

Psychometric Testing of the Revised 15-Item Bakas Caregiving Outcomes Scale

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Abstract

Background: Family caregivers of stroke survivors experience a variety of negative social, emotional, and health-related outcomes as a result of providing care.

Objectives: The purpose of this study was to psychometrically test the revised 15-item Bakas Caregiving Outcomes Scale (BCOS) measuring life changes specifically resulting from providing care. The original 10-item BCOS was improved by adding 5 items addressing financial well-being, level of energy, role functioning, physical functioning, and general health.

Method: Psychometric testing of the revised 15-item BCOS using a sample of 147 family caregivers of stroke survivors approximately 4 months after stroke was conducted to determine the quality of the items, internal consistency reliability, test-retest reliability, construct validity, and criterion-related validity. The majority of caregivers were female (78.9%), Caucasian (68.0%) or African American (29.9%), and either spouses (55.1%) or adult children (31.3%).

Results: Satisfactory evidence of internal consistency ($\alpha = .90$) and 2-week test-retest reliability ($ICC = .66$; 95% CI = .42-.81) was provided, with item-to-total correlations ranging from .41 to .74. Unidimensionality was supported by factor loadings ranging from .41 to .78. Using hierarchical multiple regression, 35% (29% adjusted) of the BCOS variance was explained by constructs in the conceptual model [$F(11,132) = 6.39$, $p < .001$]. Criterion-related validity was supported by correlations with the SF-36 General Health Subscale ($r = .32$, $p < .001$) and a criterion variable measuring how caregivers' lives had changed overall ($r = .67$, $p < .001$).

Discussion: The revised 15-item BCOS has evidence of satisfactory reliability and validity in family caregivers of stroke survivors. The BCOS is a valuable measure in research and can identify priority areas for nursing interventions designed to improve caregivers' outcomes.

Key words: caregivers, instrumentation, outcomes, stroke

Psychometric Testing of the Revised 15-Item Bakas Caregiving Outcomes Scale

Stroke is the number one cause of long-term disability in the United States, with approximately 500,000 new and 200,000 recurrent strokes reported each year (American Stroke Association, 2005). It is estimated that 68% to 74% of stroke survivors depend on the daily care of family members once they return home (Dewey et al., 2002; Dorsey & Vaca, 1998). Family caregivers of stroke survivors are at risk for a number of negative outcomes as a result of providing care, including depressive symptoms, psychosocial impairments, and declining physical health (Bakas, Austin, Okonkwo, Lewis, & Chadwick, 2002; Berg et al., 2005; Han & Haley, 1999). Furthermore, family caregivers of elderly persons who feel strained by their caregiving situation are at increased risk for mortality compared with non-caregiving controls (Schulz & Beach, 1999).

A number of existing caregiver burden measures, depressive symptom measures, and generic health-related quality of life measures have been used in this population (Berg et al., 2005; Visser-Meily, Post, Riphagen, & Lindeman, 2004). However, the Bakas Caregiving Outcomes Scale (BCOS) is the only reported instrument that measures perceived changes in social functioning, subjective well-being, and physical health specifically as a result of providing care (Bakas & Champion, 1999). Tools that measure changes specifically resulting from providing care are needed to identify rapidly deteriorating aspects of caregivers' lives in order to prioritize individualized caregiver interventions and to provide a more comprehensive assessment of caregiver outcomes.

Although the original 12-item and 10-item versions of the BCOS had evidence of satisfactory reliability and validity (Bakas & Champion, 1999), several conceptual attributes were not adequately developed as described in the methods section. Five items were added to the 10-item

BCOS to improve the scale, respectively addressing financial well-being, physical functioning, general health, roles in life, and level of energy. The purpose of this study was to obtain psychometric support for the revised 15-item BCOS using a sample of 147 family caregivers of stroke survivors approximately 4 months after stroke. Psychometric data were collected to assess the quality of items, internal consistency reliability, test-retest reliability, construct validity, and criterion-related validity.

Psychometric testing for construct validity was based on a conceptual model (Figure 1) derived from Lazarus' theory of stress and coping (Lazarus, 1991; Lazarus & Folkman, 1984). Lazarus and colleagues (1991; Lazarus & Folkman, 1984) theorized that antecedent personality and situational factors are mediated by cognitive appraisal and coping to produce emotional and adaptational outcomes in response to a particular event or situation. The conceptual model for this study (Figure 1) identifies depressive symptoms, self-perceived general health, and life changes as measured by the BCOS as emotional and adaptational outcomes of providing care. Antecedent variables include caregiver optimism as a personality factor, dependent-care tasks as a situational factor, and caregiver appraisal (threat, benign, benefit) as a mediating variable. The following research hypotheses were evaluated:

1. Individual items from the revised 15-item BCOS will demonstrate means close to the natural midpoint, good variability in relation to the means, few floor or ceiling effects, and acceptable item-to-total correlations (above .40).
2. The revised 15-item BCOS will show evidence of internal consistency reliability (Cronbach alpha > .70) and 2-week test-retest reliability using an intra-class correlation coefficient (ICC > .60).

3. The revised 15-item BCOS will show evidence of construct validity as a unidimensional scale with factor loadings above .40.
4. Antecedent personality, situational, and appraisal variables will be significantly associated with the revised 15-item BCOS as theoretically indicated in Figure 1 to show evidence of construct validity.
5. The revised 15-item BCOS will be significantly correlated with the BCOS criterion item and the SF-36 Health Survey General Health Subscale to show evidence of criterion-related validity.

Relevant Literature

The negative impact of providing care for a stroke survivor in the home setting has been well documented. Researchers found that the prevalence of depression in stroke caregivers (30% to 33%) was higher than the prevalence of depression for stroke survivors (23% to 29%) (Berg et al., 2005). Han and Haley (1999) found estimates of the prevalence of depression in stroke caregivers from 34% to 52% in their review of the literature, with caregiver psychosocial factors, such as fewer social contacts, being predictive of depression.

The effects of caregiving on the physical health of stroke caregivers has not been well studied; however, a large prospective study of 392 strained spousal caregivers of elderly persons found a 63% higher risk of mortality in caregivers 4 years after providing care, compared with 427 age and gender matched non-caregiving persons (Schulz & Beach, 1999). Bakas et al. (2002) found that caregivers lacked information about stroke, struggled with emotions and behaviors exhibited by stroke survivors, had needs and concerns related to providing personal and instrumental care, and experienced negative personal responses to the caregiving situation.

Valid and reliable assessment of caregiver outcomes must precede effective interventions. A recent review of intervention studies involving stroke caregivers (Visser-Meily, van Heugten, Post, Schepers, and Lindeman, 2005), noted that many studies had limitations, including the use of a wide variety of outcome measures that may have lacked sensitivity most relevant to stroke caregivers. Han and Haley (1999) also expressed concerns regarding the reliability and validity of existing measures, as well as their clinical significance for stroke caregivers.

Two recent comprehensive reviews of existing caregiver burden measures have been conducted (Deeken, Taylor, Manga, Yabroff, & Ingham, 2003; Visser-Meily et al., 2004). The Caregiver Reaction Assessment (Given et al., 1992) had been well developed and tested, and it addressed most of the factors relevant to caregiver burden (Deeken et al., 2003). The BCOS (Bakas & Champion, 1999) was the second tool recommended for use in caregiver research, particularly because it had the most psychometric testing of all of the tools reviewed (Deeken et al., 2003). Both reviews identified the strengths of the BCOS (Bakas & Champion, 1999) as measuring both positive and negative aspects of caregiving, emphasizing the social consequences of caregiving, and having good internal consistency reliability, moderate correlations with criterion variables, and good evidence of content and construct validity (Deeken et al., 2003; Visser-Meily et al., 2004). The BCOS items also had the highest rate of agreement among the authors for 7 different caregiver concepts (75%) compared with other tools that were evaluated (Visser-Meily et al., 2004). Weaknesses of the BCOS included a lack of information regarding responsiveness to change, test-retest reliability, feasibility of administration, and missing data per item (Deeken et al., 2003; Visser-Meily et al., 2004).

Methods

After approval from university and hospital institutional review boards, data were collected approximately 4 months after stroke from a convenience sample of 147 family caregivers of stroke survivors who provided informed consent. Approximately 71% (n = 105) of the caregivers were enrolled in an existing longitudinal cohort study of stroke survivors with no more than mild language or cognitive impairment. The remaining 29% (n = 42) of caregivers were enrolled in a smaller study of family caregivers of aphasic stroke survivors. Eligibility criteria for both studies included (a) being an unpaid family member or significant other caring for a non-institutionalized stroke survivor, (b) ability to read and speak English, and (c) providing at least 2 different tasks from the Oberst Caregiving Burden Scale (OCBS) (Bakas, Austin, Jessup, Williams, & Oberst, 2004; Carey, Oberst, McCubbin, & Hughes, 1991). Caregivers in both studies were recruited by referral from the patient's neurologist or from staff employed at a rehabilitation hospital.

Procedure. Questionnaires were administered by telephone, face-to-face interview, or self-administration during clinic appointments. Questionnaires were administered by telephone to 36 out of the 42 family caregivers of aphasic stroke survivors 2 weeks later to determine test-retest reliability. The remaining six caregivers either chose not to take part in the 2-week test-retest, or could not be contacted within 2 weeks.

Sample Characteristics. Most caregivers were spouses (55.1%) or adult children (31.3%), with 13.6% being other relatives or significant others. Caregiver age ranged from 21 to 78 years (M = 51.7) and survivor age ranged from 27 to 89 years (M = 62.5). Caregivers were mostly female (78.9%), whereas about half of the survivors were male (53.1%). A majority of the caregivers lived with the survivor (83.0%) and were unemployed, retired, or homemakers (53.1%). The rest were employed full-time (34.7%) or part-time (12.2%). Most of the caregivers

were Caucasian (68%), with (29.9%) African American and 2.1% other. Caregivers averaged about 13 years of education, with a range of 4 to 19 years. Almost half rated their incomes as comfortable (42.9%), with 37.4% having enough to make ends meet and 17.7% not having enough to make ends meet (2% did not respond to this item).

Of the demographic variables, only caregiver gender and survivor gender differed with respect to BCOS scores. Female caregivers had worse BCOS scores than male caregivers ($t = 2.81, p < .01$). Caregivers caring for male survivors had worse BCOS scores than those caring for female survivors ($t = -2.87, p < .01$). Caregiver and survivor gender were controlled for in the hierarchical multiple regression predicting the BCOS.

Measures. Each scale used in analysis is described below. Table 1 lists current scale means, variances, and internal consistency reliability. No more than 2 cases were missing for any one scale.

The **Stroke Specific Quality of Life Scale Proxy Version (SSQOL-Proxy)** (Williams, Redmon, Martinez, & Weinberger, 2000; Williams, Weinberger, Harris, Clark, & Biller, 1999) was used to measure survivor impairment as rated by their family caregiver, with lower scores indicating more impairment. Out of the 12 original SSQOL domains, 5 were selected for this study to measure this factor: mobility, self-care, language, thinking, and personality. Mobility, self-care, and language items are rated on 5-point scales ranging from *Couldn't do it at all* to *No trouble at all*, whereas thinking and personality items are rated on 5-point scales ranging from *Strongly agree* to *Strongly disagree* (Williams et al., 1999). Both the SSQOL and the SSQOL Proxy have evidence of good internal consistency reliability and construct validity for all 12 subscales (Williams et al., 2000; Williams et al., 1999). Table 1 shows significant skewness ($p < .001$) for the SSQOL Proxy mobility, self-care, and language scores, which were transformed

prior to further analyses (Tabachnick & Fidell, 1996). SSQOL Proxy Language & Mobility Subscales required reflected square root transformations, and the SSQOL Proxy Self-Care Subscale required a reflected logarithm transformation to achieve normality. On average, caregivers rated the survivors as having few mobility, self-care, or language impairments but moderate thinking and personality impairment.

The **Revised Life Orientation Test (LOT-R)** was used to measure caregiver optimism as an antecedent personality disposition. The LOT-R consists of 6 items rated on a 5-point scale ranging from *Strongly disagree* to *Strongly agree*, with higher scores indicating greater optimism. The LOT-R has shown evidence of reliability and validity (Scheier, Carver, & Bridges, 1994) and has been used in studies with stroke caregivers (Schulz, Tomkins, & Rau, 1988; Tomkins, Schulz, & Rau, 1988) as well as cancer caregivers (Given et al., 1993; Kurtz, Kurtz, Given, & Given, 1995). The mean LOT-R score was close to the natural midpoint of the scale, indicating moderate optimism.

The **Oberst Caregiving Burden Scale (OCBS)** was used to measure caregiver perceptions of time and difficulty associated with tasks they performed in caring for their family member (Bakas et al., 2004; Carey et al., 1991). Among others, such tasks included providing personal care, assisting with medications, monitoring symptoms, managing the patient's emotions and behaviors, dealing with finances, talking with health professionals. The time items on the OCBS are rated on a 5-point scale ranging from *None* to *A great amount*, and the difficulty items are rated on a 5-point scale ranging from *Not difficult* to *Extremely Difficult*. The 15-item OCBS has shown evidence of internal consistency reliability, unidimensionality, and content and construct validity in both cancer and stroke caregivers (Bakas et al., 2004; Bakas & Champion, 1999; Carey et al., 1991; Oberst, 1990). The difficulty subscale required an inverse

transformation to correct for significant ($p < .001$) skewness prior to analyses (Tabachnick & Fidell, 1996). On average, caregivers perceived a moderate amount of time, but little difficulty, with tasks.

The **Appraisal of Caregiving Scale (ACS)** was used to measure the degree to which caregivers' tasks, relationships, interpersonal support, lifestyle, emotional and physical health, and overall personal impact were appraised as threat, benign, or beneficial (Carey et al., 1991; Oberst, Thomas, Gass, & Ward, 1989). Acceptable psychometric properties have been reported in cancer caregivers (Oberst, 1991), as well as in stroke caregivers (Bakas & Burgener, 2002; Bakas & Champion, 1999). ACS items are rated on a 5-point response scale ranging from *Strongly disagree* to *Strongly agree*, with higher subscale scores indicating higher appraisal as threat, benign, or benefit. The mean threat, benign, and benefit scores were close to the natural midpoints of the scales, indicating moderate appraisals by caregivers in this sample.

Depressive symptoms experienced by caregivers were measured using the **Patient Health Questionnaire Depression Scale (PHQ-9)**. The PHQ-9 is based on the 9 DSM-IV criteria for depressive disorders. Items are rated on a 4-point scale ranging from *Not at all* to *Nearly every day* (Kroenke, Spitzer, & Williams, 2001; Williams et al., 2005). The PHQ-9 has shown internal consistency reliability, validity, specificity, and sensitivity in primary care populations (Kroenke et al., 2001; Spitzer, Kroenke, Williams, & The Patient Health Questionnaire Primary Care Study Group, 1999; Spitzer, Williams, Kroenke, Hornyak, & McMurray, 2000). Psychometric support for the PHQ-9 has also been provided in a large sample of stroke survivors (Williams et al., 2005). The PHQ-9 required a square root transformation to correct for significant ($p < .001$) skewness in this sample of stroke caregivers (Tabachnick &

Fidell, 1996). The mean for caregiver scores was 4.0, indicating few depressive symptoms on average, although there was a wide range of scores (0-27).

The **SF-36 General Health Subscale (SF-36 GH)** was used to measure caregiver perceptions of their own general health. The SF-36 GH consists of 4 items rated on a 5-point response scale ranging from *Definitely true* to *Definitely false*. An additional SF-36 GH item is rated on a scale ranging from *Poor* to *Excellent*. These 5 items were coded and transformed to a 0-100 scale using procedures outlined by Medical Outcomes Trust (1994). Higher scores indicate perceptions of better general health. Internal consistency reliability and discriminant validity have been documented for the overall SF-36 Health Survey, which consists of 8 subscales (McHorney, Ware, Lu & Sherbourne, 1994). The SF-36 GH has shown acceptable reliability and validity in large outpatient samples (McHorney et al., 1994) as well as in stroke caregivers (Bakas & Burgener, 2002; Bakas & Champion, 1999). Because general health encompasses physical, social, and mental health, the SF-36 GH was chosen as a criterion measure to compare with the BCOS. The mean score for the SF-36 GH in this sample was 65.6, indicating self-perceptions of moderately good general health, although there was a wide range in scores (0-100).

The **Revised 15-Item Bakas Caregiving Outcomes Scale (BCOS)** was used to measure caregiver outcomes and was the focus of psychometric testing in this study. The original BCOS items were generated using Lazarus' (Lazarus, 1991; Lazarus & Folkman, 1984) definition of adaptational outcomes (Bakas & Champion, 1999). The 12-item BCOS had evidence of internal consistency reliability, construct validity, and criterion-related validity (Bakas & Champion, 1999).

Further testing of the 12-item BCOS in a second sample of 104 stroke caregivers was conducted, reducing the scale to 10 items (Bakas & Champion, 1999). Two items related to financial outcomes were deleted due to low item-to-total correlations, low variability in relation to the means, and conceptual ambiguity. Additionally, the 10-item BCOS was weakly correlated with the SF-36 general health, physical functioning, and role functioning subscales.

Given these limitations with the 10-item BCOS, 5 additional items were added to improve the scale. *My financial well-being, my physical functioning, my general health, my roles in life, and my level of energy* were added, leading to the current revised 15-item BCOS tested in this study. The last item, “In general, how has your life changed as a result of taking care of the stroke survivor,?” is included as a single item criterion measure to assess criterion-related validity and is not added to the total 15-item BCOS score.

The 15 BCOS items, as well as the validity item, are rated on a 7-point scale ranging from $-3 = \textit{Changed for the worst}$ to $+3 = \textit{Changed for the best}$. The -3 to $+3$ ratings are recoded to 1 to 7 so that positive numbers can be obtained for analysis. Higher scores indicate more positive caregiver outcomes. If less than 50% of the responses were missing, responses for the remaining items were added, then divided by the number of responses to produce an item average, which was then imputed for the missing data. No more than 3 BCOS items were missing for any one caregiver in this study. In fact, only 1 caregiver had 3 missing responses, 3 caregivers had 2 missing responses, and 4 caregivers had 1 missing response. The rest of the 139 caregivers had complete data on all 16 items. The 15-item BCOS, along with the additional BCOS criterion item, took approximately 2-4 minutes to administer either by self-completion or by telephone interview. No caregivers reported problems with understanding the response scale.

Data analyses. Data were entered and double-checked for errors prior to analyses. Using procedures outlined by Tabachnick and Fidell (1996), data were screened for normality and outliers, with transformations for skewness performed as necessary. Descriptive statistics were used to summarize the scales. Item analyses included inspecting item means, medians, standard deviations, % ceiling and floor effects, item-to-total correlations, and Cronbach's alpha to determine internal consistency reliability. Two-week test-retest reliability was assessed using an intra-class correlation coefficient (ICC). Factor analysis using principal axis factoring was used to assess construct validity (Netemeyer, Bearden, & Sharma, 2003). Guided by the conceptual model (Figure 1), construct validity was further assessed using hierarchical multiple regression. To pick the most relevant variables as independent variables, all demographic and model variables were screened for possible inclusion in the regression equation. Continuous variables were correlated with the 15-item BCOS, and discrete variables were analyzed for differences using t-tests or ANOVA where appropriate. The criterion for selecting independent variables was significance at the $p < .05$ level using a two-tailed test. Eleven variables were significantly related to the 15-item BCOS ($p < .05$). With 11 independent variables, $50 + 8 (11) = 138$ cases were needed for testing regression and individual independent variables (Tabachnick & Fidell, 1996), and therefore the number of caregivers in this study ($N = 147$) was adequate. Evidence of criterion-related validity was obtained using Pearson r correlation between the BCOS and the SF-36 General health subscale and between the BCOS and the criterion item measuring perceptions of how caregivers' lives had changed overall.

Results

Item analysis. Table 2 shows item statistics for the BCOS, with item means ranging from 3.3 (time for social activities) to 4.5 (relationship with stroke survivor). There was good

variability in relation to the means (SDs ranged from .9 to 1.3), a range of 1-7, median of 4.0 (the natural item midpoint), and acceptable item-to-total correlations (.41 to .74). Note that the highest % ceiling effect was 10.7% (relationship with survivor) and the highest % floor effect was 14.1% (time for social activities). Item means indicated that time for social activities and financial well-being were the worst outcomes for caregivers, and relationship with the stroke survivor and caregiver self-esteem were the best outcomes.

Internal consistency reliability and test-retest reliability. Internal consistency reliability for the BCOS (Table 1) was supported by a Cronbach's alpha of .90 (N = 147). A small sub-sample (n = 36) also completed the BCOS two weeks later with a Cronbach's alpha of .81. The intra-class correlation coefficient (ICC) assessing 2-week test-retest reliability was substantial at .66 (95% CI = .42 to .81).

Construct validity using factor analysis. Unidimensionality is supported when a set of items fits within a single factor model (Netemeyer et al., 2003). The set of BCOS items was expected to load on a single factor measuring caregiver outcomes (Bakas & Champion, 1999). Table 2 shows factor analysis loadings using a one-factor solution and principal axis factoring ranging from .41 to .78, with 42.8% of the variance accounted for by the first factor (Eigen = 6.4). Exploratory factor analysis using principal axis factoring did not produce any additional interpretable factors. These findings provide further evidence that the 15-item BCOS is unidimensional.

Construct validity using hierarchical multiple regression. Guided by the conceptual model in Figure 1, further evidence of construct validity was sought by hierarchical multiple regression, with the 15-item BCOS as the dependent variable. Table 3 displays the hierarchical multiple regression with 144 cases. Three cases were missing with this analysis due to missing

data. Caregiver and survivor gender and survivor impairments in language, thinking, personality, and self-care as rated by their caregivers were entered into step one to identify their influence in the prediction of the 15-item BCOS. Step one accounted for 19% (15% adjusted) of the variance in BCOS scores [$F(6,137) = 5.20, p < .001$]. Caregiver's perceived difficulty with tasks was entered in step 2 as an antecedent situational factor accounted for an additional 3% of the variance in BCOS scores [$F(7, 136) = 5.49, p < .001$]. Caregiver's perceived time with tasks and optimism were not entered into the regression equation because they did not meet the $p < .05$ screening criteria for inclusion (Time $r = -.16, p = .06$; Optimism $r = .08, p = .37$). Threat, benign, and benefit appraisals were entered in step 3 of the regression equation, accounting for an additional 8% of the variance [$F(10, 133) = 5.81, p < .001$]. Depressive symptoms were entered in step 4 of the regression equation accounting for an additional 4% of the variance [$F(11,132) = 6.39, p < .001$]. Overall, 35% of the variance (29% adjusted) was accounted for by the model constructs, with caregiver threat appraisal, benign appraisal, and depressive symptoms being significant individual predictors of BCOS scores ($p < .05$). These findings provide evidence of construct validity for the revised 15-item BCOS.

Criterion-related validity testing. Criterion-related validity was supported by correlations with the SF-36 General Health Subscale ($r = .32, p < .001$) and a criterion variable measuring how caregivers' lives changed overall ($r = .67, p < .001$).

Discussion

Depressive symptoms, psychosocial impairments, and declining physical health are common in stroke survivors (Bakas et al., 2002; Berg et al., 2005; Han & Haley, 1999), yet intervention studies have been limited by the use of outcome measures that lack the ability to detect meaningful changes relevant to stroke caregivers (Visser-Meiley et al, 2005). The BCOS

shows great promise as an outcome measure in stroke caregiver research because it measures changes specifically as a result of providing care and has strong psychometric support (Bakas & Champion, 1999; Deeken et al., 2003; Visser-Meiley et al., 2004). The revised 15-item BCOS shows even stronger psychometric properties than its predecessor.

Item analysis of the 15-item BCOS revealed several important findings. Missing data were minimal and there were few ceiling or floor effects, with good variability in relation to the means. These findings are particularly important when looking at the BCOS items at the item level to determine priority areas for intervention development with individual caregivers. This study revealed that time for social activities and financial well-being were the worst outcomes experienced by family caregivers, suggesting that nurses and other health care professionals should provide information to caregivers about resources and help caregivers find respite and financial assistance. The BCOS might also be used as an assessment tool with caregivers to determine how to best address individual caregiver needs. Few studies have documented the quality of individual items, although this is important for instrument testing, particularly if items ever are used at the item level.

As with the previous study (Bakas & Champion, 1999), the revised BCOS demonstrated good internal consistency reliability. Also, for the first time, 2-week test-retest reliability was documented by an ICC correlation of .66 with a sub-sample of 36 caregivers of aphasic stroke survivors. Research is still needed however, on the ability of the instrument to detect clinically significant changes over time or after caregiver interventions.

The documentation of construct validity using factor analysis supported the use of the BCOS as a total summed scale. Although few studies have looked at this factor, the meaningfulness of summed scores requires that the items have acceptable evidence of

unidimensionality in addition to internal consistency reliability (Netemeyer et al., 2003). The BCOS items showed unidimensionality.

Construct validity was further supported by the use of a conceptual model derived from Lazarus' theory of stress and coping (Lazarus, 1991; Lazarus & Folkman, 1984). Netemeyer and colleagues (2003) underscored the importance of theory in testing the construct validity of measures used in the social sciences. Approximately 35% of the variance in BCOS scores was accounted for by the constructs depicted in Figure 1, providing strong evidence of construct validity for the BCOS.

Despite the moderate correlation between task difficulty and BCOS scores ($r = .40$), task difficulty was not a significant independent predictor of BCOS scores, although the assessment of task difficulty in stroke caregivers is important to determine specific areas for intervention (Bakas et al., 2004). Visser-Meiley and colleagues (2004) pointed out the benefit of using the BCOS in combination with the OCBS measuring task difficulty.

Caregiver optimism was not significantly related to BCOS scores for reasons that are unclear. Optimism was moderately correlated with threat appraisal ($r = -.34$, $p < .001$) and, consistent with previous research (Tomkins et al., 1988), depressive symptoms ($r = -.30$, $p < .001$) in this study. It is possible that optimism could play a role in the stress and coping process of stroke caregivers by reducing threat appraisal and depressive symptoms. The fact that depressive symptoms, threat appraisal, and benign appraisal were all significant independent predictors of the BCOS lends support for the conceptual model.

Criterion-related validity for the BCOS was improved by the addition of the 5 items addressing general health, physical functioning, role functioning, financial well-being, and level of energy. Correlations between the BCOS and the single criterion item measuring caregiver life

changes overall improved from $r = .58$ in the Bakas and Champion (1999) study to $r = .67$ in this study. Correlations between the BCOS and the SF-36 General Health Subscale improved from $r = .25$ in the Bakas and Champion (1999) study to $r = .32$ in this study. These findings indicate that the 15-item BCOS is a better measure of overall life changes and perceived general health than the earlier 10-item version.

Limitations. The cross-sectional nature of this study does not support inferences about causal directions. A longitudinal study will be necessary to document how well the BCOS performs over time in stroke caregivers. The sensitivity of the BCOS in detecting meaningful changes in outcomes following caregiver interventions also has yet to be determined. Generalizability of the findings are also limited to stroke caregivers who are predominately female and either Caucasian or African American. Further testing of the BCOS is needed to determine the psychometric properties of the BCOS in other caregiving contexts. Despite these limitations, the BCOS does show extensive evidence of reliability and validity in stroke caregivers compared with other existing caregiver burden measures (Visser-Meiley et al., 2004). The BCOS also provides the specificity needed to identify deteriorating aspects of caregivers' lives as a result of providing care.

Conclusions

The revised 15-item BCOS showed a marked improvement over the original instrument published in 1999 (Bakas & Champion, 1999). Validity and reliability are excellent and time to administer is minimal. Additionally, the instrument can be administered via telephone as well as through paper-and-pencil assessment. The BCOS shows promise as a valuable measure in research, as well as a tool that can be used at the item level to identify deteriorating aspects of caregiver lives as a result of providing care.

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Table 1. Descriptive statistics for measures.

Measure	#Items	N	Mean(SD)	(Possible) Actual Range	Cronbach Alpha
Survivor Impairment					
(SSQOL Proxy)				(1.0-5.0)	
Mobility ^a	6	146	4.0(1.0)	1.2-5.0	.92
Self-Care ^a	5	146	4.2(0.9)	1.4-5.0	.88
Language ^a	5	146	4.1(1.0)	1.0-5.0	.93
Thinking	3	146	3.0(1.1)	1.0-5.0	.83
Personality	3	146	3.1(1.2)	1.0-5.0	.89
Caregiver Optimism				(0-24)	
(LOT-R)	6	146	15.9(3.4)	8-24	.73
Caregiver Dependent- Care Tasks (OCBS)				(15-75)	
Time	15	147	36.7(13.0)	15-75	.93
Difficulty ^a	15	145	22.1(8.7)	15-51	.90

Caregiver Appraisal					
(ACS)					
Threat	12	146	30.4(7.8)	(12-60) 12-60	.90
Benign	7	146	23.0(5.0)	(7-35) 7-35	.83
Benefit	6	146	20.6(3.2)	(6-30) 7-28	.75
Caregiver Depressive				(0-27)	
Symptoms (PHQ-9)^a	9	147	4.0(4.5)	0-27	.86
Caregiver Outcomes					
(BCOS)				(15-105)	
BCOS	15	147	58.4(10.8)	15-105	.90
2 Week Retest ^b	15	36	57.4(8.9)	37-78	.81
BCOS criterion item ^c	1	146	3.8(1.4)	(1-7) 1-7	NA
Caregiver General				(0-100)	
Health (SF-36GH)^d	5	146	65.6(22.3)	0-100	.84

^a**Note:** Scales transformed to correct for skewness prior to analyses.

^b**Note:** Intra-class correlation was .66 (95% CI = .42-.81), n = 36.

^c**Note:** Correlation between BCOS and BCOS criterion item was $r = .67$, $p < .001$, $N = 146$.

^d**Note:** Correlation between BCOS and SF-36GH was $r = .32$, $p < .001$, $N = 146$.

Table 2. Item statistics and factor loadings for the 15-item BCOS (N=147).

BCOS Item	Mean(SD)^a	% Ceiling	% Floor	Item-to- Total Correlation	Factor Loading
1. My self-esteem	4.3(1.2)	6.7	2.7	.58	.62
2. My physical health	3.8(1.1)	2.7	4.7	.62	.68
3. My time for family activities	3.7(1.2)	2.0	6.0	.53	.55
4. My ability to cope with stress	4.0(1.2)	2.7	3.4	.64	.68
5. My relationship with friends	3.8(1.1)	2.7	6.0	.57	.60
6. My future outlook	4.2(1.2)	4.7	1.3	.58	.62
7. My level of energy	3.7(1.2)	3.4	3.4	.66	.70
8. My emotional well-being	3.8(1.0)	2.0	2.0	.74	.78
9. My roles in life	4.0(1.1)	2.0	1.3	.65	.68
10. My time for social activities with friends	3.3(1.2)	1.3	14.1	.43	.43
11. My relationship with my family	4.1(1.0)	4.0	1.3	.47	.49
12. My financial well-being	3.4(1.1)	1.3	9.4	.41	.41
13. My relationship with the stroke survivor	4.5(1.3)	10.7	0.7	.58	.62

14. My physical functioning	3.9(0.9)	1.3	1.3	.62	.67
15. My general health	3.9(0.9)	2.0	1.3	.65	.71

^a**Note:** All BCOS items ranged from 1-7 and had medians = 4.0 (Possible range 1-7, item midpoints = 4.0, higher scores mean more positive changes).

Table 3. Hierarchical multiple regression predicting the 15-item BCOS (N=144).

Independent Variable	B	Beta	t	Bivariate r	Unique r²
SSQOL Proxy Language	-5.08	-.17	-1.88	-.33***	.02
SSQOL Proxy Thinking	.85	.09	.93	.27**	.00
Survivor gender ^a	1.44	.07	.81	.22**	.00
SSQOL Proxy Personality	-.52	-.06	-.58	.30***	.00
SSQOL Proxy Self-Care	-1.03	-.02	-.20	-.24**	.00
Caregiver gender ^a	-.45	-.02	-.20	-.22**	.00
Step 1 R = .43***; R² = .19; Adjusted R² = .15; F(6,137) = 5.20***					
Caregiver difficulty with tasks	95.14	.13	1.20	.40***	.04
Step 2 R = .47***; R² = .22; Adjusted R² = .18; R² Change = .04; F(7,136) = 5.49***					
Caregiver threat appraisal	-.44	-.32**	-2.73	-.41**	.04
Caregiver benign appraisal	-.49	-.23*	-2.12	.24**	.02
Caregiver benefit appraisal	.40	.12	1.50	.16*	.01
Step 3 R = .55***; R² = .30; Adjusted R² = .25; R² Change = .08; F(10,133) = 5.81***					
Caregiver depressive symptoms	-2.40	-.26**	-2.96	-.45***	.04
Step 4 R = .59***; R² = .35; Adjusted R² = .29; R² Change = .04; Intercept = 78.6; F(11,132) = 6.39***					

* p < .05; ** p < .01; *** p < .001

^aNote: Caregiver gender and survivor gender: 1 = male; 2 = female.

Figure 1. Conceptual Model

