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Original Article

Mediating effect of self-control in relation to depression, stress, and activities of daily living in community residents with stroke

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Abstract. [Purpose] This study aimed to determine whether self-control mediates the relation between depression, stress, and activities of daily living in community residents with stroke. [Subjects and Methods] This study is a secondary analysis of data from 108 community-dwelling stroke patients in Korea. Data were collected through self-reporting questionnaires, including the Korean version of the Center for Epidemiological Studies Depression Scale, Korean version of the Brief Encounter Psychosocial Instrument, and the modified Barthel index. The path model was tested to investigate causal relations between variables, obtain maximum-likelihood estimates of model parameters, and provide goodness-of-fit indices. [Results] The proposed path model showed good fit to the data. Depression and stress have a significant direct effect on self-control and a significant indirect effect on activities of daily living through self-control. Depression and stress accounted for 28.0% of the variance in self-control. Depression, stress, and self-control accounted for 8.4% of the variance in explaining activities of daily living. [Conclusion] The level of self-control is an important indicator of activities of daily living in stroke patients. We suggest that interventions such as enhancement of confidence in one's self-control ability could be effective in improving the physical activity of stroke patients with depressive mood and stress.
Key words: Activities of daily living, Self-control, Stroke

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INTRODUCTION

Stroke is a common chronic condition in an aging population. One-third of patients with stroke are left with significant permanent disability[1)]. Despite the increase in prevalence, early management of stroke is emphasized mainly during the acute phase[2)]. Effective management of chronic conditions, such as those associated with stroke, promotes self-regulation of habits that keep people healthy throughout their life span[3)]. During the past two decades, the effect of programs that foster the ability to manage chronic conditions has been reported[4)]. Despite an overall shift in emphasis to individuals' ability to manage their conditions, there still exists an emphasis on the acute care of stroke and a lack of support in the later stages[5, 6)]. Although long-term issues affecting stroke survivors have been investigated, including depression, social isolation, reduction in mobility, and changing life roles[7, 8)], there are few studies evaluating programs and mechanisms to assist individuals in the longer term after a stroke[5)].

Self-control is conceptualized as the extent of a person's self-perception of having control over events and ongoing situations, and reflects the perception of the ability to manage them[9)]. The shift in emphasis from acute to chronic disease conditions inspired the development of self-management programs for chronic disease, which applies self-control and the self-efficacy theory to health promotion[3)]. The feeling of control is important for psychological adjustment, which has been found to be the strongest predictor of a person's ability to carry out behaviors aimed at achieving a desired goal by taking action[9, 10)]. Studies that investigated individual differences in self-control, known as self-regulation in psychology, reported that high levels of self-control are linked to positive outcomes[11)].

Maintaining activities of daily living (ADL) such as social interaction, grooming, upper-body dressing, and bowel control are important stroke-outcome predictors[12)]. Stroke survivors experience stress from everyday life. In addition to physical impairments, they struggle with uncertainty and coping with the consequences of stroke[13)]. Stroke patients with physical or mental disabilities are more likely to need physical assistance in performing ADL. The effect of self-regulation on ADL after a stroke has been reported in the context of the relation between chronic disease and self-regulation. Randomized controlled trials by Kendall et al.[14)] found that a self-management program for stroke patients

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could prevent declines in functioning during the first year after the stroke in the areas of family roles, ADL, self-care, and work productivity.

Self-control could be a major factor in a self-management program aimed at enhancing and maintaining the ADL capacity of stroke patients from the point of view of chronic health care. However, the mechanisms of the effect of self-control on promoting ADL in stroke patients remain unclear. The physical deficits after a stroke have been well studied; however, there is little information on the mediating effect of self-control on psychological variables and physical outcomes. Therefore, the value of these factors for health-management approaches after a stroke is unknown. Stress and depression are considered to be factors related to self-control and maintaining ADL. Self-control as measured by using the Self-control Scale has been correlated negatively with stress[15]. Psychological distress was significantly correlated with health outcomes such as managing ADL and instrumental ADL (IADL) in community-dwelling older adults[16]. Quail et al.[17] reported that having unmet IADL needs and requiring assistance to maintain ADL were associated with elevated psychological distress. Among older people receiving home-nursing care, low levels of distress were related to an inner strength conceptualized as a sense of coherence[18].

Depression is a major health problem after a stroke, and the incidence of depression after a stroke ranges from 29% to 33%[8]. It has been found that post-stroke depression is increased in patients with a higher physical dependency that affects their physical activity in daily life[19]. Depression contributes to disability and worsens the outcomes of many physical illnesses[19] because it can result in decreased daily physical activity[20]. Because a depressed mood might lead to a restriction of activities, and inactivity results in a decline of physical function, more serious health problems could result. It has been reported that self-control has positive mediating effects on depression[21]. The feeling of having a low level of self-control is related with depression among stroke patients with physical disabilities[22].

There is considerable anecdotal evidence on the relations among stress, depression, self-control, and ADL. However, most of this evidence concerns the relation between only two variables. A better understanding of the associations of all these variables could enhance interventions that aim to improve the physical and psychological outcomes for stroke survivors. The primary objective of this study is to examine the relations among depression, stress, and ADL in stroke patients. Specifically, we hypothesized that self-control would mediate the relations between depression and stress and ADL. Additionally, we hypothesized that depression would be related to stress and that both would relate to ADL through self-control.

SUBJECTS AND METHODS

A convenience sample was chosen from community-dwelling stroke patients visiting a convalescent center for the disabled in Korea. Approval was received from the ethics review board of the university, and participants were assured of their anonymity and the confidentiality of their information. This study is a secondary analysis of the data obtained for a study on developing a health-promotion program for stroke patients. The exclusion criterion for this study was cognitive dysfunction defined as a score of ≤18 on the Korean version of the Mini Mental State Examination (MMSE-K). The interview was carried out by trained registered nurses. The questionnaire responses and measurements of 108 of 115 participants were analyzed, because the data for 7 participants were incomplete. For significance testing of model effects, Kline[24] recommended having 10 times as many cases as parameters. An adequate sample size ranged from 60 to 120 participants, because six variables were measured. The mean age of the 108 participants was 63.19 years (SD = 9.16), and 33.3% were female. With respect to stroke diagnosis periods, the time ranged from 6 to 480 months, with an average of 97 months (SD = 65.20). The mean score for the MMSE-K was 24.74 (SD = 4.23).

Depression was assessed by using the Center for Epidemiological Studies Depression Scale (CES-D) translated by Chon and Rhee[25]. The CES-D is a 20-item self-report questionnaire. Items are scored on a four-point Likert scale, with responses ranging from 0 (rarely or never) to 3 (most or all the time). In the Korean version of the CES-D, total scores range from 0 to 60 points, and a score of 16 is suggested as the cutoff point for depression screening[25]. Subjects with a higher score experienced greater depression.

The modified Brief Encounter Psychosocial Instrument (BEPSI)[26] was used to measure stress in this study. The Korean version of the BEPSI was developed by Yim et al[27]. The modified BEPSI has proven to be valid and reliable[27]. It consists of five items with responses scored on a five-point Likert scale. The sum of the five items was divided by five, and higher scores indicate more stress.

The Mastery Scale[28] was used to measure self-control. This scale has proven validity and reliability for physically disabled people in Korea[24]. The scale consists of seven items, and each item is rated on a five-point scale ranging from 1 (not at all) to 4 (extremely). Five items are reversed, and each item is scored with a range of 7–28 points. Higher scores indicate stronger feelings of control.

ADL was measured with the Korean version of the modified Barthel index (K-MBI). Cronbach's α of 0.93 was reported from the Japanese version of the MBI[29].

Because evaluating covariance structure models by using multiple criteria is recommended[23], we used the following indices to examine the model fit: χ^2 statistics, the comparative fit index (CFI), the normed fit index (NFI), and the root mean square error of approximation (RMSEA). For the CFI and NFI values, >0.95 constitutes a good fit[30] and values >0.90 are seen as indicative of acceptable fit to the data. An RMSEA of 0.05 indicates a close fit[30]. Paths significant at the $p = 0.05$ level were retained for the recursive model for estimating the reduced model. There were no missing data. Path analyses were conducted with AMOS 20.0, and the remaining analyses were carried out by using SPSS version 20.0.

Path analysis was used to investigate the causal relations between depression, stress, self-control, and ADL in post-stroke community residents because this technique allows the testing of theoretical propositions about cause and effect,

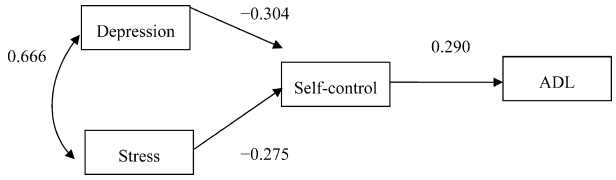

Fig. 1. Proposed path model
ADL: activities of daily living

Table 1. Model fit indices

Fit index	χ^2	RMSEA[a]	LO 90	HI 90	NFI[b]	CFI[c]
	0.103	0.000	0.000	0.008	0.999	1.000

[a] Root mean square error of approximation. [b] Normed fit index. [c] Comparative fit index

Table 2. Estimates of regression weights of the proposed model

Path	B[a]	β[b]	S.E.[c]	C.R.[d]
Self-control ← depression	−0.151	−0.304	0.055	−2.767*
Self-control ← stress	−0.247	−0.275	0.099	−2.501*
ADL[e] ← self-control	1.812	0.290	0.578	2.135*

[a] Unstandardized coefficients. [b] Standardized coefficients. [c] Standard error. [d] Critical ratio. [e] Activities of daily living.
*$p < 0.05$

and mediating effect. Path analysis is an extension of multiple linear regression techniques and tests causal relations between the variables of a specialized model[31]. Exogenous and endogenous variables are included in the path model.

Path analyses were conducted by using the sum scores of the CES-D, stress, self-control, and ADL. The correlation of variables in this study was examined before the path analysis was performed. The directions of path coefficients in this study were presumed on the basis of a previous study that investigated stress, depression, self-control, and ADL.

Multicollinearity means that there is a correlation between the independent variables. If multicollinearity exists, the variance of the regression coefficient is extremely large and the analysis becomes meaningless. For that reason, multicollinearity should be checked before a path analysis is conducted. Although the correlation matrix draws on Pearson correlation coefficients generally used for multicollinearity, another detection method and criteria were employed for an exact check. The variation inflation factor (VIF) was used for detecting multicollinearity. When VIF is >10, multicollinearity exists in the data[32]. Multicollinearity was not detected, as the VIF was <10.

RESULTS

Preliminary path analyses are performed to investigate significant variables for model identification. The probability of obtaining a critical ratio as large as 2.276 in absolute value is significant from depression to self-control ($\beta = -0.304$; $p = 0.006$). The regression weight for stress in the prediction of self-control ($\beta = -0.275$; $p = 0.012$) and for self-control in the prediction of ADL ($\beta = 0.287$; $p = 0.009$) is significantly different from zero at the 0.05 level. The regression weight for depression ($\beta = 0.032$; $p = 0.804$) and stress ($\beta = -0.039$; $p = 0.757$) in the prediction of ADL is not significantly different. The proposed path model is constructed by deleting the insignificant path from depression and stress to ADL in the preliminary model. The path model of this study is shown in Fig. 1.

The proposed model has excellent fit indices. RMSEA scores <0.00 indicate good and acceptable model fit, as do NFI and CFI scores >0.9 (Table 1).

Table 2 summarizes the results of estimates of regression weights of the proposed model. The estimate of covariance between depression and stress is 32.695, and it is significant ($p < 0.001$). The estimate of correlation among exogenous variables is 0.666.

The exogenous independent variables are depression and stress. An endogenous independent variable as a mediator is self-control. Depression and stress have a significant direct effect on self-control and a significant indirect effect on ADL through self-control. Depression and stress accounted for 28.0% of the variance in self-control. Depression, stress, and self-control accounted for 8.4% of the variance in explaining ADL. The standardized direct effect of stress on self-control is −0.275, and the standardized direct effect of depression on self-control is −0.304. The standardized direct effect of self-control on ADL is 0.20. The standardized indirect effect of stress on ADL is −0.08, and the standardized indirect effect of depression on ADL is −0.088. All of the direct and indirect effects are significant ($p = 0.01$).

DISCUSSION

A paradigm shift in health-care issues has led to changes in the view of patients' role in managing their chronic diseases[37]. Self-control, a psychological factor, should not be overlooked in the rehabilitation of stroke survivors. Performance of ADL indicates the impact of disability on a person's level of independence in daily life. ADL is a key factor in the social model of disability according to the Internal Classification of Functioning Disability and Health[33], and it is considered a major outcome variable in rehabilitation. For that reason, the relations among stress, depression, self-control, and ADL were investigated in this model focused on self-control.

We hypothesized that self-control would mediate the relations between depression, stress, and ADL. The results

of our analysis supported this hypothesis. The level of self-control is an important indicator of ADL in stroke patients. The results of our study suggest that stroke patients who experience less depressed moods and stress have more self-control and, as a result, maintain higher ADL.

The unstandardized regression weight from depression to self-control was −0.151. This means that when depression increases by 1, self-control decreases by 0.151. Its standardized regression weight was −0.304. This means that when depression increases by 1 standard deviation, self-control decreases by 0.304 standard deviation. The −0.247 unstandardized regression weight from stress to self-control means that when stress increases by 1, self-control decreases by 0.247. The standardized regression weight of stress was −0.275, which means that when stress increases 1 standard deviation, self-control decreases by 0.275. Thus, individuals with a high level of depression and stress reported lower self-control. In other words, a higher level of depression and stress was associated with substantially lower self-control.

Self-control has a significant, positive effect on ADL with an unstandardized regression weight of 1.812 and a standardized regression weight of 0.29. This means that ADL increases 1.812 with 1 increase of self-control. The estimates of regression weights for self-control offer support for the second hypothesis of an assumed positive relation between self-control and ADL.

In a preliminary model test, regression weights from depression and stress to ADL were insignificant. The indirect and mediated effect of stress on ADL was −0.08. That is, owing to the indirect effect of stress on ADL, when stress increases by 1 standard deviation, ADL decreases by 0.08 standard deviation. The indirect effect of depression also showed the same pattern. This also means that depression and stress mediated by self-control have a significant effect on ADL. It has been reported that subjects with chronic diseases such as stroke, lung disease, osteoarthritis, or rheumatoid arthritis experience lower feelings of control[26]. Self-control has received a great deal of attention in the management of various chronic diseases as well as stroke[5]. Successful experiences and positive feedback could enhance individuals' personal self-efficacy with regard to specific behaviors[34,35].

The mediated effect of depressed mood and perceived stress on ADL through depressed mood is consistent with the previous literature. There is evidence that self-efficacy is a contributing factor associated with physical outcomes such as ADL and physical functioning post-stroke[5]. To help patients adapt to changes attributed to stroke, intervention programs that promote self-control are needed so that patients can perceive themselves to be in control of events and ongoing situations, and develop the ability to manage them[27].

However, the proposed model explains 8.4% of the variance in independently performing basic ADL. There may also be additive effects among some of these factors or complex interactions that we did not consider. The variables of physical functioning such as balance, strength, and spasticity were considered with psychological factors to reach a comprehensive understanding and increase the amount of variance explained. Stroke patients are dealing with a wide variety of physical and psychological problems that influence their ability to carry out ADL[36]. The degree of dependency in performing ADL after a stroke is more affected by the intensity of neurological impairment and physical stroke symptoms than by cognitive impairment[37]. In addition, both physiological and psychosocial mechanisms are implicated in determining the effect on ADL among stroke patients.

This study has limitations. It should be noted that there is a need for more studies to establish causal inferences. Given the cross-sectional nature of our data, the direction of the hypothesized relations might be uncertain. It is possible that stroke patients with lower levels of ADL have less self-control and, as a result, experience more stress and depressed moods.

However, in this study, we found that depressive moods and stress affect the levels of ADL in stroke patients. These effects are indirect, however, and they occur through the mediation of self-control. This is the first study to examine these psychosocial pathways in stroke patients. Further studies will be conducted to examine the effectiveness of self-control and self-management in stroke survivors. A review of the literature on self-management and stroke also showed that studies on self-management programs for stroke survivors are relatively new, and although research is growing, many issues are still unknown[38].

In conclusion, we suggest that an intervention such as enhancing confidence in controlling one's life could be effective in improving physical activity in stroke patients with depressive mood and stress.

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