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CORRELATES OF HEALTH-RELATED QUALITY OF LIFE IN AFRICAN AMERICAN AND CAUCASIAN STROKE CAREGIVERS

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Abstract

Objective—Stroke is a leading cause of long-term disability in the United States. Family caregivers are susceptible to negative outcomes as a result of their caregiving role. A stress process model was utilized to identify characteristics of stroke caregivers who are at risk for poor physical and mental health-related quality of life (QOL).

Research Method—Individuals who experienced an incident stroke event within the previous year were identified from a larger epidemiologic study of stroke incidence. These stroke survivors were enrolled in the Caring for Adults Recovering from the Effects of Stroke (CARES) study along with their primary family caregivers (N=146 dyads). Caregivers completed a baseline telephone interview that assessed physical and mental health-related QOL, problems their family members were experiencing, appraisals of those problems, and caregiver resources.

Results—Objective stressors, appraisals, and caregiver resources were related to caregiver physical and mental health-related QOL, p 's <.05. Objective stressors were found to have a stronger association with caregiver mental health than physical health. Hierarchical regression models showed the relative importance of each category of predictors. In the final models, older age and receiving more support were associated with worse physical health-related QOL while African American race and fewer stroke survivor problems were associated with better mental health.

Implications—The correlates of health-related QOL identified in this national sample of caregivers can help identify stroke caregivers who are at-risk for poor adjustment to the caregiving role and aid in identifying areas that can potentially be intervened upon for these caregivers.

Keywords

stroke caregiving; health disparities; health-related quality of life; stress process; social support

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INTRODUCTION

Stroke is a leading cause of serious, long-term disability in the United States and most stroke survivors return to the community and rely on family caregivers to assist in managing stroke-related functional, cognitive, and behavioral changes (American Heart Association, 2009; Rosamond et al., 2007). Individuals who provide care for family members due to disability or disease are at an increased risk for negative physical and mental health outcomes (Pinquart & Sörensen, 2003; Gaugler, 2010). Research indicates that variables such as leisure activities, emotional wellness, and quality of life are moderately impacted for caregivers of stroke survivors (Anderson et al., 1995; Ilse et al., 2008). Recent research suggests that much of the increased risk for poor caregiver outcomes is due to the amount of mental or emotional strain associated with providing care. Caregivers who subjectively reported a high amount of strain also reported poorer physical functioning, fewer social contacts, and more emotional distress than other caregivers (Roth et al., 2009).

Lazarus and Folkman (1984) developed a general stress and coping model that was later adapted by others (e.g. Haley et al., 1987) to consider the health consequences of caregiving. Stress process models suggest that it is important to measure not only objective caregiving stressors, but also the subjective appraisals of these stressors by caregivers. Stress process models further predict that caregivers will appraise problems as relatively low in stress when they have greater amounts of internal and external resources available to manage stress. The appraisal process refers to an individual's subjective estimate of the effect that a stressor has on his or her life. The stress process models have been used to examine several psychosocial resource factors that may mediate or moderate the effects of caregiving stressors on well-being (e.g., Haley et al., 1996). These variables include, but are not limited to caregiver appraisals of stressors, social support, and coping (Goode et al., 1998).

Researchers are not simply interested in identifying conditions that may be associated with stress, but also in the nature of these conditions and how they are interrelated (Bakas & Burgener, 2002). Conceptualizing well-being as the outcome of multidimensional processes, stress process models differentiate between objective indicators of stressors and the caregiver's subjective ratings or appraisals of those stressors. Objective stressors such as physical impairment and behavioral problems of the patient pose challenges to caregivers. The extent to which these stressors affect caregivers' well-being depends in part on their subjective experience related to these problems (Son et al., 2007). In some cases, subjective appraisals of caregiving stressors have been found to be better predictors of outcomes for caregivers than the frequency of the objective stressors (Vitaliano, Young, & Russo, 1991; Gonyea et al., 2005).

A link between the mental health of the caregiver and the health status of the stroke survivor has been found in many studies. For this investigation, the term "mental health" refers to an individual's psychological or emotional state of mind. Dennis and colleagues (1998) found that caregivers of stroke survivors with poor physical and emotional health were more likely to have poor mental health themselves. Van Puymbroeck and Rittman (2005) assessed a sample of 127 dyads of stroke survivors and their caregivers and found that a caregiving individual's emotional health was closely tied to the functional capabilities of the stroke survivor. At 1 and 6 months post-stroke, higher levels of stroke survivor functional impairment were associated with the caregiver reporting more depressive symptoms and more caregiver burden (negative consequences of providing care in the personal life of the caregiver). Additionally, in a multi-site study of 132 stroke survivors who were 3 to 9 months post-stroke and their caregivers, caregivers who were caring for individuals with poor motor function (assessed by the average time to perform 15 upper extremity performance tasks using the more affected arm) in combination with high memory and

behavior problems changes reported poor mental health-related quality of life (Clark et al., 2004). However, there are inconsistent results when the relationship between stroke survivor impairment and caregiver physical health is examined, with some investigations finding that stroke survivor problems such as poor upper extremity performance and functional impairment did not have a significant direct or indirect relationship with caregiver physical health (Pinquart & Sörensen, 2007; Clark et al., 2004).

Caregivers' appraisals of stress are a major component of the stress process model, specifically in the mediation or moderation of stress (Sörensen & Conwell, 2011). Individuals who rate an event as less stressful have been found to report better adjustment. Bakas and Burgener (2002) found that stroke caregivers who reported higher threat appraisals (a type of stress appraisal that assesses whether caregiving is viewed as threatening), as measured by the Appraisal of Caregiving Scale (Oberst et al., 1989), had more emotional distress, worse general health as measured by the SF-36, and worse stroke-related outcomes compared to stroke caregivers with lower threat appraisals. Haley and associates (2003) utilized the stress process model to examine predictors of life satisfaction and depressive symptoms in a sample of 80 spousal caregivers of hospice patients (40 with dementia and 40 with lung cancer). The subjective appraisals of caregiving tasks and the caregiver's perceived benefit from caregiving each had stronger associations with caregiver depressive symptoms and life satisfaction than objective indicators of stress (Haley, LaMonde, Han, Burton, and Schonwetter, 2003). Montoro-Rodriguez and Gallagher-Thompson (2009) examined caregiver burden in a sample of Latina and non-Hispanic white females who were caring for a family with Alzheimer's disease or another form of dementia. They found that caregiver appraisals of self-efficacy mediated the effects of contextual stressors on caregiver burden.

The stress process model hypothesizes that caregiver resources, such as social support, will help mediate or moderate the negative effects of stress. Social support is a construct that can be conceptualized in many ways including actual support received from family and friends, perceived availability of support if it were necessary, and satisfaction with the social support network. Haley and associates (2003) found that more visits to and from relatives and a larger social support network were associated with fewer depressive symptoms. Participating in more social activities was associated with a higher life satisfaction.

Grant and colleagues (2006) followed caregivers of stroke survivors after the stroke survivor was discharged home from a rehabilitation facility. Higher levels of social support were associated with fewer depressive symptoms, better mental health-related quality of life, and better general health. Pinquart and Sörensen (2007) assessed 176 studies that examined the effects of caregiving on an individual's physical health. Their meta-analysis revealed that receiving less informal support was associated with worse caregiver physical health. There was not a relationship between the use of formal support and caregiver physical health.

Racial differences in stroke caregiver adaptation have not been widely studied. However, among dementia caregivers, a number of studies have indicated that African American caregivers show lower levels of depression and better well-being than White caregivers (Clay et al., 2008; Dilworth-Anderson, Williams, & Gibson, 2002), perhaps due to such factors as cultural value given to caregiving, social support, and appraisal (Dilworth-Anderson et al., 2005; Haley et al., 1996).

The majority of caregiving investigations that utilize a stress process framework focus on individuals caring for family members with dementia. This study applies the framework to aid in identifying correlates of health-related quality of life in an epidemiologically derived sample of African American and Caucasian family caregivers of stroke survivors. Based on

the stress process framework and the results from previous investigations, it was hypothesized that objective stressors would have a stronger association with caregiver mental health compared to caregiver physical health; subjective stress appraisals would be associated with both physical and mental health-related quality of life; and individuals with more resources would have better health-related quality of life. It was also hypothesized that after controlling for demographic characteristics, stressors associated with caregiving, stress appraisals, and caregiver resources would each account for an additional amount of variance in health-related quality of life. We also examined whether African American and White caregivers differed in mental and physical health after controlling for objective caregiving stressors.

METHODS

The REasons for Geographic and Racial Differences in Stroke (REGARDS) study is an ongoing, national, epidemiologic investigation of stroke incidence and mortality that enrolled 30,239 African American and Caucasian participants 45 years of age or older between 2003 and 2007 (Howard et al., 2005). Follow-up telephone interviews are conducted every six months, including queries about hospitalizations, outpatient visits, and symptoms that might indicate possible stroke events. Medical records are then examined by trained physician raters and adjudicated by stroke neurologists to confirm incident stroke events. Beginning in August 2005, individuals who (1) were community-dwelling, (2) were active participants in the REGARDS study, (3) experienced an incident stroke event within the recruitment window that could be verified using their medical records, and (4) had a primary family caregiver who would also agree to participate were enrolled in an ancillary investigation, the Caring for Adults Recovering from the Effects of Stroke (CARES) study (Roth et al., 2011). Caregivers provided proxy consent for stroke survivors who were cognitively impaired. As reported in Roth et al. (2011), 80% of the eligible dyads who were contacted agreed to participate in the study. All study procedures were approved by the University of Alabama at Birmingham Institutional Review Board. Data from the baseline CARES telephone interview were utilized for this investigation.

Demographics

Age measured in years, race, gender, and whether the caregiver lived with the stroke survivor were assessed by self-report and included as covariates of interest. Stroke survivor race was coded as African American = 1, White = 0, gender was coded as female = 1 and male = 0, and whether the stroke survivor lived with his or her primary family caregiver was coded as 1 = Yes and 0 = No.

Stressors and Appraisals

Caregiver report of the occurrence of a variety of stroke survivor impairments and problems was assessed using a 28-item instrument designed specifically for the CARES project (see Haley et al., 2009 for information on the development of this measure). Items assessed stroke survivor problems with activities of daily living (ADLs), instrumental activities of daily living (IADLs), cognition, mood, and motor and sensory impairment. The instrument shows good concurrent validity with observer-assessed indicators of stroke survivor impairment, including the Barthel and Rankin indices (Haley et al., 2009). The occurrence of a stressor within the past week was coded as 0 (no) or 1 (yes), and the items were summed to construct a summary count of the stressors with a potential range from 0 to 28 and an internal consistency of 0.82. Caregivers' subjective reactions to impairments and problems of the stroke survivor were assessed by asking caregivers to rate the stressfulness of all endorsed problems on the preceding instrument. Caregivers reported how much they were bothered or upset by the problem when it occurred using a 5-point scale: 0 (not at all),

1 (a little), 2 (moderately), 3 (very much), and 4 (extremely). These items were also summed and the resulting appraisal score had a potential range of 0 to 112 with higher scores corresponding to a higher stressfulness rating and an internal consistency of 0.88.

Resource Measures

Received Support—Information was collected about the caregiver's social support network. Eleven items used to quantify tangible, emotional, and informational assistance received in the past month from family and friends were taken from a scale used to evaluate social support in late life (Krause & Markides, 1990; Krause, 1995). Response options for the items were: never (1), once in a while (2), fairly often (3), and very often (4). A resulting summary support score with a potential range of 11 to 44 was utilized. The internal consistency for these 11 items was 0.78 within this sample. A higher score on this measure corresponds with more received support.

Satisfaction with support received from others—Items that assess satisfaction with received support from others were administered following each of the three subsection of the support received questionnaire. Each subsection concluded with a question that repeats the types of support that are considered in the domain and asks caregivers if they were satisfied with the amount of help they received from others in that domain (Krause, 1995). Response options for the satisfaction items were: not at all (1), a little (2), moderately (3), and very (4). These 3 items were summed and the resulting index had a possible range of 3 to 12, with higher scores representing more satisfaction with received social support. The internal consistency for these 3 items was 0.74 within this sample.

Negative interaction—Four questions about negative interactions experienced in the past month asked the caregiver how often others (members of their social networks) made excessive demands on them, had been critical of them, pried into their personal affairs, and had taken advantage of them (Krause, 1995). Response options for the items were: never (1), once in a while (2), fairly often (3), and very often (4). The possible range of scores was from 4 to 16 with higher scores representing more negative interactions. The internal consistency for the 4-item negative interaction scale was 0.79 within the sample.

Caregiver Health-Related Quality of Life

The 12-item Short Form Health Survey (SF-12) was utilized to assess health-related quality of life. The items were coded to compute a Physical Component Summary (PCS) score and a Mental Component Summary (MCS) score. Each constitutes a global measure of health-related quality of life and they have been standardized to range from 0 to 100 and have a mean of 50 and a standard deviation of 10 in the adult US population (Ware, Kosinski, & Keller, 1998). Higher scores on each measure indicate better health functioning.

Analyses

All analyses were conducted using SAS V9.1.3 (2006). Frequencies and means were computed to examine sample descriptive statistics. Pearson's product-moment correlations were computed to examine bivariate associations between study variables. Multiple regression models were conducted to examine the covariate-adjusted relationships between variables of interest and caregiver health-related quality of life. An initial model for each outcome examined the effects of age, race, gender, and whether the caregiver resided with the stroke survivor on health-related quality of life. Subsequently, additional models for each outcome added blocks of variables categorized as stroke survivor problems (stressors), caregiver appraisals of these problems, and caregiver resources to determine whether each

block increased the variance accounted for after taking into account the previous blocks. This was accomplished by utilizing the increment R-square test.

RESULTS

Participants

Descriptive statistics for caregivers in the sample are presented in Table 1. There were 146 caregiver/stroke survivor dyads that fit the eligibility criteria for these analyses, and the average length of time from the stroke event to the telephone interview was 9 months. Sixty-two (42%) of the caregivers were African American and 32 (22%) were male. Stroke survivors were 42% African American and 49% male. The average age of the caregivers was 63.72 years ($SD=13.44$; range 19 to 95) and the average age of the stroke survivors was 74.66 years ($SD=7.82$; range 52 to 94). The majority of the stroke events (133, or 91.10%) were classified as ischemic, 12 (8.22%) as hemorrhagic, and 1 (0.68%) as undetermined with respect to type. The left hemisphere was affected in 74 cases (50.68%), and the right hemisphere in 55 cases (37.67%). There was bilateral involvement in 7 cases (4.79%), and 10 cases (6.85%) were undetermined with respect to location.

Correlations

Correlations between study variables are listed in Table 2. It is important to note the moderate correlations between stroke survivor problems and the caregiver's appraisals of these problems, $r(144) = 0.731$, $p < .0001$, as well as between satisfaction with social support and negative interaction, $r(144) = -0.397$, $p < .0001$. The presence of relationships of this magnitude suggests to investigators the importance of interpreting the results of the increment R-square tests along with the individual effects of each measure when examining models that include correlated measures.

Physical Component Summary (PCS) score

Results of the hierarchical regressions predicting the PCS score are presented in Table 3. The total number of stroke survivor problems accounted for a significant amount of variance above and beyond the variance accounted for by demographic variables, $R^2 \Delta = .040$, $p = .016$. Subsequently, appraisals of these problems accounted for a significant amount of variance above and beyond the variance accounted for by demographic variables and stroke survivor problems, $R^2 \Delta = .026$, $p = .046$. Finally, caregiver resources accounted for a significant amount of variance above and beyond the variance accounted for by demographic variables, stroke survivor problems, and appraisals, $R^2 \Delta = .085$, $p = .004$. The relationship between race and PCS score was not significant in any of the models. In the final model, caregiver age ($B = -.283$, $p = .004$) and the total amount of support received ($B = -.304$, $p < .0001$) were significantly associated with the caregiver PCS score. Older age and receiving more support were associated poorer physical health.

Mental Component Summary (MCS) score

Results of the hierarchical regressions predicting the MCS score are presented in Table 4. The total number of stroke survivor problems accounted for a significant amount of variance above and beyond the variance accounted for by demographic variables, $R^2 \Delta = .180$, $p < .0001$. The addition of appraisals of these problems did not account for a significant amount of additional variance. Caregiver resources accounted for a significant amount of variance above and beyond the variance accounted for by demographic variables, stroke survivor problems, and appraisals, $R^2 \Delta = .044$, $p = .047$. The relationship between race and mental health was not significant when only demographics were adjusted for, but the addition of stroke survivor problems resulted in a significant difference between African Americans and

Caucasians that remained after adding the additional predictors. In the final model, race ($B = .258, p = .003$) and stroke survivor problems ($B = -.470, p < .0001$) were significantly associated with caregiver mental health. African American race and fewer stroke survivor problems were associated with better mental health-related quality of life within the sample.

DISCUSSION

A stress process model was used to develop the hypotheses for this investigation of a national sample of stroke caregivers. Therefore, the findings can be interpreted within a multivariate conceptual framework. The results suggest that stroke survivors' level of impairment is an influential correlate of their caregivers' overall well-being. Caregivers showing evidence of better physical and mental health-related quality of life were providing care for family members with less disability. It is reasonable that tangible indicators of a loved one's illness have an impact on the health of the caregiver.

The finding that less receipt of support was related to better caregiver physical health did not support our hypotheses, but likely indicates that caregivers who are in better physical health are less likely to need or to seek formal and informal support. In the final model predicting physical health-related quality of life, the relationship between the total appraisal of stroke survivor problems and health-related quality of life becomes non-significant. The addition of the final block of social support measures (specifically satisfaction with social support and negative interaction) introduces measures that are correlated with appraisals. This reduces the predictive ability of each measure and points to the importance of interpreting both the individual predictive ability of each measure as well as the importance of each block of predictors. Older caregivers were found to have worse physical health-related quality of life and this supports prevailing knowledge that health gets worse as we age.

The moderate magnitude of the effect of the number of objective stressor on mental health has been found to be similar in other studies (Dennis et al., 1998; Van Puymbroeck & Rittman, 2005; Clark et al., 2004) and potentially explains why the addition of caregiver appraisals does not explain additional variability in mental health-related quality of life above and beyond demographics and stroke survivor problems.

Stroke survivor problems were found to be related to poor caregiver mental health. Additional findings from the CARES study have shown that African American stroke survivors tended to have more problems and worse long-term outcomes than Caucasian stroke survivors (Roth et al., 2011). After controlling for the number of stroke survivor problems, levels of mental health-related quality of life were higher for African American caregivers than for Caucasian caregivers. This pattern of findings indicates that African American caregivers were showing resilience in the presence of greater stroke survivor problems, and is consistent with our previous findings for dementia caregivers where African American caregivers report fewer depressive symptoms in response to caregiving compared to Caucasian caregivers (Clay et al., 2008; Haley et al., 1996; Roth et al., 2001).

Strengths of this investigation include the epidemiologically derived sample of African American and Caucasian stroke caregivers, the focus specific to stroke caregivers rather than caregivers for heterogeneous conditions, oversampling of African Americans, and information was collected from both the stroke survivor and caregiver. The oversampling of African Americans can also be seen as a limitation when it comes to generalizing the results to certain regions of the United States. There was an inability to include stroke survivors where medical records were unavailable or where a stroke diagnosis could not be verified, and the data analyzed were self-report. An additional limitation was the measure of received support was developed to assess social support in late life and some of the items may not be

applicable to younger caregivers. Finally, the items that assessed stroke survivor problems reported the presence of a problem within the past week and not the frequency of occurrence. Assessing the frequency may have resulted in a summary score that was more sensitive to identifying the impact of stressors on health-related quality of life.

Summary

This research is a useful addition to the literature investigating the stress process framework and extending its utility to include stroke caregivers. The nature of the CARES sample, an epidemiologically based sample of stroke survivor/caregiver dyads which oversampled African Americans, and the relationships found between issues related to caregiving, caregiver resources, and caregiver health-related quality of life will complement what is currently known about the correlates of caregiver well-being. This information can be used by health providers who care for individuals affected by a stroke event. Emphasis should be placed on monitoring families members who care for individuals with deficits remaining after the stroke due to these caregivers increased susceptibility to adverse outcomes.

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IMPACT

- This investigation extends the stress process model to examine stressors, appraisals of these stressors, and caregiver resources in relation to physical and mental health-related quality of life in a national sample of African American and Caucasian stroke caregivers.
- African American stroke caregivers revealed resilience in response to caregiving stressors, with better mental health than White caregivers, as previously observed in dementia caregivers.
- The results of this investigation can be used to help health care providers identify caregivers who are at risk for negative outcomes.
- Findings from this study can be useful for researchers who plan to develop interventions to aid with caregiver resilience.

Table 1

Descriptive statistics for caregivers on study measures

Measure	Mean (SD)	Sample range	N (%)
Age	63.72 (13.44)	19 – 95	
African American race			62 (42.47)
Female gender			114 (78.08)
Lives with the stroke survivor			98 (67.12)
Total number of stroke survivor problems	7.55 (6.44)	0 – 28	
Appraisal of stroke survivor problems	8.82 (13.88)	0 – 103	
Social support received	23.11 (6.35)	11 – 41	
Satisfaction with social support	10.51 (2.16)	4 – 12	
Negative interaction	5.77 (2.32)	4 – 16	
Physical health component score (PCS) of SF-12	46.88 (10.09)	20 – 64	
Mental health component score (MCS) of SF-12.	52.90 (9.14)	18 – 68	

Table 2

Correlation Matrix of Study Measures

	1	2	3	4	5	6	7	8	9	10	11
1.) Age	1.00										
2.) African American race	-.0357 <.0001	1.00									
3.) Female gender	0.067 .4212	0.120 .1484	1.00								
4.) Live with SS	0.350 <.0001	-.0254 .0020	-.0184 .8260	1.00							
5.) Total problems	-.0160 .0537	0.261 .0014	0.068 .4118	0.021 .8002	1.00						
6.) Appraisals	-.0111 .1829	0.244 .0030	0.096 .2498	-.0076 .3634	0.731 <.0001	1.00					
7.) Social support received	-.0156 .0596	0.176 .0340	0.124 .1350	0.127 .1256	0.058 .4904	0.087 .2937	1.00				
8.) Satisfaction with social support	0.193 .0195	-.0324 <.0001	-.0175 .0347	0.185 .0255	-.0250 .0024	-.0358 <.0001	0.095 .2523	1.00			
9.) Negative interaction	-.0442 <.0001	0.258 .0017	0.041 .6209	-.0251 .0022	0.373 <.0001	0.448 <.0001	0.077 .3585	-.0397 <.0001	1.00		
10.) PCS	-.0162 .0501	0.017 .8384	-.0061 .4636	-.0053 .5246	-.0176 .0333	-.0242 .0032	-.0254 .0020	0.065 .4391	-.0099 .2366	1.00	
11.) MCS	0.039 .6429	0.069 .4046	-.0160 .0532	-.0010 .9091	-.0401 <.0001	-.0275 .0008	0.047 .5693	0.231 .0049	-.0255 .0019	0.051 .5426	1.00

Note: Live with SS = Lives with stroke survivor; Total Problems = Total number of stroke survivor problems; Appraisals = Appraisal of stroke survivor problems; PCS = Physical health component score of SF-12; MCS = Mental health component score of SF-12.

Table 3

Associations between demographics, stroke survivor problems, caregiver stress appraisals of those problems, resources, and physical health component score (PCS) of the SF-12.

Measures	Model 1	Model 2	Model 3	Model 4
Age	-.172	-.198*	-.185*	-.283**
African American race	-.040	.011	.021	.080
Female gender	-.045	-.034	-.026	.021
Live with stroke survivor	-.004	.023	-.001	.062
Total number of stroke survivor problems		-.209*	-.034	-.068
Appraisal of stroke survivor problems			-.241*	-.153
Social support received				-.304***
Satisfaction with social support				.059
Negative interaction				-.089

Notes: Standardized betas are presented;

* $p < .05$,

** $p < .01$,

*** $p < .0001$;

Model 1 $R^2 \Delta = .030$, $p = .359$; Model 2 $R^2 \Delta = .040$, $p = .016$; Model 3 $R^2 \Delta = .026$, $p = .046$; Model 4 $R^2 \Delta = .085$, $p = .004$.

Table 4

Associations between demographics, stroke survivor problems, caregiver stress appraisals of those problems, resources, and mental health component score (MCS) of the SF-12.

Measures	Model 1	Model 2	Model 3	Model 4
Age	.101	.047	.045	-.014
African American Race	.123	.232**	.230**	.258**
Female Gender	-.182*	-.160*	-.162*	-.140
Live with stroke survivor	-.017	.039	.043	.009
Total number of stroke survivor problems		-.444***	-.471***	-.470***
Appraisal of stroke survivor problems			.037	.139
Social support received				.026
Satisfaction with social support				.164
Negative Interaction				-.143

Notes: Standardized betas are presented;

* $p < .05$,

** $p < .01$,

*** $p < .0001$;

Model 1 $R^2 \Delta = .042$, $p = .194$; Model 2 $R^2 \Delta = .180$, $p < .0001$; Model 3 $R^2 \Delta = .001$, $p = .741$; Model 4 $R^2 \Delta = .044$, $p = .047$.