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Effects of Self-Esteem, Optimism, and Perceived Control on Depressive Symptoms in Stroke Survivor-Spouse Dyads

Misook L. Chung, PhD, RN, FAHA, FAAN^a, Tamilyn Bakas, PhD, RN, FAHA, FAAN^b, Laura D. Plue, MA^c, and Linda S. Williams, MD, FAHA, FAAN^c

^a University of Kentucky College of Nursing, Lexington, Kentucky

^b Indiana University School of Nursing, Indianapolis, Indiana

^c Indiana University School of Medicine and Richard L. Roudebush Veterans Administration Medical Center, Indianapolis, Indiana

Abstract

Background—Depressive symptoms are common in stroke survivors and their family caregivers. Given the interdependent relationship between the members of dyads in post-stroke management, improving depressive symptoms in dyads may depend on their partner's characteristics. Self-esteem, optimism, and perceived control, all known to be associated with depressive symptoms in an individual, may also contribute to their partner's depressive symptoms.

Purpose—The purpose of this study was to examine actor and partner effects of self-esteem, optimism, and perceived control on depression in the stroke survivors and their spousal caregivers.

Methods—A total of 112 ischemic stroke survivors (78% white, 34% female, mean age 62.5 ± 12.3) and their spouses (mean age 60.6 ± 12.9) completed surveys in which depressive symptoms, self-esteem, optimism, and perceived control were assessed using the Patient Health Questionnaire, the Rosenberg Self-esteem Scale, the Revised Life Orientation Test, and the Sense of Control Scale. Multilevel modeling, actor-partner interdependence model regression was used to determine influences on depressive symptoms within the dyad.

Results—Individuals with lower self-esteem, optimism, and perceived control had higher levels of depressive symptoms. Stroke survivors whose spouses had lower levels of self-esteem ($B = -.338, P < .001$) and optimism ($B = -.361, P < .027$) tended to have higher levels of depressive symptoms. Spouses whose stroke survivors had lower levels of self-esteem ($B = -.047, P = .036$) also had higher levels of depressive symptoms.

Conclusion—We found significant partner effects of self-esteem on depression for both members and partner effect of optimism on patient's depressive symptoms. These findings suggest that further research is needed to determine if dyadic interventions may help to improve self-esteem, optimism, and depressive symptoms in both patients and their caregivers.

Correspondent Author: Misook L. Chung, PhD, RN, FAHA, FAAN Associate Professor Co-Director, RICH Heart Program University of Kentucky, College of Nursing 529 CON Building, 760 Rose Street Lexington, KY 40536-0232 Office: 859-323-8024 Fax: 859-257-5959 misook.chung@uky.edu.

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Keywords

Depression; Family study; Stroke management

Background

Depression is a common complication of stroke survival. Although the prevalence of depression varies depending on assessment measures, diagnostic criteria, sample selection, and time of assessment, researchers have reported up to 30% to 50% of stroke survivors with major depression, and 8% to 22% with minor depression.¹ Importantly, family caregivers also experience psychological distress related to their caregiving responsibility. Up to 55% of spousal caregivers have been reported to experience depression or depressive symptoms following stroke.^{2, 3}

There is substantial evidence that depression is associated with poor outcomes for stroke survivors as well as their family caregivers.^{1, 4, 5} The presence of both depressive symptoms and major depression have been associated with delayed stroke recovery, recurrent stroke, and longer hospital stays in stroke survivors.^{1, 5} Furthermore, in a recent meta-analysis of 13 studies (n=59,598), depressed stroke survivors had a 52% higher risk of mortality than stroke survivors without depression.⁴ On the other hand, caregiver depression is also known to be a contributing factor of their poor health outcomes, including an increased risk of cardiovascular disease. In a large longitudinal cohort study with an 8 year follow-up period, spousal caregivers had a 35% higher risk of cardiovascular disease events than spouses without caregiving responsibility, and the risk was increased to 48% when the spousal caregivers also had depression.⁶

Because of the high levels of depression and the severe impact of depression on health outcomes for both stroke survivors and their spousal caregivers, early recognition and treatment for depression is important for stroke survivor-spouse dyads. Identifying factors associated with depression is also important to guide development of prevention strategies for depression. Self-esteem, optimism, and perceived control are a few personal characteristics that are considered personal resources facilitating positive perceptions of stressful situations and providing inner strength to cope with chronic disease.⁷⁻⁹ Self-esteem is an overall personal evaluation of one's own worth or value and involves accepting oneself.¹⁰ Negative self-esteem predicts the onset of depression and positive self-esteem is associated with recovery of depression.^{7, 11} Substantial evidence supports the relationship between low self-esteem and depression in various populations including patients with heart disease.¹²⁻¹⁶ Similar findings are reported in caregivers of frail older people and cancer patients.^{17, 18} Optimism is defined as a general expectation for positive rather than negative experiences in the future.^{8, 19} Optimism and psychological distress have been found to be related in persons with a variety of medical conditions (e.g. cancer, surgery, postpartum, stroke).^{8, 20-27} Optimism has also played a role in psychological distress among family caregivers of patients with chronic illness (e.g. cancer and Alzheimer's disease).^{28, 29} Sense of control is defined as a person's real or perception of control for the conditions and events of one's life, and has been found to be associated with depression.^{9, 30} According to control theory, sense of internal control is associated with lower levels of depression while sense of

external control is associated with high levels of depression.^{9, 30} There is substantial evidence in the literature on the role of control in the stress process and sense of control is also associated with depression in patients with cardiac disease including stroke³¹⁻³⁴ and in caregivers of stroke patients.³⁵

Most previous studies have investigated relationships between depression and the personal characteristics of self-esteem, optimism, and sense of control by focusing on the individual level of analysis, but no studies were found using the dyad level of analysis. Recently the need for dyadic research and treatment in post-stroke depression has been emphasized³⁶ but there is a lack of evidence about whether these individual personal factors can influence or be associated with their partner's depression within patient-caregiver dyads. Investigating these relationships among stroke patients and their caregivers is challenging because it requires measurement of these variables from both members in a dyad. Appropriate statistical strategies like multilevel modeling techniques are needed to control for non-independence in outcomes between stroke survivors and their family caregivers. Stroke survivors and their family caregivers are in an interpersonal dependent relationship in which they share their thoughts, beliefs, emotions, and behaviors as they receive and provide support to each other after stroke.

Given the high prevalence of depression in stroke survivors and their caregivers, and their interdependent relationship within dyads during post-stroke management, it can be hypothesized that individuals' self-esteem, optimism, and perceived control may contribute to their partner's depression. Although this assumption may seem obvious logically, to date, researchers have not examined this association using an appropriate statistical analysis, which is dyadic analysis, in the context of depression and stroke. Therefore, the purpose of this study was to examine whether an individual's self-esteem, optimism, and perceived control predict their own, as well as their partner's, depressive symptoms using a multilevel dyadic analysis among stroke survivors and their spousal caregivers.

Methods

Study design and sample

This study was a secondary analysis of baseline data from the randomized, controlled Active-Initiate-Monitor (AIM) study that consisted of three steps; (1) activating the dyads to understand and accept depression diagnosis and treatment, (2) initiating antidepressant medication, and (3) monitoring effects of the treatment.³⁷ The purpose of the parent AIM study was to examine the effects of a care management intervention program on post-stroke depression and quality of life in stroke survivors at 6 and 12 weeks. A detailed study summary, procedures, and results from the AIM study have been previously published.³⁷⁻³⁹

After all potentially eligible subjects were identified during stroke hospitalization from four major hospitals in Indianapolis; they were invited to be screened for depression for possible study enrollment one to two months post-stroke. Only those with scores ≥ 5 on the 9-items of the Patient Health Questionnaire (PHQ-9) or those with at least 2 symptoms on the PHQ-9, or those with the depressed mood or anhedonia item in the initial depression screening were administered the structured clinical interview for depression. Stroke survivors were included

in the AIM parent study if they were diagnosed with ischemic stroke and had major or minor depression in the clinical interview for Diagnostic and Statistical Manual of Mental Disorders (4th Edition) and if they had no severe language (a score <2 on the National Institute of Health Stroke language item) and cognitive impairment (a score > 3 on the modified 6-item Mini-Mental Status Examination), and if their life expectancy was at least 6 months.³⁷⁻³⁹

In the parent study AIM, caregivers, who were able to read and understand English, were also invited to complete the survey if they were an unpaid family member or significant other of the stroke survivor and providing care after discharge to the home setting. In the AIM parent study, total of 227 stroke survivors within 2 months of post stroke and their family caregivers participated. The participated caregivers were spouses (n=122), son/daughter or son/daughter in law (n=66), other relatives (n=28), and others (n=11).

In this secondary analysis, we selected only the 112 stroke survivors and their spouses who completed baseline data that include all main variables in this study, prior to randomization into either the intervention group or the usual care group. The rationale for selecting dyads with a spousal relationship was that spousal caregivers were considered to be in a more interdependent relationship with patients than other types of caregivers because a spouse is considered to play a primary caregiving role and to be engaged in active day-to-day involvement with stroke survivors. A strong interdependency between dyad members is one assumption in dyadic analysis. Although data were collected from patient-caregiver dyads in the AIM study,³⁷⁻³⁹ dyadic data analysis had not yet been conducted to test interdependent relationships among stroke survivors and their spousal caregivers.

Measures

Self-esteem was defined as a global judgment and attitudes about self-worth and was assessed using the Rosenberg Self-esteem Scale (SES).¹⁰ The SES has 10 items rated on 5-point Likert scale (1=strongly disagree, 5=strongly agree). The total score ranges from 10 to 50, and higher scores indicate positive global attitudes about the self. Validity has been examined in many population including stroke patients and evidence of internal consistency has been reported with a Cronbach's alpha of .83 in stroke patients and .73 in stroke caregivers,^{15, 40}

Optimism was measured using the 6-item Revised Life Orientation Test (LOT-R)⁴¹ that assessed generalized expectancies for positive and negative outcomes. All items are rated on a 5-point Likert scale from 0 (strongly disagree) to 4 (strongly agree). Item scores are summed after 3 negative items are reverse-scored. The total scores can range from 0 to 24, and a higher score indicates greater overall optimism. The LOT-R has been used to assess optimism of stroke caregivers, and evidence of reliability (e.g., Cronbach's alpha from .73 to .82) and validity has been previously demonstrated.^{20, 40, 41}

Perceived control was defined as a person's sense of control over their own life and was assessed using the Sense of Control Scale (SOC).^{9, 30} The SOC has 8 items that are coded from -2 (strongly disagree) to +2 (strongly agree). The total score of the SOC was computed based on the 4 different types of control factors (i.e., external and internal locus of control,

good and bad outcome), with higher scores indicating higher levels of perceived control.^{9, 30} The concurrent validity with Rotter's locus of control ($r = .705$) and construct validity using confirmatory factor analysis supported validity.³⁰ Although the reported reliability of 8 items was low between .574 and .633, the developers reported this measure provided a reasonable degree of efficiency with similar reliability to other measures of control.³⁰

Depressive symptoms were assessed using the 9-item Patient Health Questionnaire (PHQ-9).⁴² The PHQ-9 was developed based on the DSM-IV criteria of depression. Each item is rated on a 4-point scale ranging from not at all to nearly every day. Total score ranges from 0 to 27, and higher scores indicate higher levels of depressive symptoms. The PHQ-9 is used widely among stroke survivors and caregivers, with evidence of good internal consistency reliability (Cronbach's alpha: .82 - .86) and validity.^{20, 37, 40, 43}

Sociodemographic characteristics of all participants were collected using structure questionnaires at the baseline assessment in the parent study. In this secondary data analysis, we reported age, gender, education, race, and marital status. We also collected information about treatments of depression (i.e., antidepressants use and counseling) in the past at the baseline assessment.

Data Analysis

All analyses were conducted using SPSS for Windows, version 20. An α level of .05 was used throughout to determine statistical significance. Descriptive statistics used to describe sociodemographic characteristics of dyad members. Chi-squares were used to compare education (categorical variable). Paired t-tests were used to compare age, education (continuous variable), and levels of predictor and outcome variables between stroke survivors and their caregivers. Pearson correlations were used to determine bivariate associations among variables.

Multilevel dyadic modeling, called the actor-partner interdependence model (APIM) regression with distinguishable dyads, was used to determine influences of individual factors on outcomes within the dyad.⁴⁴ Two dyad members are considered distinguishable based on their roles (i.e., care-recipients and caregivers) in stroke rehabilitation. In the APIM for this study, the actor effect is the impact of a person's factors (i.e., self-esteem, optimism, and perceived control) on their own depressive symptoms and the partner effect is the impact of a person's factors on their partner's depressive symptoms. All dyad data were restructured to a pairwise dyadic data set. We created grand-mean centered scores that were standardized using z-scores to obtain unstandardized and standardized regression coefficients for actor and partner effects. The residual structure was treated as heterogeneous compound symmetry in this APIM analysis.⁴⁴

Results

Characteristics of the dyads

Stroke survivors in this study were predominantly white and two-thirds were male (Table 1). The mean age was 62.5 years ($SD = 12.3$). The post-stroke duration ranged between 2 to 3 months. About two-thirds of survivors had an education level of high school graduation or

less. In this secondary study, 37% of the stroke survivors were diagnosed with depression and received treatment, 33% took antidepressants and 15% received counseling prior to baseline. At baseline, 27% of the stroke survivors were on antidepressants and 5% had received depression counseling. In this study, there were no same sex marriages. Spousal caregivers were on average 1.9 years younger than stroke survivors ($p < .05$). There was no significant difference in education level between patients and caregivers. Only 39% of caregivers worked at a full or part time job, and 40% were retired. The rest were homemakers, unemployed, or on disability. Most caregivers (76%) reported that there was no change of their work due to their caregiving responsibilities. Prior to baseline, 20% of caregivers reported having a diagnosis of depression and 26% took antidepressants and 15% received counseling. At the baseline assessment, a few caregivers reported taking antidepressants (15%) or receiving counseling for depression (5%).

Depressive symptoms, self-esteem, optimism, and perceived control in the dyads

As shown in Table 2, stroke survivors had significantly higher levels of depressive symptoms and lower levels of self-esteem than caregivers. The levels of optimism and perceived control were similar between dyad members.

The correlations among predictors and outcome variables between and within dyad members (Table 3) indicated that the depressive symptom levels of stroke survivors were positively correlated with that of caregivers ($r = .255$, $p < .01$). However, stroke survivor self-esteem, optimism, and perceived control levels were not significantly correlated with those of caregivers. Within stroke survivors, there were significantly moderate correlations among self-esteem, optimism, and perceived control predictors ($r = .388$ to $r = .693$) and these predictors were significantly correlated with their own depressive symptoms ($r = -.241$ to $r = -.498$). Within caregivers, their self-esteem, optimism, and perceived control were moderately correlated ($r = .461$ to $r = .627$), and these predictors were also significantly associated with their own depressive symptoms ($r = -.246$ to $r = -.316$). All correlation coefficients were less than .7.

Self-esteem and depression

The detailed results of the APIM analysis are presented on Table 4, and only the significant findings of the APIM are shown on Figure 1. There were statistically significant results for the actor effects of self-esteem on depressive symptoms for both stroke survivors and spousal caregivers. This means that individuals who had higher levels of self-esteem were more likely to have lower levels of depressive symptoms. Specifically, a one unit increase in self-esteem was associated with a .434 unit decrease in depressive symptoms for stroke survivors and a .09 unit decrease in depressive symptoms for caregivers. There was evidence of partner effects of self-esteem on depressive symptoms for both members. Every one unit increase in caregivers' self-esteem was associated with a .337 unit decrease in the stroke survivor's depressive symptoms while every one unit increase in stroke survivors' self-esteem was associated with a .047 unit decrease in the caregivers' depressive symptoms. When we compared standardized coefficients of the actor and partner effects, for stroke survivors, the partner effect of caregivers' self-esteem was strong as 78% of actor effect on

their own depressive symptoms. For caregivers, the partner effect of stroke survivors' self-esteem was strong as 52 % of the actor effect on their own depressive symptoms.

Optimism and depression

Optimism exerted a significant actor effect for both stroke survivors and caregivers. Individuals with higher levels of optimism were more likely to have lower levels of depressive symptoms; a one unit increase in optimism was associated with a .407 unit decrease in depressive symptoms for stroke survivors and .188 unit decrease in depressive symptoms for caregivers. There was only a significant partner effect of optimism on depressive symptoms for stroke survivors. That means, stroke survivors whose spouses had higher levels of optimism were more likely to have lower levels of depressive symptoms; every one unit increase in caregiver optimism was associated with a .361 unit decrease in stroke survivors' depressive symptoms. This partner effect was 88.7% of actor effect of the optimism on depressive symptoms for stroke survivors.

Perceived control and depression

Perceived control exhibited only significant actor effects for each member in the dyads. Individuals who had higher levels of perceived control had lower levels of depressive symptoms. For each one unit of increase in actor perceived control, there was a 2.75 unit decrease in depressive symptoms for stroke survivors and a 0.86 unit decrease in depressive symptoms for caregivers. There were no significant partner effects of perceived control on depressive symptoms. Although there was a tendency toward a decrease in stroke survivor depressive symptoms as caregiver perceived control increased, this relationship did not reach statistical significance.

Discussion

In this dyadic study, we have examined whether individuals' self-esteem, optimism, and perceived control were associated with their own depressive symptoms as well as their partner's depressive symptoms in stroke survivors and their spousal caregivers. We found that stroke survivors' and spousal caregivers' self-esteem, optimism, and perceived control were significantly associated with their own depressive symptoms. Self-esteem is known to be associated with depression in stroke survivors.¹⁶ According to research by Vickery,¹⁵ stroke survivors tend to have lower levels of self-esteem in the days following a stroke, and there is a strong association between self-esteem and depressive symptoms. In a 4-year prospective cohort study of stroke survivors (n=1380), Morgenstern and his colleagues reported that poor optimism was significantly associated with severe depression. They also reported severe depression was associated with increased risk of mortality (hazard ratio 1.32, 95% CI 1.02- 1.72).²⁰ A link between perceived control and depression has also been reported in stroke and cardiovascular disease and caregivers.³¹⁻³⁴ Until this point, there has been substantial evidence of the association between these factors and depression in individuals with chronic diseases or caregivers at the individual level of analysis. Our study advanced the state of the science by specifically investigating these associations at the dyad level of analysis.

Our most compelling finding was the significant partner effects of self-esteem on depressive symptoms in both stroke survivors and caregivers we observed in the APIM model. These findings provide strong evidence on how each member's self-esteem within the dyad unit influences the other's depressive symptoms during the early stages of stroke rehabilitation. Surprisingly, the partner effect of self-esteem was as strong as at least half to two-thirds of the actor effects on their own depressive symptoms. This finding is important because it suggests that intervening to increase one person's self-esteem might simultaneously decrease depressive symptoms in the other member of the dyad. To our knowledge, this phenomenon of mutual influence has not been reported in the stroke literature. Our study provides new information on how stroke survivors and their spousal caregivers may influence each other's depressive symptoms. The finding suggests that more research is warranted to explore the usefulness of dyadic interventions in addressing self-esteem in patients and their spouses.

We also found that the partner effect of spousal caregivers' optimism was strong—close to the actor effect on stroke survivor's depressive symptoms. This result indicates that only stroke survivors were more susceptible to depressive symptoms when their spouses had lower levels of optimism. This result about the partner effect of caregivers' optimism on patient depressive symptoms has also not been reported in the literature. Patient's optimism was not associated with caregiver's depression.

It is important to note that the stroke survivors and their spouses reported only significant actor effects but no partner effects for perceived control on depressive symptoms. That means the person's depressive symptoms were affected by only his or her own score of perceived control, not by their spouses' perceived control and the partner is irrelevant in this context. The reason for this actor oriented finding for perceived control is not clear. It is possible that many stroke survivors and their spouses did not display their sense of control to their partners, or it is possible that sense of control is not easy transmittable within interpersonal relationships; thus, individual's depression is only affected by their own perceived control, and not by their partner. Although we could not find a statistically significant mutual influence of perceived control in this study, the trend of the partner effect of perceived control on the stroke survivor's depressive symptoms warrants further investigation.

The observed phenomena of partner effects among the dyads may be explained by the interdependence theory.⁴⁵ According to the interdependence theory,⁴⁵ strong interpersonal interactions exist between members of a dyad who are in a close interpersonal relationship. Individuals' emotions, cognitions, or behaviors are easily transferred from person to person when interactions between members of a dyad are active. Eventually, an individual's emotion, cognition, and behaviors may influence their partner's health outcomes. The strength of an individual's cognition, emotion, or behavioral influence on their partner may depend on the dynamic interpersonal relationship between the two members of the dyad. The findings from this study provide evidence of an interdependent relationship between stroke survivors and spousal caregivers during the early stage of stroke rehabilitation.

There is substantial knowledge about post-stroke depression and factors associated with depression in individuals (either stroke survivors or their caregivers).^{15, 16, 20, 31-33, 46} The

individual approach, however, underestimates the influence of dynamic, interpersonal interactions between care-recipients and their caregivers. Researchers have rarely investigated whether these factors predicted depression at the dyadic level. Investigations of dyadic factors of depression in stroke survivor-caregiver couples are still in the early stages of research. In addition, most researchers have investigated dyadic factors mainly by focusing on interpersonal relationships between dyad members including marital satisfaction, family function, and dyad coping strategies.^{47, 48}

Investigating factors associated with depression at the dyadic level is a challenging task. Common barriers in conducting dyadic research are conceptualizing problems at the dyad level, recruiting both members of a dyad, and collecting data using same measures from dyads.³⁶ Another challenge is the analytic approach with dyadic data. Non-independence of observed data between individual members in dyads and measurement of dyad-level predictor variables require sophisticated statistical approaches such as multilevel dyadic analysis.^{36, 44} Despite the importance of expanding our knowledge about dyadic approaches in post-stroke depression research, few researchers have examined cross partner effects of depression on health outcomes in stroke survivor-caregiver dyads using dyadic data.³⁶ To the best of our knowledge, this study is the first to examine predictors (i.e., self-esteem, optimism, and perceived control) of depressive symptoms at the dyadic level in stroke survivors and spousal caregivers using a multilevel model dyadic approach. The findings of this study highlight the ability of dyadic statistics to determine how an individual's self-esteem, optimism, and perceived control influence depressive symptoms for both members of the dyad.

There are several clinical and research implications that can be generated from our study. First, health care providers should be aware of the presence of dynamic interpersonal relationships, the consequence of dynamic interaction between members of dyads, and the possibility of mutual influence on a partner's outcome among stroke survivors and their spousal caregivers during early stroke rehabilitation. Stroke survivors and their spouses function as a team as well as individuals. Thus, clinicians should approach stroke survivors and their spousal caregivers as a pair in the assessment of depressive symptoms. Second, we have identified several important factors to consider at the dyadic level that will be useful to design effective interventions to reduce depressive symptoms. Although dyadic interventions may maximize the intervention effect on depressive symptoms in dyads, this assumption needs to be examined in the future.

According to a recent scientific statement by the American Heart Association/American Stroke Association,⁴⁹ 17 caregiver interventions and 15 dyadic interventions were critically analyzed to determine whether they improved stroke survivor and caregiver outcomes; however none of the studies reported findings using a dyadic approach to data analysis. Of the 15 dyadic interventions, most 14 (93.3%) resulted in improved outcomes for stroke survivors, however only 9 (60%) reported significant outcomes for caregivers. None of the dyadic interventions reported significant improvements in survivor or caregiver depressive symptoms. Of the 17 caregiver interventions, 16 (94%) resulted in improved outcomes for the caregivers, but only 4 (23.5%) reported improvements in survivor outcomes.

Many of the caregiver intervention studies did not measure survivor outcomes. Only one caregiver intervention study reported significant improvements in depressive symptoms for both survivors and caregivers.⁵⁰ This was a randomized controlled clinical trial by Kalra and colleagues⁵⁰ targeting 300 stroke caregivers who received 3 to 5 inpatient sessions and 1 home visit in the intervention group. The intervention provided tailored psycho-education and skill-building strategies (e.g., hands on training and goal setting) for the caregiver; however, most of the content of the intervention focused on the care provided to the survivor, rather than the caregiver's own self-care. The scientific statement emphasized the need for interventions to address the needs of both survivors and caregivers⁴⁹; and, when studying depressive symptoms as an outcome, ensuring survivors and caregivers exhibit sufficient depressive symptoms at baseline to demonstrate significant improvements.⁴⁹ Interventions that combine skill building (e.g., problem solving, stress management, goal setting) with tailored psycho-educational strategies were recommended, along with interventions that are delivered face to face and/or by telephone.⁵⁰ While only two studies cited in the scientific statement used web-based interventions,⁴⁹ the use of modern technology (e.g., smart phones, tablets, or telehealth) is important for the future development of interventions, especially for dyads living in rural areas or dyads who experience barriers to access to care.

The significant mutual influence in this study suggests that depressed stroke survivors may benefit from interventions that improve spousal caregiver self-esteem and optimism. According to Bakas,⁴⁰ caregiver optimism levels were significantly increased by an 8-week telephone intervention for caregivers that consisted of stroke education and skill building. The intervention addressed caregiver knowledge about stroke, providing personal care and instrumental care, managing survivor emotions and behaviors, and dealing with the caregiver's own personal responses to providing care using skill-building strategies such as problem solving and stress management. Further research on this intervention, as well as other interventions to improve caregiver self-esteem and optimism is warranted.

There are a few limitations. First, this study is a secondary data analysis using cross-sectional data, and our results are based on a predictive regression model, not a causal model. In addition, we have not controlled for possible confounding variables of depression outcomes such as demographic (e.g. age, gender) or clinical characteristics (e.g. location of stroke, comorbidity, disability). Another limitation is possible confounding effects of antidepressants or alternative non-pharmacological treatment for depressive symptoms. Adherence to antidepressants is crucial in improving depressive symptoms. A few participants were on antidepressants at the baseline assessment but we had not assessed their adherence behavior to antidepressants and non-pharmacological treatments. Thus, we need to be cautious in interpretation of study findings and we cannot infer direct causality based on the simple two variables relationships. Nevertheless, since examining the associations in this study were based on mutual influence on outcomes based on the interdependence theory,⁴⁴ future replicated findings will enhance the causal relation among variables.

Second, generalizability may be limited because the selection of study dyads was purposefully narrowed to those whom met the inclusion criteria for the primary intervention study of stroke survivors. For example, stroke survivors who were excluded due to language

or cognitive impairment in the parent study may have severe depression or be more interdependent with their family caregivers.

Third, although we assumed that spouses were the primary caregivers and the primary sources of support, it is possible that some couples who have poor quality of marriage or conflicts in their interpersonal relationship may have different associations between personal characteristics and depression.

Finally, because this study focused on only spousal caregivers, it is not known whether non-spousal family caregivers have similar effects on patient outcomes. Stroke survivors may interact more with non-spousal caregivers (i.e., son and daughters). Selecting only stroke survivors with spousal caregivers in this study may result in sample not being representative of the stroke population. It is necessary to replicate the study in the dyads who demonstrate strong interdependent relationships rather than selecting specific types of caregivers.

Summary

This study highlights the important mutual contribution that an individual's self-esteem, optimism, and perceived control influence both their own depressive symptoms and their partner's depressive symptoms using a multilevel dyadic statistical approach. Specifically, the spouses' self-esteem and optimistic view was found to be associated with stroke survivors' depressive symptoms, and this finding suggests that depressed stroke survivors may benefit from interventions that improve spousal self-esteem and optimism.

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B= unstandardized coefficient

Figure 1.

Significant actor and partner effects on depressive symptoms

Table 1

Demographic characteristics of participants

Characteristics	Stroke survivors	Caregivers
Sex, male, n (%)	74 (66.1%)	38 (33.9%)
Age, years, Mean (SD) *	62.5 (12.3)	60.6 (12.9)
Education, years, Mean (SD)	12.7 (2.8)	13 (2.8)
High school diploma, n (%)	67 (63.2%)	60(53.6%)
Race, n (%)		
White	87(77.7%)	87(77.7%)
Black	22(19.6%)	21(18.8%)
Others	3(2.7%)	4 (3.6%)

* Paired sample t-test $P < .05$

Table 2

Comparisons of predictors and outcome in the dyads

Characteristics	Stroke survivors	Caregivers	Paired t	p-value
	Mean (SD)	Mean (SD)		
Self-esteem	37.4 (7.3)	39.9 (5.8)	−3.0	.003
Optimism	15.0 (4.0)	15.2 (3.8)	−.45	.65
Perceived control	.58 (.54)	.66 (.50)	−1.29	.20
Depressive symptoms	8.6 (6.8)	.77 (1.8)	12.8	<.001

Note: SD= standard deviation

Table 3

Correlation among variables

	1	2	3	4	5	6	7
1. Stroke survivor self-esteem							
2. Caregiver self-esteem	.116						
3. Stroke survivor optimism	.693**	.072					
4. Caregiver optimism	.019	.627**	.048				
5. Stroke survivor perceived control	.503**	-.045	.388**	.015			
6. Caregiver perceived control	.177	.461**	.156	.472**	.141		
7. Stroke survivor depressive symptoms	-.498**	-.341**	-.251**	-.215*	-.241*	.206*	
8. Caregiver depressive symptoms	-.224*	-.316**	-.066	-.404**	-.088	-.246**	.255**

**
P<.01*
P<.05

Table 4

The actor and partner effects on depressive symptoms

Predictors	Stroke Survivors			Spousal Caregivers				
	B	SB	t	p-value	B	SB	t	p-value
Self-esteem								
Actor	-.434	-.455	-5.8	<.001	-.090	-.095	-3.3	.001
Partner	-.338	-.354	-3.6	<.001	-.047	-.049	-2.1	.036
Optimism								
Actor	-.407	-.251	-2.7	.009	-.188	-.116	-4.6	<.001
Partner	-.361	-.223	-2.2	.027	-.021	-.013	-.53	.597
Perceived control								
Actor	-2.75	-.224	-2.3	.021	-.858	.070	-2.5	.013
Partner	-2.40	-.196	-1.9	.061	-.182	.015	-.58	.562

B= unstandardized coefficient, SB= standardized coefficient, t= t-value