsler S. Chapter 19 - Fruit and vegetable consumption in the United States: Patterns, barriers and federal nutrition assistance programs. In: Watson RR, Preedy VR, eds. *Fruits, Vegetables, and Herbs*. San Diego, CA: Academic Press; 2016:411-422.
66. Bray BC, Dziak JJ, Lanza ST. Age trends in alcohol use behavior patterns among U.S. adults ages 18-65. *Drug Alcohol Depend*. 2019;205. <https://doi.org/10.1016/j.drugalcdep.2019.107689>.

67. Salvi S. Tobacco smoking and environmental risk factors for chronic obstructive pulmonary disease. *Clin Chest Med.* 2014;35(1):17-27.  
<https://doi.org/10.1016/j.ccm.2013.09.011>.
68. Peters R, Poulter R, Warner J, Beckett N, Burch L, Bulpitt C. Smoking, dementia and cognitive decline in the elderly, a systematic review. *BMC Geriatr.* 2008;8.  
<https://doi.org/10.1186/1471-2318-8-36>.
69. Sasco AJ, Secretan MB, Straif K. Tobacco smoking and cancer: a brief review of recent epidemiological evidence. *Lung Cancer.* 2004;45 Suppl 2:S3-9.  
<https://doi.org/10.1016/j.lungcan.2004.07.998>.
70. Śliwińska-Mossoń M, Milnerowicz H. The impact of smoking on the development of diabetes and its complications. *Diab Vasc Dis Res.* 2017;14(4):265-276.  
<https://doi.org/10.1177/1479164117701876>.
71. Saari AJ, Kentala J, Mattila KJ. The smoking habit of a close friend or family member—how deep is the impact? A cross-sectional study. *BMJ Open.* 2014;4(2).  
<https://doi.org/10.1136/bmjopen-2013-003218>.
72. Falba TA, Sindelar JL. Spousal concordance in health behavior change. *Health Serv Res.* 2008;43(1 Pt 1):96-116. <https://doi.org/10.1111/j.1475-6773.2007.00754.x>.
73. Slopen N, Kontos EZ, Ryff CD, Ayanian JZ, Albert MA, Williams DR. Psychosocial stress and cigarette smoking persistence, cessation, and relapse over 9-10 years: a prospective study of middle-aged adults in the United States. *Cancer Causes Control.* 2013;24(10):1849-1863. <https://doi.org/10.1007/s10552-013-0262-5>.

74. Salgado-García FI, Zuber JK, Graney MJ, Nichols LO, Martindale-Adams JL, Andrasik F. Smoking and smoking increase in caregivers of Alzheimer's patients. *Gerontologist*. 2015;55(5):780-792. <https://doi.org/10.1093/geront/gnt149>.
75. Neugaard B, Andresen E, McKune SL, Jamoom EW. Health-related quality of life in a national sample of caregivers: findings from the Behavioral Risk Factor Surveillance System. *J Happiness Stud*. 2008;9(4):559-575. <https://doi.org/10.1007/s10902-008-9089-2>.
76. Sörensen S, Duberstein P, Gill D, Pinquart M. Dementia care: mental health effects, intervention strategies, and clinical implications. *Lancet Neurol*. 2006;5(11):961-973. [https://doi.org/10.1016/S1474-4422\(06\)70599-3](https://doi.org/10.1016/S1474-4422(06)70599-3).
77. Wolff JL, Mulcahy J, Huang J, Roth DL, Covinsky K, Kasper JD. Family caregivers of older adults, 1999-2015: trends in characteristics, circumstances, and role-related appraisal. *Gerontologist*. 2018;58(6):1021-1032. <https://doi.org/10.1093/geront/gnx093>.
78. Beesley VL, Price MA, Webb PM. Loss of lifestyle: health behaviour and weight changes after becoming a caregiver of a family member diagnosed with ovarian cancer. *Support Care Cancer*. 2011;19(12):1949-1956. <https://doi.org/10.1007/s00520-010-1035-2>.
79. Dich N, Head J, Rod NH. Role of psychosocial work factors in the relation between becoming a caregiver and changes in health behaviour: Results from the Whitehall II cohort study. *J Epidemiol Community Health*. 2016;70(12):1200-1206. <https://doi.org/10.1136/jech-2015-206463>.

80. Capistrant BD. Caregiving for older adults and the caregivers' health: an epidemiologic review. *Curr Epidemiol Rep*. 2016;3(1):72-80. [https://doi.org/10.1007/s40471-016-0064-](https://doi.org/10.1007/s40471-016-0064-x)

x.

**Figure Titles and Notes**

**Figure 1.** *Odds/Relative Risk Ratio Plots of Health Behaviors of Caregiver Groups in Comparison to Non-Caregivers*

*Note.* Odds ratios and relative risk ratios are displayed for each caregiver group in comparison to non-caregivers for each health behavior. COPD = Chronic obstructive pulmonary disease.

**Appendix Titles**

**Table S1.** *Sample Size and Health Behavior Data Availability Across BRFSS 2015-2019 Waves*

**Table S2.** *Outcome Measures Across BRFSS 2015-2019 Waves*

**Table S3.** *Average Estimated Marginal Effects for the Regression Analyses Comparing Health Behaviors of Caregiver Groups to Non-Caregivers*

**Table S4.** *Average Estimated Marginal Effects for the Regression Analyses of Caregiving Intensity in Relation to Health Behaviors*

**Figure S1.** *Caregiving Duration*

*Note.* COPD = Chronic obstructive pulmonary disease.

**Figure S2.** *Caregiving Hours*

*Note.* COPD = Chronic obstructive pulmonary disease.

**Figure S3.** *Caregiving Relationship*

*Note.* COPD = Chronic obstructive pulmonary disease.

**Table 1**  
*Descriptive Statistics and Group Comparisons for Study Variables*

Caregiver Characteristics	COPD/					Statistic
	Non-Caregivers	Dementia CG	Cancer CG	Emphysema CG	Diabetes CG	
	% or Mean (SE)					
Age	48.34 (0.08)	53.75 (0.43)	48.29 (0.59)	49.52 (0.64)	46.09 (0.69)	$F(4, 217631) = 42.6, p < .001$
Gender (female)	50.51%	61.55%	60.67%	67.48%	57.78%	$\chi^2(4) = 664, p < .001$
Race/ethnicity						$\chi^2(16) = 849, p < .001$
Non-Hispanic White	69.00%	76.13%	70.88%	85.84%	59.25%	
African American	12.37%	13.10%	13.51%	6.83%	22.36%	
Hispanic	12.13%	6.30%	9.48%	2.61%	11.49%	
Multiracial	1.48%	1.67%	2.42%	1.29%	1.73%	
Other	5.03%	2.79%	3.89%	3.43%	5.17%	
Household income						$\chi^2(16) = 357, p < .001$
Less than \$25,000	27.35%	25.03%	29.37%	30.57%	37.36%	
Between \$25,000 and \$34,999	10.33%	10.82%	10.84%	12.37%	11.95%	
Between \$35,000 and \$49,999	13.84%	13.88%	14.41%	13.02%	12.80%	
Between \$50,000 and \$74,999	15.24%	17.51%	14.47%	17.74%	16.36%	
More than \$75,000	33.23%	32.77%	30.91%	26.31%	21.54%	
Highest education						$\chi^2(12) = 344, p < .001$
Did not graduate from high school	13.79%	8.26%	11.61%	15.96%	15.70%	
Graduated from high school	30.44%	27.86%	33.97%	31.63%	32.30%	
Attended college	29.76%	35.11%	30.18%	33.14%	33.02%	
Graduated from college	26.01%	28.78%	24.24%	19.27%	18.98%	
Marital status (married/partnered)	55.75%	62.98%	57.39%	61.98%	53.14%	$\chi^2(4) = 142, p < .001$
Employment status						$\chi^2(8) = 288, p < .001$
Employed	56.54%	54.33%	55.60%	49.29%	55.00%	
Retired	19.75%	24.33%	18.25%	17.48%	14.34%	
Unemployed	23.71%	21.34%	26.15%	33.23%	30.66%	
Children/minors at home (yes)	35.66%	25.22%	35.88%	37.14%	40.78%	$\chi^2(4) = 265, p < .001$
Body Mass Index (BMI)	28.08 (0.03)	28.80 (0.16)	28.33 (0.21)	28.95 (0.26)	29.60 (0.24)	$F(4, 204507) = 16.8, p < .001$
Underweight (BMI < 18.50)	1.76%	1.34%	1.16%	0.50%	1.43%	$\chi^2(12) = 332, p < .001$
Normal weight (18.50 ≤ BMI < 25.00)	31.84%	27.54%	33.58%	30.12%	27.05%	
Overweight (25.00 ≤ BMI < 30.00)	35.72%	35.73%	31.15%	31.13%	30.68%	
Obese (BMI ≥ 30.00)	30.69%	35.39%	34.11%	38.25%	40.84%	
Number of chronic health conditions (0-9)	0.81 (0.00)	1.03 (0.03)	1.04 (0.04)	1.09 (0.06)	0.99 (0.04)	$F(4, 217591) = 32.1, p < .001$
2 or more chronic health conditions	19.78%	26.81%	26.37%	28.78%	24.93%	$\chi^2(4) = 390, p < .001$
<b>Caregiving Variables</b>						
Care recipient's relationship to caregiver	--					$\chi^2(9) = 517, p < .001$
Spouse/partner	--	10.62%	15.63%	18.29%	16.80%	
Parent/parent-in-law	--	54.44%	34.52%	45.73%	41.68%	
Other relative <sup>a</sup>	--	25.30%	31.22%	22.96%	30.47%	

Non-relative <sup>b</sup>	--	9.65%	18.64%	13.02%	11.06%	
Caregiving duration	--					$\chi^2(12) = 1286, p<.001$
Less than 30 days	--	10.63%	23.83%	14.74%	17.12%	
1 month to less than 6 months	--	10.38%	21.53%	9.37%	8.23%	
6 months to less than 2 years	--	23.10%	24.59%	22.11%	15.30%	
2 years to less than 5 years	--	29.65%	15.38%	27.53%	22.61%	
More than 5 years	--	26.25%	14.67%	26.25%	36.75%	
Caregiving hours	--					$\chi^2(9) = 124, p<.001$
Up to 8 hours per week	--	49.91%	60.19%	52.28%	56.25%	
9 to 19 hours per week	--	14.30%	13.20%	14.11%	13.81%	
20 to 39 hours per week	--	13.44%	10.19%	13.63%	12.38%	
40 hours or more	--	22.35%	16.42%	19.98%	17.56%	
Providing personal care	--	66.34%	51.45%	52.58%	58.51%	$\chi^2(3) = 239, p<.001$
Providing help with household tasks	--	82.07%	78.61%	84.70%	80.40%	$\chi^2(3) = 39, p=.02$
<b>Health Behaviors</b>						
<b>Physical activity<sup>c</sup></b>						
Met aerobic activity recommendations	48.28%	52.35%	51.16%	52.86%	46.78%	$\chi^2(4) = 42, p=.03$
Met muscle-strengthening recommendations	29.59%	32.14%	31.97%	26.99%	28.51%	$\chi^2(4) = 23, p=.20$
<b>Diet<sup>d</sup></b>						
Daily servings of fruit	1.33 (0.01)	1.39 (0.04)	1.38 (0.06)	1.40 (0.11)	1.44 (0.08)	$F(4, 135818) = 1.36, p=.24$
Daily servings of vegetables	1.86 (0.01)	2.04 (0.05)	2.04 (0.08)	2.03 (0.16)	1.98 (0.06)	$F(4, 134457) = 5.57, p<.001$
Meeting dietary recommendations	14.75%	17.84%	18.08%	14.48%	17.58%	$\chi^2(4) = 61, p=.003$
<b>Alcohol use<sup>e</sup></b>						
Average drinks per week	2.97 (0.05)	2.24 (0.13)	3.03 (0.36)	2.30 (0.25)	2.90 (0.31)	$F(4, 213308) = 7.63, p<.001$
Binge drinking	16.11%	12.24%	16.24%	12.18%	16.00%	$\chi^2(4) = 74, p=.003$
Heavy drinking	5.78%	4.26%	6.69%	4.60%	6.50%	$\chi^2(4) = 35, p=.09$
Smoking status (currently smoking)	16.30%	17.54%	23.80%	31.26%	29.25%	$\chi^2(4) = 921, p<.001$
<b>Sleep</b>						
Average duration of sleep	7.02 (0.01)	6.90 (0.06)	6.81 (0.10)	6.66 (0.10)	6.84 (0.14)	$F(4, 79869) = 5.03, p<.001$
Slept at least 7 hours per night	66.23%	61.10%	59.27%	54.04%	58.06%	$\chi^2(4) = 147, p<.001$
Influenza immunization (immunized)	40.02%	46.05%	41.68%	45.56%	38.15%	$\chi^2(4) = 103, p<.001$

**Note.** CG = Caregiver. COPD = Chronic obstructive pulmonary disease. Boldface indicates statistical significance ( $p<0.05$ ). <sup>a</sup>Other relatives include offspring, siblings, siblings-in-law, grandparents, and grandparents-in-law. <sup>b</sup>Non-relatives include friends, neighbors, and other caregivers. <sup>c</sup>Aerobic activity recommendations = at least 150 minutes of moderate-to-vigorous intensity aerobic activity per week. Muscle strengthening recommendations = at least 2 days of muscle strengthening activity per week. <sup>d</sup>Dietary recommendations = 5 or more servings of fruit and vegetables per day. <sup>e</sup>Binge drinking = 5 or more drinks (men) or 4 or more drinks (women) on at least one occasion in the past 30 days. Heavy drinking = more than 14 drinks per week (men) or more than 7 drinks per week (women). The total sample from 2015-2019 was 218,431 people, including Non-caregivers ( $n = 203,848$ ), Dementia CG ( $n = 5,525$ ), Cancer CG ( $n = 4,246$ ), COPD/emphysema CG ( $n = 1,959$ ), and Diabetes CG ( $n = 2,853$ ). Most health behaviors were only measured in certain cross-sectional waves. See Table S1 for the sample sizes for each health behavior.

**Table 2**  
*Regression Analyses Comparing Health Behaviors of Caregiver Groups to Non-Caregivers*

Variables Included	Meeting Aerobic Activity Recommendations (n = 167,601)			Meeting Muscle Strengthening Recommendations (n = 167,601)			Daily Servings of Fruit (n = 167,601)			Daily Servings of Vegetables (n = 167,601)			5+ Daily Servings of Fruit and Vegetables (n = 167,601)		
	OR	95% CI	p	OR	95% CI	p	RRR	95% CI	p	RRR	95% CI	p	OR	95% CI	p
Step 1: Covariates															
Age	1.004	1.002, 1.006	<.001	.982	.980, .984	<.001	1.002	1.001, 1.003	.003	1.000	.999, 1.001	.507	1.000	.997, 1.002	.708
Gender	1.158	1.102, 1.216	<.001	1.474	1.396, 1.556	<.001	.901	.875, .927	<.001	.879	.861, .898	<.001	.659	.613, .708	<.001
Race	.893	.840, .949	<.001	1.172	1.098, 1.250	<.001	1.180	1.137, 1.225	<.001	1.013	.984, 1.043	.380	1.306	1.201, 1.421	<.001
Income	1.092	1.075, 1.109	<.001	1.114	1.094, 1.134	<.001	1.011	1.001, 1.022	.040	1.024	1.017, 1.032	<.001	1.028	1.004, 1.052	.020
Education	1.200	1.167, 1.234	<.001	1.209	1.170, 1.249	<.001	1.047	1.030, 1.065	<.001	1.057	1.045, 1.069	<.001	1.124	1.075, 1.175	<.001
Employment status	.770	.725, .819	<.001	.801	.749, .855	<.001	.976	.943, 1.010	.164	1.004	.979, 1.029	.767	.969	.888, 1.057	.480
Marital status	.961	.908, 1.016	.162	.794	.746, .845	<.001	1.012	.973, 1.051	.557	1.063	1.036, 1.091	<.001	1.106	1.016, 1.205	.020
Children at home	.945	.890, 1.003	.061	.873	.818, .931	<.001	1.038	.999, 1.079	.059	1.014	.987, 1.041	.313	1.018	.935, 1.108	.684
BMI	.768	.729, .810	<.001	.712	.672, .753	<.001	.934	.904, .964	<.001	.947	.927, .968	<.001	.804	.748, .864	<.001
Multimorbidity	.837	.818, .857	<.001	.928	.905, .953	<.001	.984	.971, .997	.020	.999	.988, 1.011	.928	.971	.938, 1.006	.100
Step 2: Group															
Non-caregiver	REF	--	--	REF	--	--	REF	--	--	REF	--	--	REF	--	--
Dementia	1.200	1.036, 1.390	.015	1.351	1.153, 1.583	<.001	1.035	.979, 1.094	.219	1.049	1.001, 1.099	.045	1.222	1.003, 1.490	.047
Cancer	1.213	1.020, 1.442	.029	1.205	1.007, 1.441	.041	1.030	.951, 1.115	.472	1.091	1.002, 1.189	.046	1.255	.993, 1.585	.057
COPD/Emphysema	1.301	1.045, 1.620	.019	1.103	.850, 1.432	.459	1.077	.895, 1.297	.432	1.108	.926, 1.326	.261	1.013	.741, 1.386	.934
Diabetes	1.035	.840, 1.275	.749	1.006	.809, 1.252	.957	1.123	.985, 1.281	.083	1.081	1.004, 1.164	.039	1.224	.958, 1.563	.105
Variables Included	Binge Drinking (n = 258,856)			Heavy Drinking (n = 258,856)			Currently Smoking (n = 258,856)			Sleeping 7+ Hours per Night (n = 115,530)			Received Influenza Immunization (n = 258,856)		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Step 1: Covariates															
Age	.966	.964, .968	<.001	.989	.986, .991	<.001	.984	.983, .986	<.001	1.009	1.006, 1.011	<.001	1.021	1.019, 1.023	<.001
Gender	1.825	1.722, 1.934	<.001	1.067	.977, 1.165	.148	1.367	1.295, 1.444	<.001	.934	.876, .997	.041	.790	.759, .822	<.001
Race	.790	.737, .848	<.001	.729	.646, .823	<.001	.600	.560, .644	<.001	.791	.732, .854	<.001	.913	.870, .960	<.001
Income	1.089	1.069, 1.110	<.001	1.090	1.058, 1.124	<.001	.871	.857, .884	<.001	1.018	.998, 1.038	.082	1.083	1.069, 1.098	<.001
Education	.970	.939, 1.003	.074	.907	.861, .956	<.001	.696	.677, .717	<.001	1.054	1.017, 1.091	.004	1.182	1.154, 1.210	<.001

Employment status	1.504	1.399, 1.617	<.001	1.312	1.170, 1.471	<.001	1.317	1.231, 1.408	<.001	.833	.770, .902	<.001	.781	.742, .822	<.001	
Marital status	.826	.774, .881	<.001	.760	.691, .836	<.001	.755	.710, .803	<.001	1.206	1.123, 1.296	<.001	.991	.947, 1.038	.712	
Children at home	.722	.676, .771	<.001	.642	.576, .715	<.001	1.035	.968, 1.106	.318	.806	.745, .873	<.001	1.043	.992, 1.096	.098	
BMI	1.044	.981, 1.110	.175	.848	.777, .926	<.001	.763	.719, .808	<.001	.814	.758, .875	<.001	1.035	.991, 1.080	.122	
Multimorbidity	.885	.857, .914	<.001	.894	.857, .933	<.001	1.159	1.133, 1.186	<.001	.831	.808, .854	<.001	1.220	1.198, 1.243	<.001	
<b>Step 2: Group</b>																
Non-caregiver	REF	- -	--	REF	- -	--	REF	--	--	REF	- -	--	REF	- -	--	
Dementia	.896	.729, 1.100	.293	.733	.561, .959	<b>.023</b>	1.324	1.127, 1.555	<.001	.719	.581, .890	<b>.002</b>	1.028	.914, 1.156	.648	
Cancer	1.153	.965, 1.377	.117	1.277	.982, 1.661	.068	1.575	1.340, 1.851	<.001	.735	.591, .914	<b>.006</b>	1.025	.888, 1.182	.740	
COPD/ Emphysema	.807	.608, 1.071	.138	.915	.619, 1.354	.658	2.202	1.789, 2.711	<.001	.644	.484, .858	<b>.003</b>	1.069	.884, 1.294	.491	
Diabetes	1.073	.843, 1.367	.566	1.363	.927, 2.003	.115	1.934	1.576, 2.373	<.001	.738	.555, .981	<b>.037</b>	1.004	.840, 1.200	.963	

*Note.* CG = Caregiver. COPD = Chronic obstructive pulmonary disease. RRR = Relative risk ratio. Boldface indicates statistical significance ( $p < 0.05$ ). Logistic regressions were used to estimate meeting aerobic activity and muscle-strengthening recommendations, consuming 5+ daily servings of fruit and vegetables, alcohol use, smoking status, sleeping 7+ hours per night, and influenza immunization, and Poisson regressions were used to estimate daily servings of fruit and vegetables. Aerobic activity recommendations = at least 150 minutes of moderate-to-vigorous intensity aerobic activity per week. Muscle strengthening recommendations = at least 2 days of muscle strengthening activity per week. Binge drinking = 5 or more drinks (men) or 4 or more drinks (women) on at least one occasion in the past 30 days. Heavy drinking = more than 14 drinks per week (men) or more than 7 drinks per week (women). Covariates were coded as follows: Gender: female = 0, male = 1. Race: non-Hispanic White = 0, other = 1. Employment status: retired/unemployed = 0, employed = 1. Marital status: not married/partnered = 0, married/partnered = 1. Children at home: no = 0, yes = 1. BMI: normal weight = 0, overweight/obese = 1. Multimorbidity is the number of chronic conditions. Each group was coded as follows: Non-Caregiver = 0, CG (Dementia, Cancer, COPD/Emphysema, or Diabetes) = 1. The total sample from 2015-2019 was 218,431 people, including Non-caregivers ( $n = 203,848$ ), Dementia CG ( $n = 5,525$ ), Cancer CG ( $n = 4,246$ ), COPD/emphysema CG ( $n = 1,959$ ), and Diabetes CG ( $n = 2,853$ ). Most health behaviors were only measured in certain cross-sectional waves. See Table S1 for detailed information on sample sizes for each health behavior.

**Table 3**  
*Regression Analyses of Caregiving Intensity in Relation to Health Behaviors*

Variables Included	Meeting Aerobic Activity Recommendations			Meeting Muscle Strengthening Recommendations			Daily Servings of Fruit			Daily Servings of Vegetables			5+ Daily Servings of Fruit and Vegetables		
	OR	95% CI	p	OR	95% CI	p	RRR	95% CI	p	RRR	95% CI	p	OR	95% CI	p
<b>Step 1: Covariates</b>															
Age	1.002	.993, 1.010	.709	.974	.965, .983	<.001	1.000	.996, 1.004	.903	.999	.996, 1.002	.577	.997	.986, 1.009	.628
Gender	1.118	.917, 1.362	.270	1.615	1.291, 2.020	<.001	1.057	.947, 1.181	.323	.926	.858, .999	.047	.830	.623, 1.106	.204
Race	1.005	.778, 1.297	.972	1.607	1.229, 2.102	.001	1.151	1.025, 1.292	.018	1.024	.932, 1.124	.623	1.253	.904, 1.739	.176
Income	1.068	.998, 1.143	.056	1.117	1.041, 1.198	.002	1.001	.971, 1.031	.974	1.019	.990, 1.049	.205	1.004	.907, 1.111	.939
Education	1.145	1.023, 1.282	.019	1.118	.979, 1.277	.099	1.080	1.024, 1.139	.005	1.085	1.046, 1.124	<.001	1.269	1.083, 1.487	.003
Employment status	.794	.614, 1.027	.079	.692	.543, .883	.003	.947	.836, 1.072	.388	.976	.864, 1.103	.698	1.015	.690, 1.493	.939
Marital status	.953	.739, 1.228	.709	.842	.650, 1.091	.193	1.005	.911, 1.109	.917	1.032	.934, 1.141	.531	.992	.708, 1.391	.963
Children at home	.975	.761, 1.248	.839	.894	.680, 1.174	.419	1.115	.976, 1.274	.110	.985	.906, 1.071	.717	1.100	.790, 1.533	.572
BMI	.677	.547, .838	<.001	.663	.529, .829	<.001	.925	.847, 1.009	.080	.984	.920, 1.053	.641	.845	.651, 1.098	.208
Multimorbidity	.902	.818, .994	.037	1.030	.935, 1.136	.550	1.050	.983, 1.122	.150	1.037	.992, 1.084	.108	1.159	1.009, 1.330	.036
<b>Step 2: Caregiving Intensity</b>															
Caregiving duration	1.030	.954, 1.112	.450	.974	.893, 1.063	.551	1.008	.975, 1.043	.627	1.003	.980, 1.026	.800	.943	.857, 1.038	.231
Caregiving hours	.932	.846, 1.027	.154	.904	.822, .994	.038	.989	.945, 1.035	.636	1.000	.963, 1.038	.987	.977	.862, 1.106	.708
Providing personal care	1.021	.822, 1.269	.852	.892	.705, 1.129	.342	1.011	.916, 1.115	.829	1.042	.969, 1.121	.264	1.066	.796, 1.428	.666
Providing help with household tasks	1.061	.822, 1.369	.650	1.308	.988, 1.732	.060	1.047	.907, 1.208	.532	1.010	.906, 1.126	.859	1.191	.800, 1.773	.389
<b>Step 3: Group</b>															
Dementia	REF	- -		REF	- -		REF	- -		REF	- -		REF	- -	
Cancer	.960	.739, 1.246	.757	.814	.614, 1.081	.155	.951	.857, 1.056	.347	1.035	.945, 1.134	.461	.958	.669, 1.372	.816
COPD/Emphysema	1.078	.802, 1.449	.618	.792	.563, 1.114	.181	.920	.810, 1.044	.196	.977	.893, 1.069	.611	.889	.584, 1.354	.583
Diabetes	.755	.565, 1.008	.057	.633	.461, .870	.005	1.019	.882, 1.179	.795	1.042	.948, 1.145	.397	1.048	.714, 1.537	.812
Variables Included	Binge Drinking			Heavy Drinking			Currently Smoking			Sleeping 7+ Hours per Night			Received Influenza Immunization		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
<b>Step 1: Covariates</b>															
Age	.960	.951, .968	<.001	.995	.983, 1.007	.443	.978	.971, .986	<.001	1.011	.999, 1.022	.082	1.016	1.008, 1.023	<.001
Gender	1.910	1.506, 2.421	<.001	1.477	1.051, 2.075	.025	1.369	1.110, 1.688	.003	1.032	.793, 1.341	.817	.780	.659, .923	.004
Race	.820	.618, 1.089	.171	.749	.487, 1.152	.188	.659	.503, .862	.002	.734	.536, 1.006	.054	.904	.733, 1.114	.342
Income	1.107	1.031, 1.188	.005	1.038	.932, 1.156	.497	.849	.797, .903	<.001	.968	.895, 1.047	.416	1.105	1.048, 1.165	<.001

Education	.810	.713, .919	<b>.001</b>	.868	.724, 1.040	.125	.644	.576, .720	<b>&lt;.001</b>	1.160	.999, 1.347	.052	1.130	1.027, 1.243	<b>.012</b>	
Employment status	1.706	1.287, 2.260	<b>&lt;.001</b>	1.182	.815, 1.713	.379	1.326	1.051, 1.672	<b>.017</b>	.740	.542, 1.012	.060	.775	.634, .948	<b>.013</b>	
Marital status	.677	.520, .882	<b>.004</b>	.606	.435, .844	<b>.003</b>	.641	.512, .801	<b>&lt;.001</b>	1.261	.942, 1.689	.120	.951	.776, 1.166	.631	
Children at home	.640	.485, .846	<b>.002</b>	.938	.639, 1.377	.744	1.207	.941, 1.547	.139	.936	.676, 1.295	.689	1.006	.819, 1.236	.952	
BMI	.800	.632, 1.014	.065	.551	.390, .779	<b>&lt;.001</b>	.661	.533, .821	<b>&lt;.001</b>	.674	.511, .889	<b>.005</b>	1.119	.940, 1.332	.208	
Multimorbidity	.994	.859, 1.151	.938	.844	.712, 1.001	.051	1.095	1.000, 1.199	.051	.872	.791, .960	<b>.006</b>	1.243	1.152, 1.342	<b>&lt;.001</b>	
<b>Step 2: Caregiving Intensity</b>																
Caregiving duration	.955	.872, 1.046	.324	.975	.849, 1.120	.721	1.043	.956, 1.138	.345	.986	.887, 1.095	.785	.995	.933, 1.062	.890	
Caregiving hours	.944	.842, 1.057	.316	.889	.756, 1.045	.152	1.103	1.009, 1.206	<b>.031</b>	.864	.772, .968	<b>.012</b>	.926	.856, 1.002	.055	
Providing personal care	.958	.742, 1.237	.742	1.069	.740, 1.545	.723	.716	.572, .896	<b>.004</b>	.740	.556, .985	<b>.039</b>	1.072	.899, 1.279	.438	
Providing help with household tasks	1.043	.756, 1.439	.797	1.009	.657, 1.551	.967	1.235	.934, 1.634	.139	1.153	.828, 1.606	.399	.962	.772, 1.198	.729	
<b>Step 3: Group</b>																
Dementia	REF	- -		REF	- -		REF	- -		REF	- -		REF	- -		
Cancer	1.195	.880, 1.623	.255	1.683	1.149, 2.466	<b>.008</b>	1.042	.793, 1.370	.767	.922	.663, 1.283	.630	1.010	.816, 1.248	.930	
COPD/Emphysema	.938	.632, 1.393	.752	1.349	.812, 2.242	.247	1.545	1.143, 2.088	<b>.005</b>	.807	.558, 1.167	.254	1.020	.805, 1.293	.870	
Diabetes	1.171	.826, 1.660	.376	1.865	1.184, 2.938	<b>.007</b>	1.383	1.024, 1.868	<b>.034</b>	1.001	.695, 1.440	.998	.981	.776, 1.240	.872	

**Note.** CG = Caregiver. COPD = Chronic obstructive pulmonary disease. RRR = Relative risk ratio. Boldface indicates statistical significance ( $p < 0.05$ ). Logistic regressions were used to estimate meeting aerobic activity and muscle-strengthening recommendations, consuming 5+ daily servings of fruit and vegetables, alcohol use, smoking status, sleeping 7+ hours per night, and influenza immunization, and Poisson regressions were used to estimate daily servings of fruit and vegetables. Aerobic activity recommendations = at least 150 minutes of moderate-to-vigorous intensity aerobic activity per week. Muscle strengthening recommendations = at least 2 days of muscle strengthening activity per week. Binge drinking = 5 or more drinks (men) or 4 or more drinks (women) on at least one occasion in the past 30 days. Heavy drinking = more than 14 drinks per week (men) or more than 7 drinks per week (women). Covariates were coded as follows: Gender: female = 0, male = 1. Race: non-Hispanic White = 0, other = 1. Employment status: retired/unemployed = 0, employed = 1. Marital status: not married/partnered = 0, married/partnered = 1. Children at home: no = 0, yes = 1. BMI: normal weight = 0, overweight/obese = 1. Multimorbidity is the number of chronic conditions. Each group was coded as follows: Non-Caregiver = 0, CG (Dementia, Cancer, COPD/Emphysema, or Diabetes) = 1. The total CG sample from 2015-2019 was 14,583 people, including Dementia CG ( $n = 5,525$ ), Cancer CG ( $n = 4,246$ ), COPD/emphysema CG ( $n = 1,959$ ), and Diabetes CG ( $n = 2,853$ ). Most health behaviors were only measured in certain cross-sectional waves. See Table S1 for the sample sizes for each health behavior.

**Appendix Table 1***Sample Size and Health Behavior Data Availability Across BRFSS 2015-2019 Waves*

<b>Sample Size (n)</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
Caregivers	24,034	15,193	4,918	3,082	7,781
Non-caregivers	84,412	60,973	19,357	12,007	27,099
<b>Health Behaviors</b>					
Exercise (Physical activity)					
Meeting aerobic activity recommendations	x	NA	x	NA	x
Meeting muscle-strengthening recommendations	x	NA	x	NA	x
Diet					
Daily fruit consumption	x	NA	x	NA	x
Daily vegetable consumption	x	NA	x	NA	x
Alcohol use	x	x	x	x	x
Smoking status	x	x	x	x	x
Sleep duration	NA	x	x	x	NA
Influenza immunization	x	x	x	x	x
<i>Note.</i> x indicates that data are available in the marked year. NA = Not available.					

**Appendix Table 2***Outcome Measures Across BRFSS 2015-2019 Waves*

<b>Health Behaviors</b>	<b>Measures</b>
<b>Exercise (Physical activity)</b>	
Meeting aerobic activity recommendations	<p>Based on the following items, respondents who reported doing 150+ minutes (or vigorous equivalent) of physical activity were categorized as meeting aerobic activity recommendations.</p> <ul style="list-style-type: none"> <li>• During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?</li> <li>• What type of physical activity or exercise did you spend the most time doing during the past month?</li> <li>• How many times per week or per month did you take part in this activity during the past month?</li> <li>• And when you took part in this activity, for how many minutes or hours did you usually keep at it?</li> <li>• What other type of physical activity gave you the next most exercise during the past month?</li> <li>• How many times per week or per month did you take part in this activity during the past month?</li> <li>• And when you took part in this activity, for how many minutes or hours did you usually keep at it?</li> </ul>
Meeting muscle-strengthening recommendations	<p>Based on the following item, respondents who reported doing muscle-strengthening activity such as strength or resistance training at least 2 days per week were categorized as meeting muscle-strengthening recommendations.</p> <ul style="list-style-type: none"> <li>• During the past month, how many times per week or per month did you do physical activities or exercises to strengthen your muscles? [Do not count aerobic activities like walking, running, or bicycling. Count activities using your own body weight like yoga, sit-ups or push-ups and those using weight machines, free weights, or elastic bands.]</li> </ul>
<hr/> <b>Diet</b>	
Daily fruit consumption	<p>In 2015, based on the following items, respondents' total number of servings of whole fruit and 100% fruit juice consumption per day was calculated.</p> <ul style="list-style-type: none"> <li>• During the past month, how many times per day, week or month did you drink 100 percent pure fruit juices? Do not include fruit-flavored drinks with added sugar or fruit juice you made at home and added sugar to. Only include 100 percent juice.</li> <li>• During the past month, not counting juice, how many times per day, week, or month did you eat fruit? Count fresh, frozen, or canned fruit. (Read only if necessary: "Your best guess is fine. Include apples, bananas, applesauce, oranges, grape fruit, fruit salad, watermelon, cantaloupe or musk melon, papaya, lychees, star fruit).</li> </ul>

In 2017 and 2019, based on the following items, respondents' total number of servings of whole fruit and 100% fruit juice consumption per day was calculated.

- Not including fruit-flavored drinks or fruit juices with added sugar, how often did you drink 100% fruit juice such as apple or orange juice?
- Not including juices, how often did you eat fruit?

#### Daily vegetable consumption

In 2015, based on the following items, respondents' total number of servings of dried beans, dark green vegetables, orange vegetables, fried potatoes, other potatoes, and other vegetables consumption per day was calculated.

- During the past month, how many times per day, week, or month did you eat cooked or canned beans, such as refried, baked, black, garbanzo beans, beans in soup, soybeans, edamame, tofu or lentils? Do not include long green beans. (Read only if necessary: "Include round or oval beans or peas such as navy, pinto, split peas, cow peas, garbanzo beans, lentils, soy beans and tofu. Do not include long green beans such as string beans, broad or winged beans, or pole beans.")
- During the past month, how many times per day, week, or month did you eat orange-colored vegetables such as sweet potatoes, pumpkin, winter squash, or carrots? (Read only if needed: "Winter squash have hard, thick skins and deep yellow to orange flesh. They include acorn, buttercup, and spaghetti squash.")
- During the past month, how many times per day, week, or month did you eat dark green vegetables for example broccoli or dark leafy greens including romaine, chard, collard greens or spinach?
- Not counting what you just told me about, during the past month, about how many times per day, week, or month did you eat other vegetables? Examples of other vegetables include tomatoes, tomato juice or V-8 juice, corn, eggplant, peas, lettuce, cabbage, and white potatoes that are not fried such as baked or mashed potatoes. (Read only if needed: "Do not count vegetables you have already counted and do not include fried potatoes.")

In 2017 and 2019, based on the following items, respondents' total number of servings of dried beans, dark green vegetables, orange vegetables, fried potatoes, other potatoes, and other vegetables consumption per day was calculated.

- How often did you eat any kind of fried potatoes, including french fries, home fries, or hash browns?
- How often did you eat any other kind of potatoes, or sweet potatoes, such as baked, boiled, mashed potatoes, or potato salad?
- How often did you eat a green leafy or lettuce salad, with or without other vegetables?
- Not including lettuce salads and potatoes, how often did you eat other vegetables?

Binge drinking	<p>Based on the following items, male respondents who reported having 5 or more drinks or female respondents who reported drinking 4 or more drinks on at least one occasion in the past month were categorized as engaging in binge drinking.</p> <ul style="list-style-type: none"> <li>• During the past 30 days, how many days per week or per month did you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor?</li> <li>• Considering all types of alcoholic beverages, how many times during the past 30 days did you have 5 or more drinks for men or 4 or more drinks for women on an occasion?</li> </ul>
Average drinks per week	<p>Based on the following items, respondents' average number of drinks per week was calculated.</p> <ul style="list-style-type: none"> <li>• During the past 30 days, how many days per week or per month did you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor?</li> <li>• One drink is equivalent to a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor. During the past 30 days, on the days when you drank, about how many drinks did you drink on the average? (A 40 ounce beer would count as 3 drinks, or a cocktail drink with 2 shots would count as 2 drinks.)</li> </ul>
Heavy drinking	<p>Based on the following items, male respondents who reported having more than 14 drinks per week or female respondents who reported having more than 7 drinks per week in the past month were categorized as engaging in heavy drinking.</p> <ul style="list-style-type: none"> <li>• During the past 30 days, how many days per week or per month did you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor?</li> <li>• One drink is equivalent to a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor. During the past 30 days, on the days when you drank, about how many drinks did you drink on the average? (A 40 ounce beer would count as 3 drinks, or a cocktail drink with 2 shots would count as 2 drinks.)</li> </ul>

---

**Smoking status**

Based on the following items, respondents were categorized as currently smoking or formerly/never smoking.

- Have you smoked at least 100 cigarettes in your entire life? [Note: 5 packs = 100 cigarettes]
- Do you now smoke cigarettes every day, some days, or not at all?

---

**Sleep duration**

Average sleep duration

Based on the following item, respondents' average hours of sleep per night was calculated.

- On average, how many hours of sleep do you get in a 24-hour period?

Sleeping 7+ hours per night

Based on the following item, respondents were categorized as sleeping on average 7 hours or more per night or not.

- On average, how many hours of sleep do you get in a 24-hour period?
-

---

**Influenza immunization**

In 2015, 2016, 2017, and 2018, based on the following item, respondents were categorized as receiving a flu shot or vaccine in the past 12 months or not.

- During the past 12 months, have you had either a flu shot or a flu vaccine that was sprayed in your nose? (A new flu shot came out in 2011 that injects vaccine into the skin with a very small needle. It is called Fluzone Intradermal vaccine. This is also considered a flu shot.),

In 2019, based on the following item, respondents were categorized as receiving a flu shot or vaccine in the past 12 months or not.

- During the past 12 months, have you had either flu vaccine that was sprayed in your nose or flu shot injected into your arm?
-

**Appendix Table 3**

*Average Estimated Marginal Effects for the Regression Analyses Comparing Health Behaviors of Caregiver Groups to Non-Caregivers*

<b>Variables Included</b>	<b>Meeting Aerobic Activity Recommendations</b>	<b>Meeting Muscle Strengthening Recommendations</b>	<b>Daily Servings of Fruit</b>	<b>Daily Servings of Vegetables</b>	<b>5+ Daily Servings of Fruit and Vegetables</b>	<b>Binge Drinking</b>	<b>Heavy Drinking</b>	<b>Currently Smoking</b>	<b>Sleeping 7+ Hours per Night</b>	<b>Received Influenza Immunization</b>
<b>Step 1: Covariates</b>										
Age	0.001	-0.004	0.001	0.000	0.000	-0.004	-0.001	-0.002	0.002	0.005
Gender	0.035	0.075	-0.077	-0.068	-0.054	0.067	0.003	0.037	-0.014	-0.054
Race	-0.027	0.031	0.122	0.007	0.035	-0.026	-0.017	-0.061	-0.050	-0.021
Income	0.021	0.021	0.008	0.013	0.004	0.009	0.005	-0.016	0.004	0.018
Education	0.044	0.037	0.034	0.029	0.015	-0.003	-0.005	-0.043	0.011	0.038
Employment status	-0.062	-0.043	-0.018	0.002	-0.004	0.045	0.015	0.033	-0.039	-0.057
Marital status	-0.010	-0.045	0.008	0.032	0.013	-0.021	-0.015	-0.033	0.040	-0.002
Children at home	-0.014	-0.026	0.027	0.007	0.002	-0.036	-0.024	0.004	-0.046	0.010
BMI	-0.063	-0.066	-0.050	-0.028	-0.028	0.005	-0.009	-0.032	-0.044	0.008
Multimorbidity	-0.042	-0.014	-0.012	0.000	-0.004	-0.014	-0.006	0.018	-0.040	0.046
<b>Step 2: Group</b>										
Non-caregiver	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Dementia	0.044	0.058	0.025	0.025	0.026	-0.012	-0.017	0.033	-0.070	0.006
Cancer	0.046	0.036	0.021	0.046	0.030	0.016	0.013	0.054	-0.066	0.006
COPD/ Emphysema	0.063	0.019	0.055	0.054	0.002	-0.024	-0.005	0.094	-0.094	0.015
Diabetes	0.008	0.001	0.085	0.041	0.026	0.008	0.017	0.078	-0.065	0.001

*Note.* CG = Caregiver. COPD = Chronic obstructive pulmonary disease. Logistic regressions were used to estimate meeting aerobic activity and muscle-strengthening recommendations, consuming 5+ daily servings of fruit and vegetables, alcohol use, smoking status, sleeping 7+ hours per night, and influenza immunization, and Poisson regressions were used to estimate daily servings of fruit and vegetables. Aerobic activity recommendations = at least 150 minutes of moderate-to-vigorous intensity aerobic activity per week. Muscle strengthening recommendations = at least 2 days of muscle strengthening activity per week. Binge drinking = 5 or more drinks (men) or 4 or more drinks (women) on at least one occasion in the past 30 days. Heavy drinking = more than 14 drinks per week (men) or more than 7 drinks per week (women). Covariates were coded as follows: Gender: female = 0, male = 1. Race: non-Hispanic White = 0, other = 1. Employment status: retired/unemployed = 0, employed = 1. Marital status: not married/partnered = 0, married/partnered = 1. Children at home: no = 0, yes = 1. BMI: normal weight = 0, overweight/obese = 1. Multimorbidity is the number of chronic conditions. Each group was coded as follows: Non-Caregiver = 0, CG (Dementia, Cancer, COPD/Emphysema, or Diabetes) = 1.

**Appendix Table 4**

*Average Estimated Marginal Effects for the Regression Analyses of Caregiving Intensity in Relation to Health Behaviors*

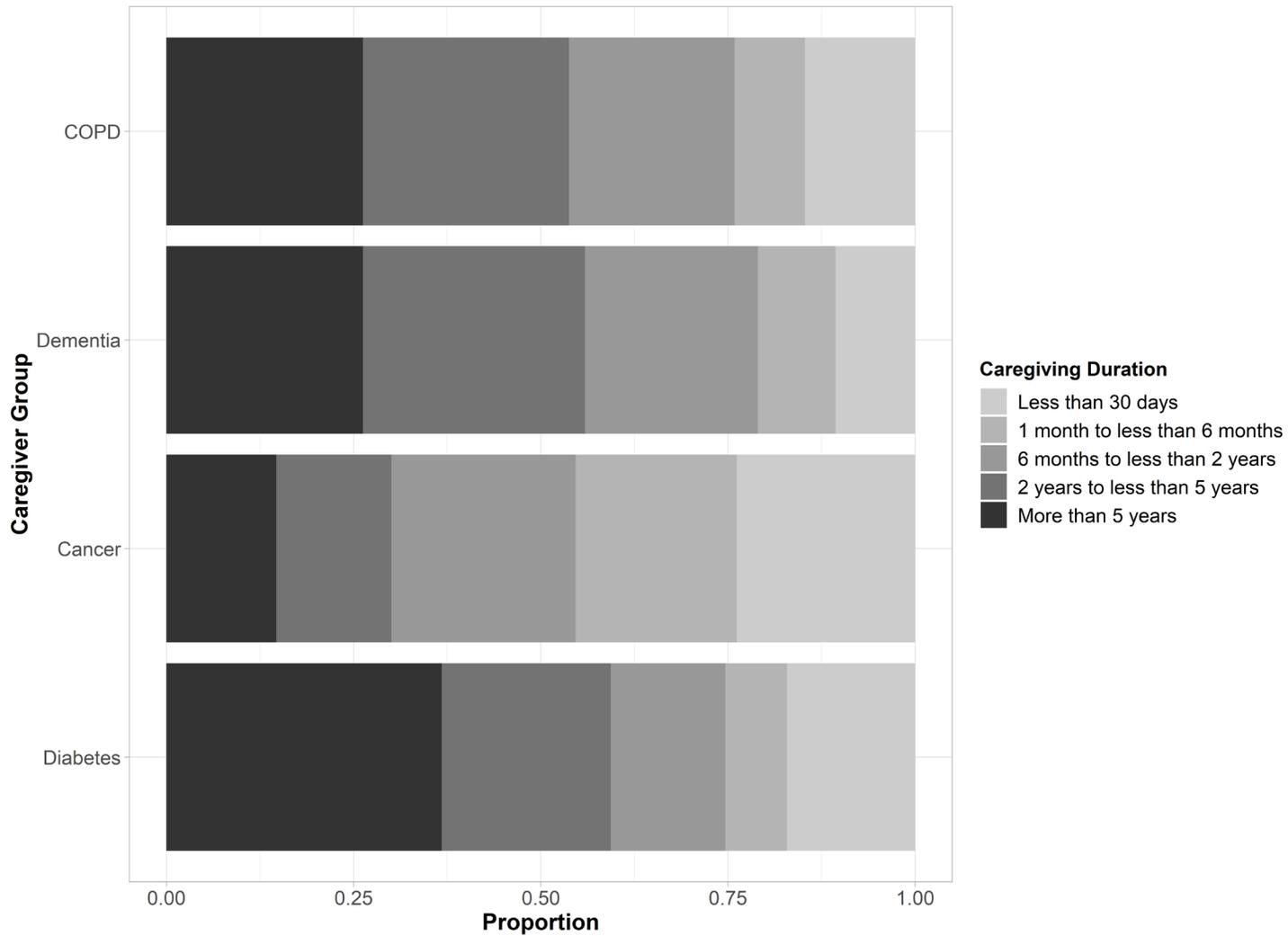
<b>Variables Included</b>	<b>Meeting Aerobic Activity Recommendations</b>	<b>Meeting Muscle Strengthening Recommendations</b>	<b>Daily Servings of Fruit</b>	<b>Daily Servings of Vegetables</b>	<b>5+ Daily Servings of Fruit and Vegetables</b>	<b>Binge Drinking</b>	<b>Heavy Drinking</b>	<b>Currently Smoking</b>	<b>Sleeping 7+ Hours per Night</b>	<b>Received Influenza Immunization</b>
<b>Step 1:</b>										
<u>Covariates</u>										
Age	0.000	-0.005	0.000	0.000	0.000	-0.004	0.000	-0.003	0.002	0.004
Gender	0.027	0.092	0.040	-0.038	-0.027	0.061	0.019	0.043	0.007	-0.058
Race	0.001	0.092	0.100	0.012	0.033	-0.019	-0.014	-0.057	-0.069	-0.024
Income	0.016	0.021	0.000	0.009	0.001	0.010	0.002	-0.022	-0.007	0.023
Education	0.033	0.022	0.055	0.040	0.035	-0.020	-0.007	-0.060	0.033	0.029
Employment status	-0.056	-0.071	-0.039	-0.012	0.002	0.050	0.008	0.038	-0.067	-0.060
Marital status	-0.012	-0.033	0.004	0.016	-0.001	-0.037	-0.025	-0.060	0.052	-0.012
Children at home	-0.006	-0.022	0.077	-0.008	0.014	-0.042	-0.003	0.025	-0.015	0.001
BMI	-0.094	-0.079	-0.056	-0.008	-0.025	-0.021	-0.030	-0.056	-0.089	0.026
Multimorbidity	-0.025	0.006	0.035	0.018	0.022	-0.001	-0.008	0.012	-0.031	0.051
<b>Step 2:</b>										
<u>Caregiving Intensity</u>										
Caregiving duration	0.007	-0.005	0.006	0.001	-0.009	-0.004	-0.001	0.006	-0.003	-0.001
Caregiving hours	-0.017	-0.019	-0.008	0.000	-0.004	-0.005	-0.006	0.013	-0.033	-0.018
Providing personal care	0.005	-0.022	0.008	0.021	0.010	-0.004	0.003	-0.045	-0.068	0.016
Providing help with household tasks	0.014	0.052	0.033	0.005	0.026	0.004	0.000	0.029	0.032	-0.009
<b>Step 3: Group</b>										
Dementia	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Cancer	-0.010	-0.040	-0.036	0.017	-0.006	0.017	0.026	0.006	-0.018	0.002
COPD/ Emphysema	0.018	-0.045	-0.060	-0.012	-0.017	-0.006	0.015	0.059	-0.048	0.005
Diabetes	-0.068	-0.088	0.014	0.020	0.007	0.015	0.031	0.044	0.000	-0.005

*Note.* CG = Caregiver. COPD = Chronic obstructive pulmonary disease. Logistic regressions were used to estimate meeting aerobic activity and muscle-strengthening recommendations, consuming 5+ daily servings of fruit and vegetables, alcohol use, smoking status, sleeping 7+ hours per night, and influenza immunization, and Poisson regressions were used to estimate daily servings of fruit and vegetables. Aerobic activity recommendations = at least 150 minutes of moderate-to-vigorous intensity aerobic activity per week. Muscle strengthening recommendations = at least 2 days of muscle strengthening activity per week. Binge drinking = 5 or more drinks (men) or 4 or more drinks (women) on at least one occasion in the past 30 days. Heavy drinking = more than 14 drinks per week (men) or more than 7 drinks per week (women). Covariates were coded as follows: Gender: female = 0, male = 1. Race: non-Hispanic White = 0, other = 1.

---

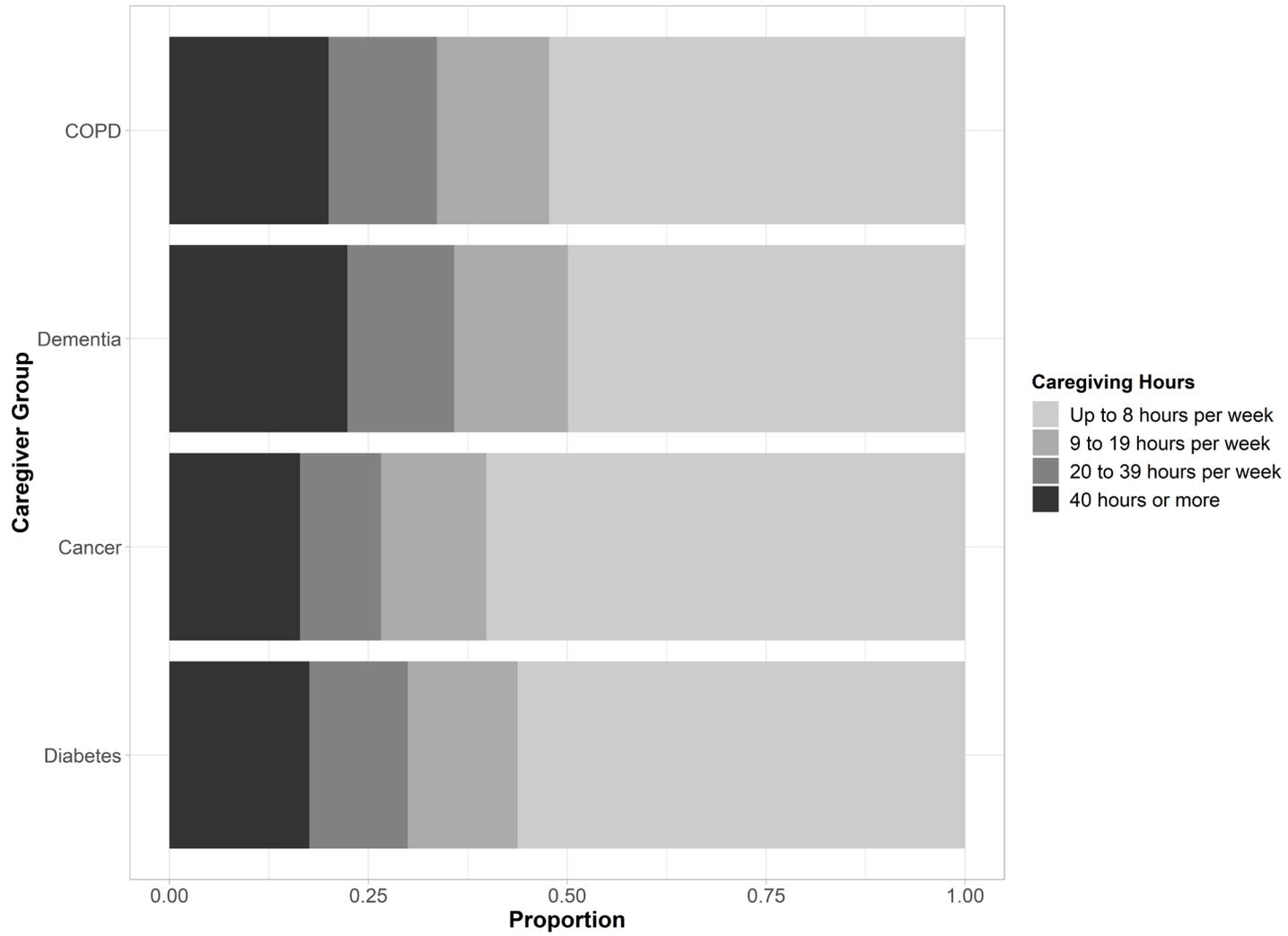
Employment status: retired/unemployed = 0, employed = 1. Marital status: not married/partnered = 0, married/partnered = 1. Children at home: no = 0, yes = 1. BMI: normal weight = 0, overweight/obese = 1. Multimorbidity is the number of chronic conditions. Each group was coded as follows: Non-Caregiver = 0, CG (Dementia, Cancer, COPD/Emphysema, or Diabetes) = 1.

**Appendix Figure 1: Caregiving Duration**



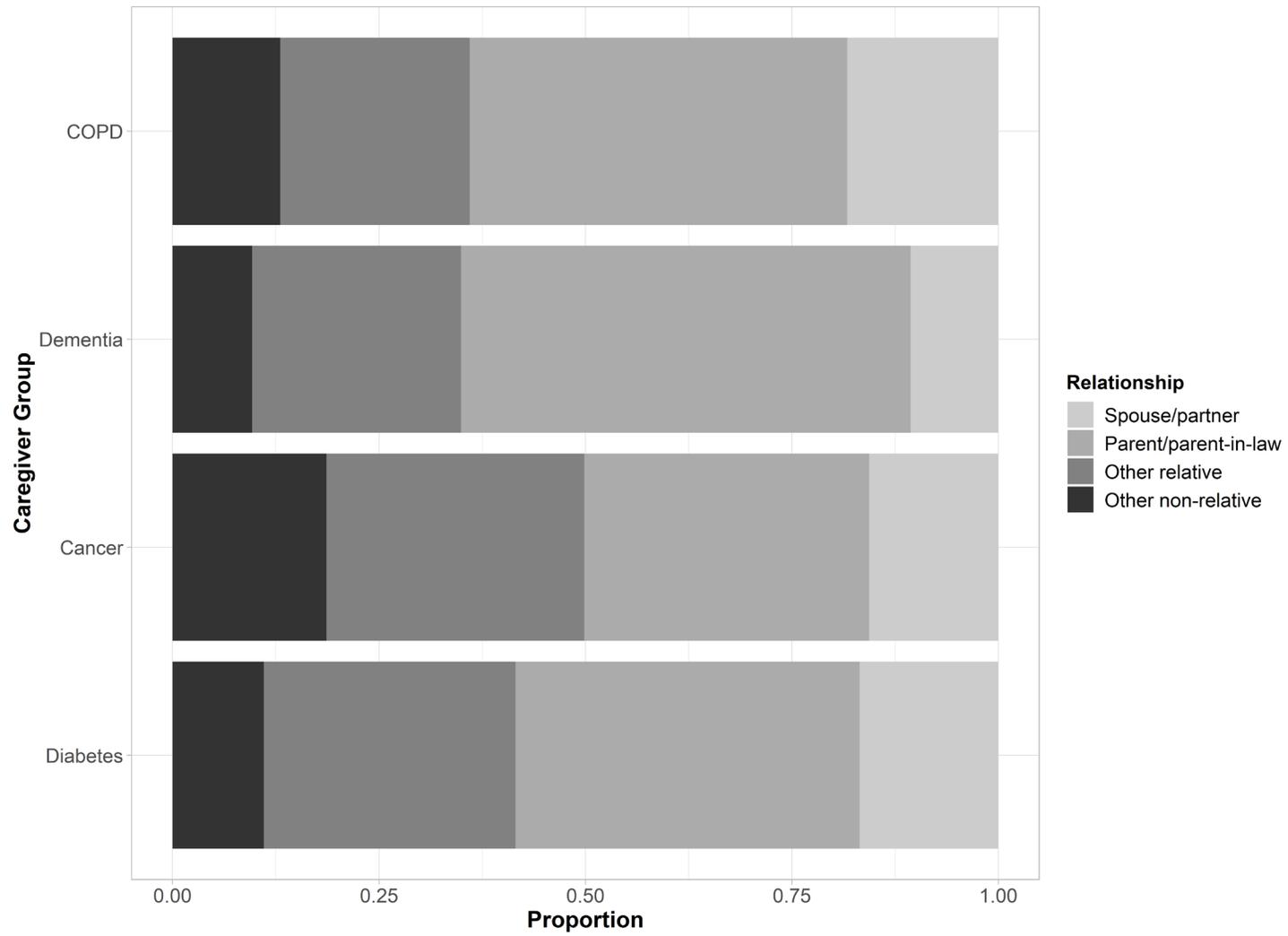
Note. COPD = Chronic obstructive pulmonary disease

**Appendix Figure 2: Caregiving Hours**



Note. COPD = Chronic obstructive pulmonary disease

**Appendix Figure 3: Caregiving Relationship**



Note. COPD = Chronic obstructive pulmonary disease