

# Prevalence and associated factors of post-stroke depression among stroke survivors during the early rehabilitation period: a cross-sectional study

S A T Harini, C Suraweera

## Abstract

### Background

Post-stroke depression (PSD) is the commonest psychiatric morbidity observed among stroke survivors and it has a significant negative impact on the rehabilitation process.

### Aims

This study aimed to identify the prevalence of PSD, its associated factors, and the relationship between the severity of depression and functional impairment among stroke survivors during the first six months of rehabilitation.

### Methods

A descriptive cross-sectional study using a convenient sampling method was carried out at the Rheumatology and Rehabilitation Hospital (RRH), Ragama, among patients during the first six months following stroke. PSD was screened with Sinhala and Tamil translations of the Patient Health Questionnaire-9 (PHQ-9) and functional ability was measured using the validated Lawton Instrumental Activities of Daily Living (IADL) scale. Pearson's correlation coefficient, ANOVA, independent-sample t-test, and binary logistic regression were used for statistical analysis.

### Results

Among 70 participants of ages 33-79 years (mean  $\pm$  SD:  $56.3 \pm 11.31$ ) depressive symptoms were observed among 74.3%. A negative correlation ( $-0.428$ ) was observed between PSD and functional ability. There was a statistically significant association ( $p < 0.05$ ) between PSD and female gender, stroke affecting the dominant side of the body and previous history of stroke. A low score on IADL (OR =  $0.506$ , 95% CI:  $0.274 - 0.936$ ) and stroke affecting the dominant side of the body (OR =  $0.013$ , 95% CI:  $0.01 - 0.270$ ) was observed to be significant risk factors to be screened positive for major depression as per the PHQ-9.

### Conclusion

We detected a high prevalence of PSD among the participants as per the PHQ 9 and a negative correlation between PSD and functional ability. Screening for depression and appropriate management of PSD in stroke survivors should be practised during the early rehabilitation period.

**Keywords:** stroke, post-stroke depression, rehabilitation, impairment

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## Introduction

Stroke or 'cerebrovascular accident' (CVA) is reported as the second leading cause of premature mortality and the third leading cause of disability-adjusted life years (DALYs) worldwide (1). Depression is reported as the most common post-stroke psychiatric complication and patients with untreated post-stroke depression (PSD) show less improvement in rehabilitation, poorer functional outcomes, worsening quality of life (QoL) and higher mortality rates compared to non-depressed patients with stroke (2).

The reported prevalence of PSD shows a wide variation with values ranging from 20% to 81% (2-4). The variability

in the results could be attributed to the different methodologies used in the above studies (4). Multiple studies have found that PSD has been associated with functional disability that occurs after stroke (3,5,6).

Previous research has shown that a relatively steady state in the recovery takes place during the first six months following a stroke and that depression that occurs during this period complicates the recovery process (3,7,8).

Even though PSD among stroke survivors have been studied previously, there is limited data regarding the prevalence of PSD during the initial six months of

rehabilitation in Sri Lanka (7,8). This study aimed to identify the prevalence of PSD, its associated factors, and the relationship between the severity of depression and functional impairment among stroke survivors during the first six months of rehabilitation.

## Methods

A cross-sectional descriptive study was conducted at the Rheumatology and Rehabilitation Hospital (RRH), Ragama, Sri Lanka among patients aged 20-80 years who had suffered a stroke during the preceding six months who were able to provide written informed consent, undergoing rehabilitation at the Department of Physiotherapy, RRH. The study was conducted from September 2020 to March 2021. Patients with communication and comprehension difficulties, impaired consciousness, severe cognitive deficits and who were unable to provide consent, were excluded.

The ethical approval was obtained from the Ethics Review Committee, Faculty of Medicine, University of Colombo, Sri Lanka (UCP-AL-16-358).

A semi-structured questionnaire was used to gather the demographical and stroke-related data. The validated Sinhala and the Tamil translation of the Patient Health Questionnaire-9 (PHQ-9) and the validated Lawton Instrumental Activities of Daily Living (IADL) scale were used to assess depression, its severity and the functional level respectively (9,10).

The PHQ-9 is a self-administered instrument for diagnosing depressive disorder and serves the dual purpose of diagnosing and assessing the severity of depression (11). Total scores of 5, 10, 15, and 20 represent the cut-off points for mild, moderate, moderately severe, and severe depression respectively in the validated Sinhala forms of PHQ-9 (9,11). The PHQ-9 has been shown to have acceptable psychometric properties for detecting depression in post-stroke patients (8,11,12).

The participants filled in the Sinhala or the Tamil versions of the PHQ-9s depending on their language preference.

The Lawton IADL scale consists of eight criteria that assess activities of daily living that include the ability to use a telephone, shopping, food preparation, house-keeping, laundry, transportation, responsibility for own medications and handling finances (13). It is scored by rating each category dichotomously (0 = less able, 1 = more able). The Lawton IADL scale is culturally adapted and validated to the Sri Lankan setting (10).

Statistical Package for Social Sciences version (SPSS) 23.0 was used to analyse the data. The prevalence of mild to severe depression was categorized and analysed using descriptive analysis. Pearson's correlation coefficient was used to identify the nature and strength

of the relationship between PSD and functionality. Associated factors for PSD were measured using one-way ANOVA and independent sample t-test. The binary logistic regression was used to identify the possible predictors of PSD during rehabilitation.

## Results

The study sample consisted of 70 participants, with a mean age of 56.29 years ( $SD \pm 11.311$ ).

The PHQ-9 scores for depression in the sample ranged from 0-17 (mean score 7.16,  $SD \pm 4.11$ ) and 74.3% screened positive for some degree of depression while 28.57% were detected to have major depression (Table 1, Figure 1).

Table 1. Prevalence of post-stroke depression graded according to the severity of depression

| Depression severity       | Frequency | Percentage |
|---------------------------|-----------|------------|
| None (0-4)                | 18        | 25.7%      |
| Mild (5-9)                | 32        | 45.7%      |
| Moderate (10-14)          | 16        | 22.9%      |
| Moderately severe (15-19) | 4         | 5.7%       |
| Total                     | 70        | 100.0%     |

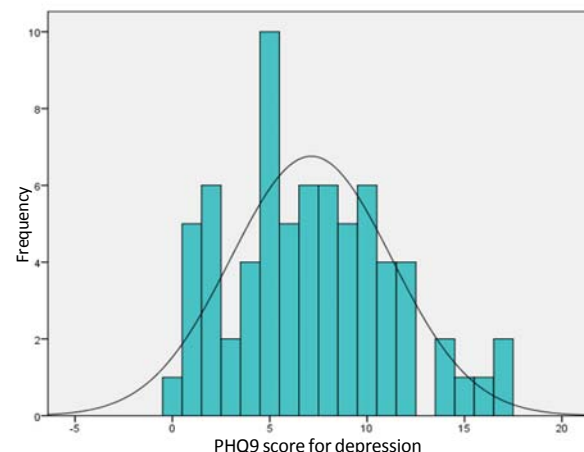


Figure 1. Distribution of Patient Health Questionnaire-9 score for depression.

The presence of major depression (PHQ-9 score  $\geq 10$ ) categorized into demographic characteristics is described in Table 2.

The total scores of the Lawton IADL scale for functionality for each patient ranged from 0 to 8, with a mean of 3.41 ( $SD \pm 1.974$ ). There was a statistically significant negative association ( $p=0.000$ ,  $r = -0.428$ ) between PSD and functionality level (Figure 2).

Table 2. Presence of major depression categorized into demographic factors

| Demographic factors                  | Frequency of having major depression | Percentage of having major depression |
|--------------------------------------|--------------------------------------|---------------------------------------|
| <b>Age</b>                           |                                      |                                       |
| < 60 years (n = 44)                  | 16                                   | 36.4%                                 |
| > 60 years (n = 26)                  | 4                                    | 15.4%                                 |
| <b>Sex</b>                           |                                      |                                       |
| Male (n=39)                          | 7                                    | 17.9%                                 |
| Female (n=31)                        | 13                                   | 41.9%                                 |
| <b>Marital status</b>                |                                      |                                       |
| Married (n=65)                       | 20                                   | 30.8%                                 |
| Unmarried (n=5)                      | -                                    | 0                                     |
| <b>Ethnicity</b>                     |                                      |                                       |
| Sinhala (n=62)                       | 20                                   | 32.3%                                 |
| Tamil (n=6)                          | -                                    | 0                                     |
| Malay (n=2)                          | -                                    | 0                                     |
| <b>Level of education</b>            |                                      |                                       |
| Not completed OL (n=23)              | 7                                    | 30.4%                                 |
| Completed OL (n=29)                  | 8                                    | 27.6%                                 |
| Completed OL (n=13)                  | 5                                    | 38.5%                                 |
| Completed degree or equivalent (n=5) | -                                    | 0                                     |

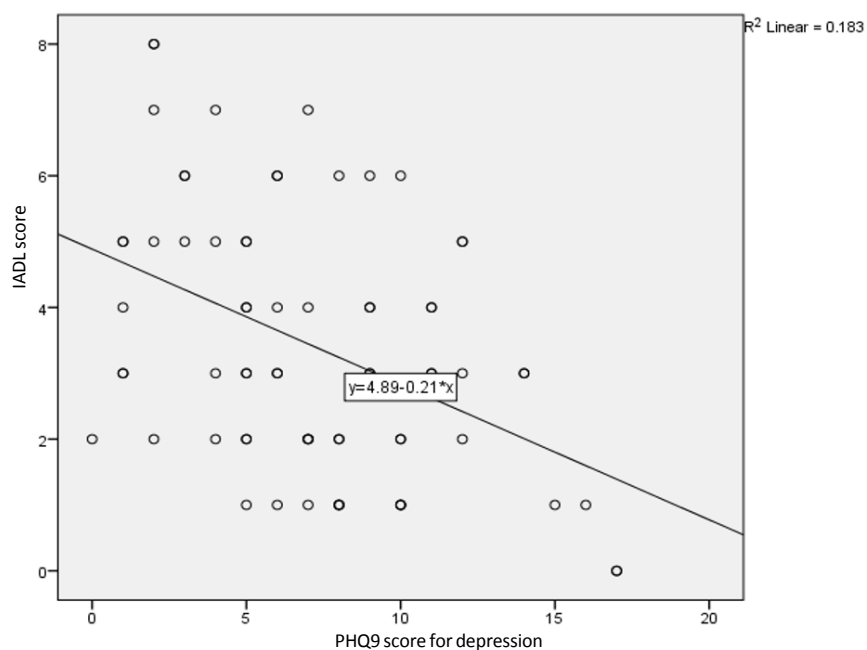


Figure 2. Relationship between functionality level and the severity of post-stroke depression.

Table 5. Risk factors for major depression

| Variable                      | B coefficient | Standard Error | df | P value      | Odds ratio (OR)  | 95% C.I. for OR |             |
|-------------------------------|---------------|----------------|----|--------------|------------------|-----------------|-------------|
|                               |               |                |    |              |                  | Lower bound     | Upper bound |
| IADL score                    | - 0.681       | 0.313          | 1  | <b>0.030</b> | <b>0.506</b>     | 0.274           | 0.936       |
| Age < 60 years                | 0.287         | 1.134          | 1  | 0.800        | 1.333            | 0.144           | 12.309      |
| Female sex                    | - 0.208       | 0.935          | 1  | 0.824        | 0.812            | 0.130           | 5.074       |
| Ethnicity*                    |               |                | 2  | 1.000        |                  |                 |             |
| Sinhala                       | 18.308        | 28420.714      | 1  | 0.999        | 893869<br>42.643 | 0.000           | -           |
| Tamil                         | -1.430        | 32080.175      | 1  | 1.000        | 0.239            | 0.000           | -           |
| Married                       | -18.955       | 16765.602      | 1  | 0.999        | 0.000            | 0.000           | -           |
| Education**                   |               |                | 3  | 0.173        |                  |                 |             |
| Not completed O/L             | 14.183        | 16743.566      | 1  | 0.999        | 144383<br>9.652  | 0.000           | -           |
| Completed O/L                 | 17.080        | 16743.566      | 1  | 0.999        | 261761<br>99.783 | 0.000           | -           |
| Completed A/L                 | 18.183        | 16743.566      | 1  | 0.999        | 788268<br>98.941 | 0.000           | -           |
| The dominant side is affected | -4.369        | 1.561          | 1  | 0.005        | 0.013            | 0.001           | 0.270       |
| Prior stroke incidents        | -2.245        | 1.605          | 1  | 0.162        | 0.106            | 0.005           | 2.460       |

\* Malay is the reference category for ethnicity

\*\* Completed degree or equivalent is the reference category for education

## Discussion

The prevalence of PSD during the first six months is high in the current study (74.3%), with 28.6% scoring ten or above in the PHQ-9. The relatively high prevalence of PSD in our sample when compared to other studies could be attributed to various methodological differences, including the tools used to detect depression and other sample characteristics (2-4). Even though the overall PSD prevalence is relatively high in this study, most were found to have mild depression (4,5,7). Similar to another study, 28.6% of participants had major depression (7). The negative correlation we observed between the functional level and PSD has been reported in other studies (3,4).

While we found female gender to be significantly associated ( $p < 0.05$ ) with PSD, other studies (14-16) have found males to have a higher risk of developing PSD than females (4,17).

Participants whose dominant side of the body was affected had a higher mean PHQ-9 score of 9.91 ( $SD \pm 4.660$ ) than those who had their non-dominant side affected ( $PHQ-9 = 5.77, SD \pm 3.073$ ). Pooled evidence in a meta-analysis revealed that the level of handicap is a predictor and or an associated factor for PSD (16). The increased dependency on ADLs due to the level of handicap may increase the physiological and psychological burden of patients, which may predispose them to develop PSD (16).

Even though the history of a previous stroke had a statistically significant association ( $p < 0.05$ ) with PSD in our sample which has been shown in other studies, we could not find that it was a strong predictor ( $p > 0.05$ ) for developing major depression (15).

In our study, age was not found to be associated with PSD ( $p > 0.05$ ) and this is in concordance with several previous studies (4,18). However, some studies report

young age as a risk factor while others report older age (> 70 years) as a risk factor (19, 20). A meta-analysis showed that middle-aged patients are more prone to develop PSD than older adults (> 70 years) and that this may be due to the sudden loss of work capacity and their difficulties in facing physical disabilities than their older counterparts (16).

In our study, marital status was not found to be an associated factor for PSD ( $p = 0.170$ ), however, this finding may be due to the high proportion of married patients in the sample. Some existing studies state that PSD is associated with being married while others report that PSD is associated with being divorced (4,18).

We did not find a significant association between the education level and PSD ( $p > 0.05$ ), however, several previous studies report a positive association between lower education levels and PSD (21).

Although we did not find a positive association between ethnicity and PSD, a study conducted in Malaysia reports a correlation between ethnicity and PSD (22).

None of the participants in our sample had a previous diagnosis of depression. However, studies conducted in other countries have identified previous diagnosis of depression as a risk factor for developing PSD (15,16).

## Limitations of the study

The study was conducted during the COVID-19 period with a relatively small sample which may place limitations in interpreting the results. The PHQ-9 was used to screen for depression and the participants were not interviewed by a trained clinician to diagnose depression. Therefore, participants with anxiety and stress could have responded positively to some of the questions which may have increased the number of those who scored at or above the cut-off of the PHQ-9. We did not study other confounding factors for depression including the impact of COVID 19 which may also have contributed to the high prevalence of depression.

The Tamil translation of the PHQ-9 questionnaire used in our study was not validated among the Tamil-speaking population which is another limitation of our study.

## Conclusions

We report a high prevalence of depression during the first six months after stroke and recommend standardising guidelines and protocols in the regular screening for depression among this population.

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Investigators bore all the expenses of the study.

## Statement of contribution

TH and CS conceptualized the research and developed the proposal. TH collected the data and wrote the original manuscript. CS supervised the procedure and edited the manuscript. Both authors approved the final manuscript.

## Declaration of interests

None.

**S A T Harini**, Department of Allied Health Sciences, Faculty of Medicine, University of Colombo, Sri Lanka

**C Suraweera**, Department of Psychiatry, Faculty of Medicine, University of Colombo, Sri Lanka

**Corresponding author:** S A T Harini

**E-mail:** thameeshaharini@gmail.com

 <http://orcid.org/0000-0001-5859-0945>

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