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Article type   : Clinical Investigation

Title: The association of spousal caregiver wellbeing with patient healthcare expenditures.

Running title: Spousal wellbeing and patient utilization

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Spousal wellbeing and patient utilization

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Abstract word count: 247

Manuscript word count: 2,824

3 tables, 1 figure

KEY WORDS: caregiving, healthcare utilization, depression, quality of life

1 **Abstract:**

2 Background/Objectives: Disabled older adults are a high-cost population often relying on

3 spouses for caregiving. We aim to measure the association of spousal depression, general health,

4 fatigue and sleep with patient future healthcare expenditures and Emergency Department (ED)

5 utilization.

6 Design: Prospective cohort study.

7 Setting/Participants: 3,101 home-dwelling spousal dyads where one individual ("patient") is age

8 ≥65 with ≥1 disabilities in activities of daily living or instrumental activities of daily living and

9 enrolled in Medicare Part B within the Health and Retirement Study.

10 Exposure: Caregiver sleep (Jenkins Sleep Scale), depressive symptoms (Center for

11 Epidemiological Studies Depression-8 Scale), and self-reported general health measures.

12 Measurements: Primary outcome was patient Medicare expenditures. Secondary outcome was

13 patient ED utilization. Follow-up was 6 months.

14 Results: Caregiver depressive symptoms score and 6 of 17 caregiver wellbeing measures were

15 prospectively associated with higher patient expenditures after minimal adjustment ($p < 0.05$).

16 Higher patient expenditures remained significantly associated with presence of caregiver fatigue

17 (cost increase, \$1,937 [95% CI, \$770-\$3,105]) and caregiver sadness (cost increase, \$1,323 [95%

18 CI, \$228-\$2,419]) after full adjustment. Four of 17 caregiver wellbeing measures, including

19 severe fatigue, were significantly associated with patient ED utilization after minimal adjustment

20 ($p < 0.05$). Greater odds of patient ED utilization remained significantly associated with caregiver

21 fatigue (odds ratio, 1.24 [95% CI, 1.01-1.52]) and caregiver fair/poor health status (odds ratio,

22 1.23 [95% CI, 1.04-1.45]) after full adjustment. Caregiver total sleep score was not associated

23 with patient outcomes.

24 Conclusions: Poor caregiver wellbeing, particularly severe fatigue, is independently and

25 prospectively associated with higher patient Medicare expenditures and ED utilization.

26

Background:

As the population of adults age 65 years and older in the United States is predicted to rise from 14.9% in 2015 to 22.1% in 2050,[1] supporting community-dwelling aging adults is critical.[2] One key component of this support is the presence of informal caregivers, who support an estimated 14.7 million Americans,[3] and are growing in number over the last decade.[4] Given the common and critical role of the caregiver, a growing body of literature has explored the health impact of caregiving—both positive and negative—on the caregiver. While caregiving itself may have health benefits,[5,6] caregiver wellbeing may deteriorate if caregiver strain or burnout develops.[7,8] Several pathways have been proposed that link patient illness and exposure to high-intensity medical care at the end of life to poor caregiver health and increased caregiver healthcare utilization.[9–11] In addition, the extent of patient suffering has been identified as an additional risk factor for caregiver strain.[12]

While patient illness and utilization are risk factors for poor caregiver wellbeing, the reverse may also be true: that poor caregiver wellbeing could contribute to higher patient healthcare utilization in a causal fashion through several possible mechanisms. Caregiving demands may contribute to more physical and mental impairment in the caregiver,[9] resulting in the inability to keep up with caregiving demands, which may worsen the patient's health requiring medical attention and leading to additional healthcare expenditures. In addition, caregivers with poor wellbeing such as severe fatigue may be more prone to burnout and thus decreased capacity to provide care,[12–15] leading to reliance on the health system and Emergency Department in particular as a source of respite, commonly described by clinicians as the "Pop drop". Complicating these hypothesized pathways is the potential for reverse causality. Either high patient treatment intensity[16] or the emotional impact of worsening illness[8,9] may result in both poor caregiver wellbeing and higher patient utilization, thus confounding the association. Therefore, longitudinal measurements of caregiver wellbeing and spousal patient utilization are necessary to elucidate the association.

Even in the absence of a causal association, there is a great need to identify factors associated with higher future patient utilization, especially potentially burdensome utilization such as Emergency Department visits. Patient factors that are not captured by traditional claims-based risk models have been showed to predict hospital readmissions[17] as well as utilization and mortality better than claims-based approaches.[18] For older adults with functional impairment, it

58 is possible that caregiver factors such as wellbeing predict utilization as well. If this is true,

59 screening for poor caregiver wellbeing and offering targeted supports has the potential to reduce

60 future patient utilization as well as improve caregiver health and outcomes.

61   The Health and Retirement Study (HRS) provides a unique opportunity to study these

62 phenomena as both individuals in spousal pairs are enrolled in this longitudinal cohort study.[19] In

63 this analysis, we tested the association of caregiver symptoms of wellbeing with patient

64 utilization using data on these spousal caregiver and care recipient ("patient") dyads. To help

65 account for the possibility that patients' healthcare utilization might drive caregiver distress, we

66 determined patient healthcare utilization *following* the caregiver assessment, adjusting for the

67 patients' previous six months of utilization.

68

69 **Methods:**

70   This study used Medicare-linked data from the HRS between 2000 and 2012. The HRS is

71 a nationally-representative longitudinal panel study in the U.S. designed to assess wellbeing and

72 disability in respondents age 51 and older through biennial surveys. HRS also enrolls the spouses

73 of all respondents, which allows for spousal dyads to be examined. Proxy respondents were

74 interviewed where sampled participants are unable to complete the survey. HRS has baseline

75 response rates of 70% to 82% with re-interview rates of 90%.[20] HRS respondents were asked for

76 permission to release their Medicare claims, which are then linked to their survey responses.

77 *Study population:*

78   This study included 8,785 HRS observations of respondents from 2000-2012 who were

79 home dwelling, ADL or IADL disabled, residing with a spouse and alive 6 months after

80 interview. ADLs were defined as bathing, dressing, eating, toileting, walking, or transferring in

81 and out of bed and IADLs were defined as grocery shopping, cooking, making telephone calls,

82 managing money or taking medications. Of these, 463 (5.3%) were excluded as they did not

83 consent to Medicare linkage or had failed linkage and 2,362 (26.9%) were excluded as they did

84 not have continuous Medicare Fee-for-Service coverage the 6 months before and after surveying,

85 which resulted in 5,960 observations.

86 *Study variables:*

87   The primary dependent variable was patient Medicare expenditures during the 6 months

88 following the spousal caregiver HRS survey. We adjusted expenditures to 2012 US dollars using

89   the medical Consumer Price Index.[21] The secondary outcome was patient ED utilization, defined

90   as the count of ED visits.

91   Prior work has demonstrated that wellbeing measures that capture depressive symptoms,

92   sleep symptoms, and self-reported health status have all been associated with caregiver strain in

93   this population.[22–24] Given that there is no composite scale of caregiver wellbeing in the HRS,

94   these wellbeing measures were instead used. Primary independent variables were therefore the

95   eight-item (yes/no) Center for Epidemiological Studies Depression Scale (CES-D-8);[25] four

96   items of the Jenkins Sleep Scale,[26] with responses classified as 0 "rarely or never," 1

97   "sometimes," or 2 "most of the time"; a single-item severe fatigue item (yes/no); and the

98   validated single-item general self-rated health item,[27] which was dichotomized into fair/poor vs.

99   good/very good/excellent. Within the HRS, the CES-D-8 items were not surveyed in the case of

100   a proxy respondent. These measures have all been validated in an older adult population.[25,27,28]

101   The CES-D-8 and Jenkins sleep scale have been demonstrated to contain multiple

102   dimensions in prior psychometric analysis in our cohort of caregivers.[29] Therefore, we tested the

103   effect of the total CES-D-8 score, total Jenkins sleep scale score as well as individual measures

104   comprising these scales on the 2 patient outcomes.

105   All models adjusted for either patient total Medicare expenditures or ED visits in the 6

106   months prior to the patient HRS survey depending on whether the outcome variable was

107   expenditures or ED visits, respectively. All models also adjusted for caregiver age, sex, and

108   proxy-respondent status. Other covariates included caregiver race (white, black or other), net

109   worth, education level, and presence of children residing within 10 miles to help account for

110   support for the caregiver. We also included the number of ADL/IADL impairments and the

111   presence of cognitive impairment for both patient and caregiver as determined by the Langa-

112   Weir method which includes cognitive measures assessed within the HRS.[30] Final models

113   additionally included whether or not the spouse assisted with the patients' impaired ADL(s).

114   *Statistical analysis:*

115   Descriptive statistics, adjusting for survey weights and design, were used to compare the

116   observations of spouses and patients in identified dyads. Separate models were constructed to

117   assess the effect of each caregiver wellbeing measure on total healthcare expenditures and

118   numbers of ED visits in the following six months. Because both expenditures and ED visits have

119   a high concentration of observations with a value of zero and a skewed distribution, two-part

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120   models were used.[31–33] The first part was a multilevel mixed effects logistic regression for any

121   expenditures vs. no expenditures and any ED use vs. no ED use, accounting for multiple

122   observations for individuals. The second part of each model was a mixed effects generalized

123   linear regression model with a gamma distribution and log link to assess the effect of caregiver

124   wellbeing characteristics on greater expenditures or greater ED use for those with non-zero

125   values. Therefore, two separate statistics describe both expenditures and ED utilization.

126   The first minimally adjusted models adjusted for patients' prior 6 month expenditures or

127   ED visits, proxy status, caregiver age and sex. Prior 6 month expenditures or ED visits were

128   included to isolate the association between caregiver wellbeing and future expenditures given the

129   potentially bidirectional relationship.[9] For those caregiver characteristics with significant

130   ($p<0.05$) associations, fully adjusted models were built that included all demographic,

131   socioeconomic, functional and cognitive covariates of the patient and caregiver. Given that

132   multiple caregiver wellbeing characteristics were tested, the Bonferroni method was used to

133   adjust p-values used to determine statistical significance. This altered the threshold for statistical

134   significance from $p<0.05$ to $p<0.01$. This is considered a more conservative approach to adjust

135   for multiple comparisons.[34]

136   In order to elucidate whether the association between spousal wellbeing and patient

137   utilization was driven by cohabitation vs. caregiving, one final analysis step was performed. For

138   all fully-adjusted models that remained statistically significant to a threshold of $p<0.01$,

139   interaction effects were assessed between the wellbeing characteristic and whether or not the

140   spouse assisted the patient with impaired ADLs. All analysis was done using Stata 14.0

141   software.[35]

142

143   **<u>Results:</u>**

144   There were 3,101 patient-caregiver dyads with 5,960 observations (mean number of

145   observations 1.83, median 1, range 1-7). Given the longitudinal nature of the HRS, some dyads

146   were observed multiple times. Table 1 shows that the patient and spouse in each dyad were

147   similar in age, race and education, although patients were more likely to be male and have higher

148   degrees of functional and cognitive impairment.

149   The mean adjusted healthcare expenditures for the cohort of functionally-disabled home-

150   dwelling patients for the 6 months following assessment were \$8,751 (standard deviation \$226).

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151 There were 311 observations (5.2%) that had zero expenditures in the 6 months following HRS

152 assessment and 4,539 observations that had no ED visits over this time (76.2%). Mean number

153 of ED visits the 6 months following HRS assessment was 0.39.

154   Caregiver wellbeing measures did not predict whether patients had any healthcare

155 expenditures (See Table 1a in appendix). However, among patients who did incur Medicare

156 costs (94.8% of observations), caregiver total CES-D score and 6 of 17 individual caregiver were

157 significantly associated with higher patient healthcare costs after adjusting for prior expenditures,

158 age, sex, and proxy status (p<0.05)(Table 2). Specifically, caregiver reports of feeling depressed,

159 sad, and severe fatigue were associated with higher patient utilization costs; conversely,

160 caregiver reports of feeling happy and rested were associated with lower patient costs. The total

161 Jenkin's sleep scale, and the other individual caregiver measures (caregiver reports that

162 everything takes effort, restlessness, loneliness, enjoying life, difficulty getting going, fair/poor

163 health, trouble falling asleep, waking at night, and waking up early) were not associated with

164 healthcare expenditures. In fully adjusted models, only caregiver sadness (coefficient, 0.13 [95%

165 CI, 0.03-0.23]; P=0.01) and caregiver severe fatigue (coefficient, 0.20 [95% CI, 0.08-0.32];

166 P=0.001) remained significantly associated with higher patient expenditures. These results

167 remained statistically significant after adjusting for multiple comparisons. The interaction for

168 spousal fatigue and whether the spouse assisted with ADLs/IADLs was significant at p=0.02. As

169 Figure 1 demonstrates, the patients of spouses who assisted with ADLs/IADLs and were fatigued

170 had $3,262 higher expenditures over the following 6 months than the patients of spouses who

171 assisted with ADLs/IADLs but were not fatigued (Standard Error $1,952-$4,572). There was no

172 significant difference for non-caregiving spouses reporting fatigue vs. no fatigue. The

173 interaction term for spousal sadness and caregiving was not significant (p=0.17). Regardless of

174 ADL/IADL assistance, patients with sad spouses had greater adjusted expenditures of $1,323

175 (95% CI, $228-$2,419) over the following 6 months.

176   In models predicting the presence/absence of patient ED utilization (binary outcome)

177 (Table 3), spousal report of depression, sadness, fair/poor health and severe fatigue were

178 significantly (P<0.05) associated with higher odds of the patient having an ED visit in the next 6

179 months when adjusting for sex, age, proxy status, and ED utilization over the prior 6 months.

180 Caregiver total CES-D score and report of trouble waking up at night were non-significantly

181 associated with odds of the patient having an ED visit. Measures for caregiver reports that

182 everything takes effort, restlessness, happiness, loneliness, enjoying life, difficulty getting going

183 as well as the total Jenkins sleep scale were not associated with odds of ED utilization. In fully

184 adjusted models, caregiver fair/poor health was associated with significantly higher odds of

185 having an ED visit (odds ratio, 1.23 [95% CI, 1.04-1.45]; *P*=0.01) as was caregiver severe

186 fatigue (odds ratio, 1.24 [95% CI, 1.01-1.52]; *P*=0.04), although only caregiver fair/poor health

187 was statistically significant when alpha was adjusted for multiple comparisons. An added

188 interaction term for caregiver fair/poor health and whether or not the spouse provided ADL

189 assistance was not significant (p=0.25)

190   In minimally adjusted models predicting the number of ED visits (continuous outcome)

191 for the 23.8% of patients with non-zero ED use, caregiver total CES-D score and 6 of 17

192 individual caregiver wellbeing measures were associated with number of ED visits (Appendix

193 Table 2A). In particular, caregiver total CES-D score and reports of sadness, difficulty getting

194 going, fair/poor health status, and severe fatigue were associated with increased number of ED

195 visits. Conversely, decreased number of ED visits was significantly associated with caregiver

196 reports of feeling happy and rested and non-significantly associated with caregiver report of

197 enjoying life. After full adjustment, only caregiver report of difficulty getting going was

198 associated with more ED visits (coefficient, 0.07 [95% CI, 0.00-0.13]; P=0.04) and this result

199 was not statistically significant after adjusting for multiple comparisons.

200

201 **Discussion:**

202   The recent National Academies report highlights the dire need for increased attention and

203 support for caregivers in the United States.[36] Our findings are novel in linking caregiver

204 wellbeing to patient utilization. Even with a conservative analysis approach that adjusted for

205 prior health care use as well as caregiver and patient characteristics, caregiver sadness and severe

206 fatigue were significantly associated with higher expenditures in functionally disabled patients.

207 In addition, these disabled spouses of caregivers who have fair/poor health and severe fatigue

208 were significantly more likely to visit the ED. These findings suggest that identifying spousal

209 caregivers with suboptimal wellbeing may help to identify *patients* with impending higher

210 healthcare costs and ED use. This work raises the potential that screening for caregivers with

211 poor wellbeing could not only benefit caregivers but help target interventions to reduce patient

212 utilization as well.

213   We found that caregiver's total CES-D score and several individual caregiver wellbeing

214   measures were prospectively and significantly associated with patient health care costs and

215   number of ED visits over the next 6 months with the effects in the expected directions after

216   adjusting for caregiver age, sex, and proxy status. Our results also suggest that caregiver and

217   patient factors explain some, but not all, of the association between these caregiver wellbeing

218   measures and patient health care utilization. In particular, caregiver fatigue was consistently

219   associated with patient health care costs and ED utilization, though some associations were no

220   longer statistically significant, after accounting for all caregiver and patient characteristics. Our

221   analysis of caregiver fatigue showed that the association of fatigue and patient utilization was

222   specifically associated with higher patient healthcare costs when the spouse was assisting with

223   impaired ADL/IADLs (one of many forms of caregiving), indicating that it is caregiving and not

224   cohabitation driving this pattern. Taken together, our data suggest that caregiver wellbeing is

225   associated with patient outcomes, and that caregiver and patient factors may attenuate these

226   associations. Our findings suggest a scientific need to better understand the pathways between

227   caregiver wellbeing and patient outcomes and to determine how caregiver and patient factors

228   influence these pathways.

229   The nature and direction of the relationship between patient medical care and caregiver

230   characteristics is challenging to disentangle due to likely bidirectional relationships between

231   caregiver wellbeing and patient utilization. Previous research has established that patient severity

232   of illness and intensity of medical treatment are both risk factors for caregiver burnout.[9]

233   However, as we suggest in our conceptual model, it is possible that caregiver characteristics

234   could also drive patient utilization. In our study, we used the patients' prior 6 months of

235   expenditures and adjusted for their levels of cognitive and functional disability to account for the

236   key patient characteristics that might drive caregiver distress. By adjusting for these important

237   patient characteristics and incorporating prior expenditures, our findings contribute evidence that

238   caregiver distress may potentially lead to higher patient expenditures and health care utilization.

239   These results also suggest that caregiver distress could serve as a marker for patients likely to

240   have higher utilization in the future.

241   This study has several limitations. Two of our models had null results (for predicting

242   likelihood of healthcare expenditures and for predicting higher numbers of ED visits), but we are

243   likely underpowered to assess these effects. However, given the distribution of expenditures and

244 ED visits, relying on two-part models was the best statistical approach and allowed for better

245 estimations of higher healthcare expenditures and likelihood of ED visits. This study is unable to

246 establish a causal relationship between caregiver wellbeing and patient utilization because our

247 data are observational and the relationship is likely bidirectional. We attempted to isolate the

248 directionality of the association by adjusting for prior costs, recognizing that this likely results in

249 a conservative bias to our estimates, given the probable correlation of caregiver wellbeing and

250 prior costs as well. Although the HRS captures several valuable measures of caregiver wellbeing

251 domains that we use in this study, caregiver strain is not specifically assessed. Future work

252 should specifically explore the association of strain with utilization. In addition, while we adjust

253 for degree of caregiver assistance with ADL/IADLs and presence of children, a more nuanced

254 picture of the role of the caregiver such as emotional support, medication administration and

255 healthcare decision support would be useful to understand moderating factors for the association

256 of caregiver symptoms and patient utilization.

257   The HRS presents a unique opportunity to explore the issue of how caregiver factors

258 influence patient healthcare utilization and expenditures that has not been measured before.

259 However, because the HRS enrolls spouses but no other individuals (e.g., children) providing

260 caregiving for older adults, our results are not generalizable to other caregivers and may

261 underestimate the total impact of caregiver wellbeing on patient healthcare use. The role of

262 caregivers is critical to understand given the growing recognition that factors external to the

263 health system often drive healthcare utilization. While our goal is not to reduce disabled

264 patients' health care costs, excessive ED use likely signals care that is not optimal for patients

265 and their families and is a potential marker of caregiver distress and unmet needs. The

266 attenuation of some of the effects of caregiver distress on patient health care costs and ED

267 utilization by adjusting for caregiver and patient factors such as availability of child help and net

268 assets suggests that these effects are potentially modifiable and that these patient/caregiver

269 factors or subgroups are potential targets for interventions. Since functionally disabled older

270 adults represent a high-cost population, our findings suggest caregivers are critical targets to

271 improve care received by older adults with functional disabilities.

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Title: Figure 1. Mean adjusted patient healthcare expenditures by spousal wellbeing characteristic and caregiver role.

Legend: [Gray]= Spouse reports fatigue/sadness, [Black/white stripe]= Spouse does not report fatigue/sadness

Supplementary Table S1. The association of caregiver wellbeing characteristics with odds of having patient healthcare expenditures.

Supplementary Table S2. The association of caregiver wellbeing characteristics with higher ED utilization.

Table 1. Characteristics of observations of spousal dyads (N=5,960)

	Patient	Spousal caregiver
Age, mean (SD)	76.21 (0.18)	74.17 (0.24)
Sex:		

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Men, %	57.3%	42.6%
Women, %	42.7%	57.4%
Race:		
White, %	90.9%	90.2%
Black, %	7.1%	6.8%
Other, %	2.0%	3.0%
Education:		
Less than high school, %	29.6%	24.8%
High school, %	49.6%	53.7%
>High school, %	20.8%	21.5%
Mean household net assets, mean (SD)	$488,824 (33,325)	
Independent in ADL/IADLs (%)	0	66.19%
Mean number ADL/IADL impairments (SD)	2.75 (0.06)	0.86 (0.05)
Cognitive function:		
Normal, %	57.1%	73.1%
CIND, %	26.7%	20.7%
Dementia, %	16.2%	6.2%
Child resides within 10 miles, %	62.1%	
Healthcare use:		
Expenditures next 6 months, mean (SD)[1]	$8,751 ($226)	
No expenditures next 6 months, %	5.2%	
ED visits next 6 months, mean (SD)	0.39	
No ED visits next 6 months, %	76.2%	
Spouse wellbeing characteristics:		
Depressed, %		16.1%
Everything takes effort, %		28.3%
Restless, %		32.1%
Happy, %		87.3%
Lonely, %		13.2%
Enjoys life, %		92.1%
Sad, %		19.7%
Difficulty getting going, %		25.0%

Spousal wellbeing and patient utilization

Fair/poor health, %	32.1%
Difficulty falling asleep, %	14.2%

Table 2. The association of caregiver wellbeing characteristics with higher patient healthcare expenditures.[1]

Difficulty with waking up at night, %	30.6%
Difficulty with early waking, %	13.8%
Feel rested, %	58.9%

Source: Health and Retirement Study, 2000-2012. Abbreviations: SD= standard deviation, ADL= activities of daily living, IADL= instrumental activities of daily living, CIND= cognitive impairment no dementia, ED= Emergency Department, CES-D-8= Center for Epidemiologic Studies- Depression Scale. [1]Expenditures are in adjusted 2012 USD.

Spousal wellbeing and patient utilization

	Minimally adjusted[2]		Fully adjusted[3]	
	coefficient	p-value	coefficient	p-value
CES-D-8 items:				
Total CES-D-8 scale	0.02 (0.00-0.05)	0.03	0.01 (-0.01-0.04)	0.26
Depressed	0.12 (0.01-0.23)	0.04	0.07 (-0.04-0.19)	0.23
Everything takes effort	-0.03 (-0.12-0.06)	0.52		
Restless	0.06 (-0.03-0.15)	0.18		
Happy	-0.14 (-0.26- -0.02)	0.02	-0.10 (-0.23 to 0.02)	0.11
Lonely	0.04 (-0.08-0.16)	0.49		
Enjoys life	-0.01 (-0.15-0.13)	0.88		
Sad	0.19 (0.09-0.29)	<0.001	0.13 (0.03- 0.23)	0.01
Difficulty getting going	0.03 (-0.06-0.12)	0.51		
Self-reported general health:				
Fair/poor health	0.04 (-0.05-0.13)	0.39		
Severe fatigue:				
Severe fatigue	0.26 (0.15-0.38)	<0.001	0.20 (0.08-0.32)	0.001
Jenkin's sleep scale:				
Total Jenkin's sleep scale:	-0.00 (-0.03-0.03)	0.98		
Trouble falling asleep	-0.02 (-0.09-0.06)	0.67		
Trouble with waking at night	-0.04 (-0.11-0.02)	0.18		
Trouble waking up early	-0.01 (-0.08-0.06)	0.83		
Rested	-0.07 (-0.13- -0.01)	0.03	-0.05 (-0.11-0.02)	0.14

Data source: Health and Retirement Study, 2000-2012. CES-D-8= Center for Epidemiologic Studies 8-item Depression Scale. [1]Among those with non-zero expenditures. The coefficients are the unstandardized logit-scale regression coefficients. See appendix for first part of two-part model examining the association of caregiver characteristics and odds of non-zero expenditures. [2]Minimally adjusted models include proxy status, caregiver age and sex as covariates. [3]Fully adjusted models additionally adjust for race, net assets, functional limitations of caregiver and patient, cognitive function of caregiver and patient, whether a child resides within 10 miles, whether the spouse reports assisting with activities of daily living/instrumental activities of daily living.
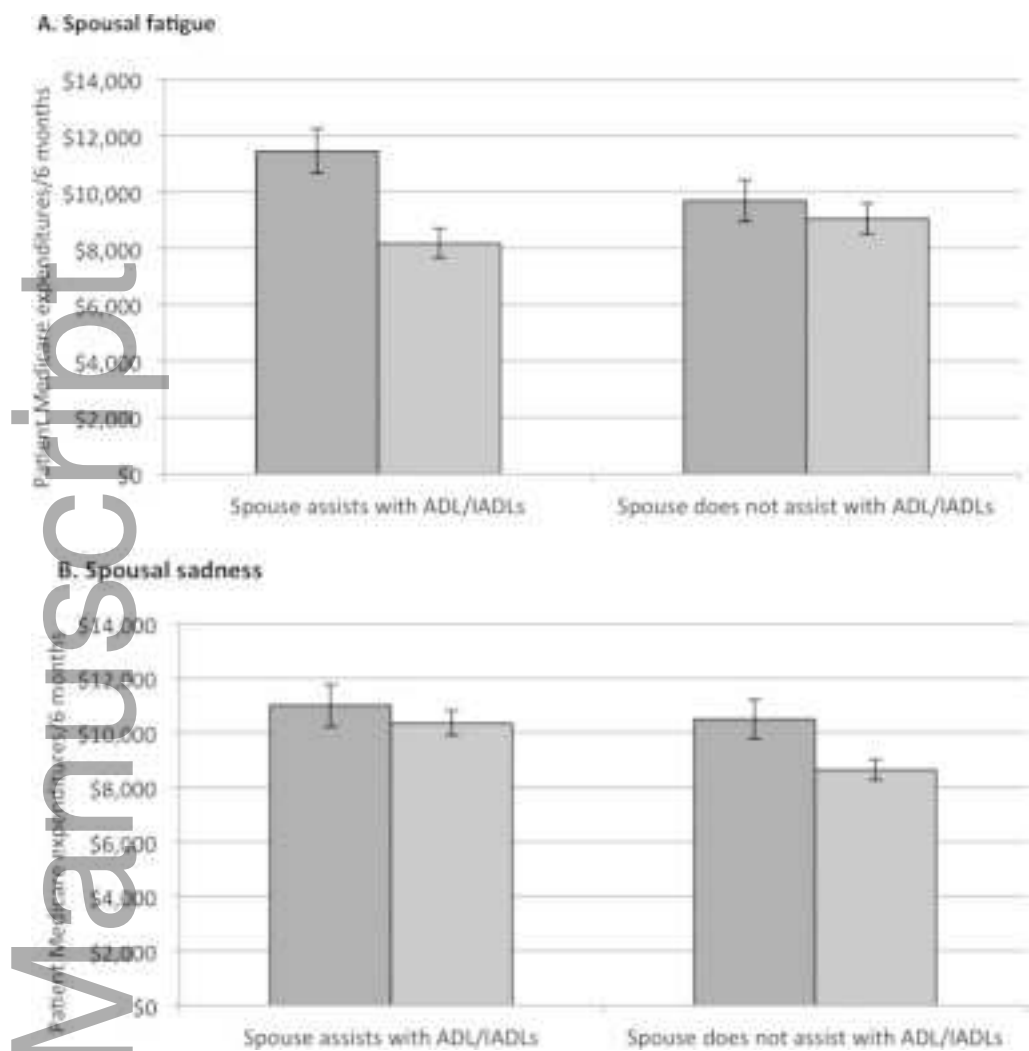
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Spousal wellbeing and patient utilization

Table 3. The association of caregiver wellbeing characteristics odds of Emergency Department use in the next 6 months. [1]

	Minimally adjusted:[2]		Fully adjusted:[3]	
	OR	p-value	OR	p-value
CES-D-8 items:				
Total CES-D-8 scale:	1.03 (1.00-1.07)	0.08		
Depressed	1.25 (1.05-1.49)	0.01	1.16 (0.96-1.40)	0.12
Everything takes effort	1.02 (0.88-1.19)	0.77		
Restless	1.01 (0.87-1.17)	0.89		
Happy	0.92 (0.75-1.11)	0.39		
Lonely	1.09 (0.90-1.32)	0.37		
Enjoys life	0.94 (0.74-1.20)	0.63		
Sad	1.26 (1.07-1.48)	0.006	1.16 (0.97-1.38)	0.10
Difficulty getting going	1.06 (0.91-1.24)	0.46		
Self-reported general health:				
Fair/poor health	1.24 (1.07-1.43)	0.004	1.23 (1.04-1.45)	0.01
Severe fatigue:				
Severe fatigue	1.30 (1.07-1.57)	0.007	1.24 (1.01-1.52)	0.04
Jenkin's sleep scale:				
Total Jenkin's sleep scale:	0.98 (0.94-1.02)	0.31		
Trouble falling asleep	0.99 (0.88-1.11)	0.81		
Trouble waking at night	0.91 (0.82-1.01)	0.07		
Trouble waking up early	0.98 (0.87-1.09)	0.67		
Rested	0.99 (0.89-1.09)	0.82		

Data source: Health and Retirement Study, 2000-2012. CES-D-8= Center for Epidemiologic Studies Depression Scale, 8 item. [1]The first of a two-part model: see Appendix Table 2A for the association between caregiver wellbeing and greater emergency department use for those with non-zero utilization. [2]Minimally adjusted models include proxy status, caregiver age and sex as covariates. [3]Fully adjusted models additionally adjust for race, net assets, functional limitations of caregiver and patient, cognitive function of caregiver and patient, whether a child resides within 10 miles, whether the spouse reports assisting with activities of daily living/instrumental activities of daily living.

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A. Spousal fatigue

Patient Medicare expenditures/6 months

Spouse assists with ADL/IADLs   Spouse does not assist with ADL/IADLs

B. Spousal sadness

Patient Medicare expenditures/6 months

Spouse assists with ADL/IADLs   Spouse does not assist with ADL/IADLs

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