# The Association of Activity Limitation on Health-Related Quality of Life and Depression in Elderly Korean Stroke Patients

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**Purpose:** The purpose of this study was to help the numerous health care workers who participate in the rehabilitation of stroke patients by understanding how limitations on the activities of stroke patients affect the health-related quality of life and depression.
**Methods:** We investigated 527 stroke patients from the Korean's National Health and Nutrition Examination Survey (KNHANES, 2013-2018). The subjects were divided into two categories: with and without activity limitation. A medical doctor's diagnosis of depression and the EQ-5D, which measures life satisfaction connected to health, were the study's factors. Based on their level of activity limitation, the individuals' depression and health-related quality of life were compared. The odds ratios relating to activity limitation's relationships with depression and stroke patients' quality of life were computed using logistic regression analysis.
**Results:** The diagnosis of depression in subjects with activity limitation was 16.0%, while in those with no limitation on activity it was 5.6%, and the EQ-5D index was 0.67 ± 0.02, 0.85 ± 0.01. For every item on the EQ-5D, there existed a significant difference in the odds ratio. Furthermore, when comparing depression with activity limitation to non-activity limitation, the odds ratio was 4.09 (2.12-7.788).
**Conclusion:** Limitation of activities of stroke patients significantly reduces the health-related quality of life and increase the probability of depression. Therefore, treatment of stroke patients should be approached taking into consideration their psychological condition. It is also deemed necessary to have a systematic and continuous rehabilitation program.

**Keywords:** Activity limitation, Health-related quality of life, Depression, Stroke

## INTRODUCTION

Stroke is a typical geriatric disease that causes tissue damage caused by cerebral blood disorder, causing permanent disorders such as hemiplegia, speech disorders, sensory disorders, or delayed recovery, and making it difficult to return to social life due to limited activities.[1]

After a stroke, 30% to 50% of surviving patients have permanent disabilities, which make it difficult to carry out independent activities of daily living; thus, these patients become subject to limitations in social roles and interpersonal relationships.[2] This limitation of activity and chronic physical dysfunction in stroke patients changes the lifestyle pattern and causes lack of confidence, psychological anxiety, depression, and poorer quality of life due to long-term stress.[2,3]

Quality of life is an evaluation that deals with the degree and value of life based on an individual's cultural, social, and environmental background and is becoming important as an indicator of long-term outcome evaluation used for patients with various chronic diseases such as stroke, diabetes, and arthritis.[4] According to a prior study, the factors that affect the quality of life include physical dysfunction, cognitive impairment, and psychiatric symptoms such as depression and anxiety.[5] More importantly, physical dysfunction after a stroke is not just a limitation exercise control and routine activity, but a condition that accompanies emotional disorders, such as depression, anxiety, and anger; therefore, it is essential to consider the health-related quality of such patients.[6]

Depression is one of the most common socio-psychological symptoms in patients diagnosed with stroke, with a frequency of 27% to 60%, and the more one fails to lead an independent daily life due to limitations on activity, the more likely the person is to fall into a state of helplessness and severe depression.[7] In stroke patients, depression negatively affects rehabilitation and recovery by allowing them to indulge in feelings of loss of role

as human beings, and in cases of severe pain, the rehabilitation motivations are reduced, making treatment difficult or delaying recovery time, directly affecting physical functioning and quality of life.[8]

There have been many studies on the level of depression and health-related quality of life (HRQOL) in stroke patients, but few studies have focused on the direct influence of limiting the activities of stroke patients on depression and quality of life.[9,10] In addition, functional disorders in stroke patients results in voluntary functional recuperation over time up to the initial three months after the onset, and the recovery of learning-induced motor function is most effective up to six months.[11] Therefore, if the activity limitations of stroke patients are associated to depression and quality of life, an intervention program is needed to improve this early.

Therefore, this study was conducted to investigate the relevance of health-related quality of life on depression due to limitation of activities in stroke patients. By identifying these associations, we also hope to provide rehabilitation-related health care professionals a foundation of evidence regarding the necessity of treating stroke patients with psychological factors taken into account during treatment and rehabilitation programs, as well as to support the clinical direction of interventions that can enhance their quality of life.

## METHODS

### 1. Subjects

This study used data from the KNHANES (2013-2018), which is a nationally representative population-based survey. This survey is cross-sectional and designed to examine the health and nutrition status of non-institutionalized Korean population; it is conducted by Korea Centers for Disease Control and Prevention.

From the 47,217 individuals who participated in the KNHANES, 37,752 (under 65 years of age) and 8,912 others (who had not been diagnosed with a stroke) were excluded. In addition, 26 subjects who did not participate in the quality of life and depression diagnosis survey were excluded. Thus, 527 participants who met the study selection criteria were finally included in this study for analysis.

### 2. Measurements

The health survey items of the KNHANES were analyzed using data from diagnosis of gender, age, body mass index (BMI), individual income level, marital status, smoking status, alcohol drinking status, subjective health condition, activity limitation, and depression.

### 1) General characteristics

The general characteristics of stroke patients were gender, age, individual income level, and marital status. Individual income level was divided into "Quartile 1 (Lowest)" to "Quartile 4 (Highest)" using based on the quartile. Marital status was reclassified as "no" if the patient did not and "yes" if the patient lived with a spouse.

### 2) Health-related characteristics

The health-related characteristics used in this study were body mass index, status of smoking and drinking, subjective health condition, and diagnosis of depression. Body mass index (BMI) was reclassified as "low weight: $BMI < 18.5$", "normal: $\geq 18.5, < 25$", and "overweight: $\geq 25$" using variables calculated as [weight (kg) / height (㎡)]. Smoking status was classified as "never", "former", and "current". Drinking status was classified as "yes" if the answer was "one or four times a month, two to four times a month, or two to three times a week or more" and "no" in the latest year's frequency of drinking, when subjects answered, "no more than once a month or never drank". Subjective health conditions were divided into "good", "normal", and "bad". The diagnosis of depression by doctor used the responses "yes" and "no".

### 3) Health-related quality of life (HRQoL)

The health-related quality of life for stroke patients was analyzed using EQ-5D (EuroQol-5 Dimension). The EQ-5D is a five-item assessment of health-related quality of life that includes mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The three levels of the EQ-5D health-related quality of life indicators-"no problems," "moderate problems," and "severe problems"-are weighted according to each of the five problem measures and are utilized for chronic patients. This value ranges from 1 for complete health to -1 for less than death. Three answer levels were split into two groups for this study (No problem/problem present). Those who selected "moderate problem" and "severe problem" from the three severity levels were included in the problem group.[12]

### 4) Activity limitation

For activity limitations, data that answered 'Yes' or 'No' to the question 'Are you currently limited from daily life and social activities due to health problems or physical or mental disorders?' were used.

### 3. Statistical analysis

The KNHANES data were weighted based on the extraction and response rates so that the subjects participating in the survey could represent the

people of Korea. The weights were then considered for analyzing the data for this study. The general and health-related characteristics of the subjects were analyzed using descriptive statistics, chi-square test. The subjects' depression and health-related quality of life were compared according to their activity limitation. Gender, age, BMI, smoking and drinking status, marital status, and subjective health status were all adjusted and evaluated using logistic regression analysis to determine the relationship between the respondents' activity limit and their quality of life regarding depression and health. The data analysis used the SPSS 27.0 (IBM Corp, Armonk, NY, USA) program, and the statistical significance level was defined as p < 0.05.

## RESULTS

### 1. General and health-related characteristics of the study subjects

Of the total 527 people surveyed, there were 256 men and 271 women, and the average age was 73.2 and 74.5 years, respectively. With regards to BMI, 54.5% of the participants were in the normal category and 43.2% fell in the

**Table 1.** General characteristics of this study population

| Characteristics | Categories | N (%) or Mean ± SD |
|---|---|---|
| Age (years) | Male | 73.2 ± 0.4 |
| | Female | 74.5 ± 0.3 |
| Sex | Male | 256 (47.8) |
| | Female | 271 (52.2) |
| Income (individual) | Quartile 1 (lowest) | 153 (30.8) |
| | Quartile 2 | 138 (25.1) |
| | Quartile 3 | 119 (21.1) |
| | Quartile 4 (highest) | 117 (23.1) |
| Spouse | Yes | 346 (62.3) |
| | No | 181 (37.7) |
| BMI (kg/m²) | Underweight (<18.5) | 11 (2.3) |
| | Normal (≥18.5, <25) | 296 (54.5) |
| | Overweight (≥25) | 220 (43.2) |
| Smoking status | Current | 65 (11.6) |
| | Former | 175 (33.3) |
| | Never | 287 (55.1) |
| Alcohol drinking status | Yes | 250 (47.9) |
| | No | 277 (52.1) |
| Subject health status | Good | 56 (11.0) |
| | Common | 203 (39.7) |
| | Poor | 268 (49.3) |
| Activity limitation | Yes | 170 (32.3) |
| | No | 357 (67.7) |
| Depression (diagnosed by a doctor) | Yes | 52 (8.8) |
| | No | 475 (91.2) |

Mean ± SD. BMI: body mass index.

overweight category. Of the total participants, 11.6% were current smokers, 33.3% used to smoke in the past, and 55.1% were non-smokers. Over the past year, 47.9% of the participants had been drinking more than once a month. Almost half 49.3% of the respondents said their subjective health status were rather poor. The number of participants diagnosed by doctors as suffering from depression was about 8.8%, as shown in Table 1.

### 2. Differences in the quality of life related to depression and health due to activity limitation of stroke patients

The health-related quality of life for stroke patients was significantly lower statistically than 0.67 ± 0.02 points for those who responded that there was an activity limitation based on a maximum value of 1 and 0.85 ± 0.01 for those who said there was no activity limitation. The differences in quality of life due to limitations on activities showed statistically significant differences in mobility, self-care, usual activity, pain/discomfort, and anxiety/depression. Subjective health conditions were the poorest in those with activity limitation, wherein 68.4% of the participants answering "poor," while 45.0% answered "common" for those without activity limitation. The diagnosis of depression showed a statistically significant difference of 16.0% in the group with activity limitation and 5.6% in the group without activity limitation (Table 2).

**Table 2.** Response of depression and health-related quality of life according to the activity limitation of stroke patients

| Characteristics/Categories | | Activity limitation (Mean ± SD or %) | | | |
|---|---|---|---|---|---|
| | | Yes (n = 170) | No (n = 357) | $\chi^2$ | p |
| EQ-5D | Index* | 0.67 ± 0.02 | 0.85 ± 0.01 | | <0.001 |
| | Problem of mobility* | 77.9 | 45.9 | 49.181 | <0.001 |
| | Problem of self-care* | 50.2 | 19.2 | 59.856 | <0.001 |
| | Problem of usual activities* | 41.9 | 3.2 | 85.478 | <0.001 |
| | Problem of pain/ discomfort* | 71.6 | 43.7 | 45.689 | <0.001 |
| | Problem of anxiety/ depression* | 36.9 | 17.4 | 26.058 | <0.001 |
| Subject health status* | Good | 3.7 | 14.5 | | |
| | Common | 27.9 | 45.0 | 35.031 | <0.001 |
| | Poor | 68.4 | 40.4 | | |
| Depression (diagnosed by a doctor)* | Yes | 16.0 | 5.6 | 7.708 | <0.001 |

Mean ± SD. *p < 0.05.

Table 3. Odds ratio of quality of life according to activity limitation of stroke patients

| Individual components | | Activity limitation | | |
|---|---|---|---|---|
| | | Yes OR (95% CI) | No | p |
| EQ-5D | Problem of mobility* | 3.946 (2.411-6.459) | 1 (ref) | <0.001 |
| | Problem of self-care* | 3.905 (2.454-6.213) | 1 (ref) | <0.001 |
| | Problem of usual activities* | 5.288 (3.340-8.371) | 1 (ref) | <0.001 |
| | Problem of pain/discomfort* | 3.310 (2.108-5.199) | 1 (ref) | <0.001 |
| | Problem of anxiety/depression* | 2.649 (1.635-4.292) | 1 (ref) | 0.003 |

p values were obtained by logistic regression analysis adjusted for sex, age, income (individual), spouse, BMI, smoking status, alcohol drinking status, subject health status. *p<0.05.

### 3. Odds ratio of quality of life and depression according to activity limitation of stroke patients

There was a problem with the quality of life in the participants who answered 'yes' compared to the participants who answered 'no' to the activity limitation of stroke patients. More specifically, the case of mobility problems in stroke with activity limitations was 3.946 times higher, 3.905 times higher in self-care, 5.288 times higher in usual activities, 3.310 times higher in pain/discomfort, and 2.649 times higher in anxiety/depression (Table 3).

The odds ratio of those diagnosed with depression, which was adjusted for gender, age, personal income level, BMI, smoking and drinking status, marital status, and subjective health conditions differed depending on whether they were restricted from their activities. The diagnosis of depression in those who answered that there were limitations on activity was 4.092 times higher than those who did not have any activity limitation (Table 4).

## DISCUSSION

This study used data from the KNHANES to look at the effects of activity limitation on the quality of life and depression of stroke patients. There were significant differences in the association between depression and health-related quality of life, stratified by activity limitations in 527 stroke patients. The diagnosis of depression for stroke patients with activity limitation was 16.0% and 5.6% with no activity limitation-a statistically significant difference. The comparison of influence between the two groups showed 4.04 times higher for those with activity limitation. These findings can be said to have a high degree of correlation between activity limitation

Table 4. Odds ratio of depression according to activity limitation of stroke patients

| Depression | Activity limitation | | |
|---|---|---|---|
| | Yes OR (95% CI) | No | p |
| Diagnosed by a doctor | 4.092 (2.123-7.886)* | 1 (ref) | <0.001 |

p values were obtained by logistic regression analysis adjusted for sex, age, income (individual), spouse, BMI, smoking status, alcohol drinking status, and subject health status. *p<0.05.

and depression in stroke patients.

This is consistent with the results of a prior study, which showed that the more the stroke patients perform their daily routine, the lower the level of depression, and the reverse correlation.[13] Another study reported that depression is a symptom that usually accompanies the acute and convalescence of stroke patients,[14] and that although early treatment focuses on improving physical function, early-stage depression can be an obstacle to rehabilitation will and functional recovery.[15] In this study, the diagnosis of depression was 4.092 times higher in stroke patients with activity limitations. This provides evidence that emotional therapy through continuous observation should be included in the initial rehabilitation program to prevent depression in stroke patients with activity limitations.

Comparing health-related quality of life relationships with activity limitation, EQ-5D index was significantly different, with 0.67±0.02 for those who reported activity limitation and 0.85±0.01 for those who did not report any limitation. Individual items also showed statistically significant differences in mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. In terms of the influence of activity limitations on quality of life, the respondents who reported "severe problems" were 9.91 times higher, 7.85 times higher, 8.62 times higher, 5.88 times higher, and 4.02 times higher for each of the above individual items, respectively. These results indicate a significant decrease in the quality of health-related life and serious problems with motor skills, self-care, usual activities, pain/discomfort, anxiety/depression, and depression in stroke patients compared to those with no activity limitations.

The results of the association of quality of life resulting from activity limitation in this study are in line with the reported study that the quality of life for stroke subjects improves 4.53 times when daily activities increase by one unit.[16] In addition, the quality of life of stroke patients is a correlated variable between depression and everyday behavior, and it is consistent with a prior study that calls for interventions of various programs, such as improving independent activities and training of daily movements through physical and occupational therapy, to improve the quality of life.[17]

Despite some meaningful discoveries in this study, there are a few limitations that need to be mentioned. Firstly, in the case of KNHANES data, there are some issues that are difficult to grasp about more detailed demographic and medical variables, such as specific areas of the brain lesions, the presence of psychiatric disorders before the outbreak, the presence and type of rehabilitation treatment at present, etc. Secondly, the sociodemographic characteristics of the study population were collected through investigation, which may have led to recall bias. Therefore, it is believed that more comprehensive research is needed to compensate for these shortcomings in the future. Despite these limitations, the clinical and research implications are significant because this study represents the Korean population with a large sample size and has enabled various statistical adjustments that could increase the validity, sensitivity, and robustness of the study.

Through this study, we looked at the limitation of activities in stroke patients and its effects on depression and quality of life for these patients. It was observed in our research that a statistically significant percentage of stroke patients with activity limitation were diagnosed with depression and that their quality of life was compromised. This requires a psychological approach to the treatment of stroke patients; and a systematic and ongoing rehabilitation program also needs to be considered.

The conclusion of this study is that limitation of activity in stroke patients is closely related to diagnosis of depression and health-related quality of life. It is believed that depression and the poorer quality of life resulting from limitation of activities in stroke patients should continue steadily from the initial stage, as the recovery rate will be about 70% within three months of the onset, and the recovery rate will gradually slow down until the next six months.[18] Moreover, since depression and quality of life do not improve in a short period of time, it is thought that a systematic and continuous rehabilitation program is essential. Furthermore, this study provides basic data that psychological factors such as depression should be included in rehabilitation interventions for stroke patients.

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