Title: Prevalence and Associated Factors of Psychological Distress of Patients with Stroke Attending a Neurology Clinic – An Analytical Cross-sectional Study

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Discussion Points: Psychological distress is a significant issue in the current context accounting for approximately ¼ of the post-stroke patients. Many factors influence it.

ABSTRACT.

Background: A vast range of factors leads to psychological distress among stroke patients causing poor outcomes. This study was aimed to assess the prevalence of psychological distress and identify the factors associated with it among patients with stroke attending the Neurology Clinics of the National Hospital of Sri Lanka (NHSL), Colombo.

Methods: A descriptive cross-sectional study with an analytical component was conducted among 177 patients with stroke attending the Neurology Clinics of the NHSL, Colombo who were sampled by multistage random sampling. Psychological distress was assessed using the Kessler Psychological Distress Scale (K-10). Data collected under 6 domains underwent initial bivariate analysis using Chi square and Fisher's Exact Tests followed by multivariate analysis via binary logistic regression.

Results: The mean age of the participants with stroke was 59.7 (SD:12.3) years. The prevalence of psychological distress among stroke patients was found to be 23.3% (95% CI:16.1–31.9). During bivariate analysis, six factors (p<0.05) were significant. The regression analysis identified five independent predictors: younger age (*OR* =0.87, *95% CI*=0.79–0.97, p<0.05), female gender (*OR*=70.94, *95% CI*=3.73–1348.89, p=0.05), patient being the sole source of income (*OR*=24.71, *95% CI*=1.67–362.01, p<0.05), increased level of disability (*OR*=13.05, *95% C*I=3.59–47.36, p<0.001), and past personal history of psychiatric disorders (*OR*=172.59, *95% CI*=3.64–8174.42, p<0.05) with a R^2 of 0.772.

Conclusion: The prevalence of psychological distress among patients with stroke attending the Neurology Clinics of the NHSL, Colombo is considerably high and is associated with multiple health and non-health related factors.

Key Words: psychological distress, stroke, cross-sectional studies, Sri Lanka

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INTRODUCTION.

Stroke is one of the major causes, which reduces the quality of life. According to the American Heart Association, stroke is described in relation to brain, spinal cord or retinal cell death from ischemia or hemorrhage based on symptoms persisting for >24 hours/death or pathological, radiological or objective evidence which is not attributable to trauma.(1) Stroke is the second most common cause of death and the third most common cause of disability-adjusted life years lost worldwide (2). Regarding Sri Lanka, stroke is the sixth leading cause of death and fifth leading cause of disability-adjusted life years lost. (3)

Stress can be defined as a real or perceived perturbation to an organism's psychological, resulting in activation of coping mechanisms such as behavioral changes, activation of the sympathetic nervous system and adrenal medulla and secretion of stress hormones. Thus, distress denotes a negative state which the coping mechanisms and adaptation processes have failed to return the organism to the normal state. (4)

Approximately one third of post-stroke patients suffer from psychological distress (PsyD) worldwide. (5) A multitude of factors affect the prognosis of PsyD among the post- stroke patients and at the end lead to poor outcomes such as limitation of daily activities, poor rehabilitation outcomes, social isolation, poor functional recovery, vascular events, and recurrent episodes of stroke. (6)

Most research found in the literature was found to be focused on the effect of either depression or anxiety on stroke patients rather than assessing the combined effect (7). Added to that, was the use of specific rating scales to assess either the level of PSD (Post-stroke depression) or PSA (Post-stroke anxiety) which was rather more sensitive in measuring the common level of distress rather than an isolated condition. The conclusions of Schramke et al. (1998) states that "these results suggest the need for caution in using rating scales of depression and anxiety in neurologic patients and support the notion that these scales are sensitive to distress rather than specific for identifying depressive and anxiety disorders" supporting the validatory importance of a general approach to PsyD to avoid misinterpretations and inequity towards different groups within the same study population.(8) Furthermore stroke induced PsyD carries a greater risk of mortality, social impairment, and poor drug compliance imposing detrimental effects on the quality of life of the patient and pose a long-lasting effect on the rest of the family as well (7).

Hence, we believe that psychiatric consequences of stroke are significant, especially in low-income settings comparable to that in developed countries and aim to have a wholistic approach in this regard by the assessment of PsyD. The conduction of these studies can be used to identify the potential factors that can have possible implications which can be beneficial in the local setting, as it allows future researchers to correlate local and international research evidence to improve the practical applications of findings. The conclusions thus derived, can be used in Sri Lanka as well as in other lower middle-income countries to channel their limited resources for early detection and prevention which is of higher feasibility than the medical management that follows progressed severe clinical depression. Furthermore, it can also be applied in the busy clinic and ward schedules that are commonly seen here, as clinicians will only require to direct their specific psychiatric concerns towards a selected group of people with a potential tendency.

METHODS

Study Design

A descriptive cross-sectional study with an analytical component was conducted in the Neurology Clinics of the National Hospital of Sri Lanka (NHSL), Colombo, which is the largest tertiary care hospital in the country. The analytical component was incorporated with the intention of assessing the prevalence of psychological distress amongst adult post-stroke patients and thereon evaluate the factors influencing it in order to pragmatically apply them, particularly in resource-poor clinical settings. The study period extended from April 2021 to December 2021 and data collection was carried out during the month of September 2021. The study population was based on the adult post-stroke patients attending the Neurology Clinics of the study setting since long-term management of stroke is mainly based on an out-patient basis in the local context. Patients diagnosed with stroke who were above 18 years of age and had been diagnosed at least 1 month prior were included in the study while patients with significant language and cognitive impairment that will hinder the fidelity of the data, other severe disabilities unrelated to the stroke such as loss of limb and those severe mental illnesses (preceding the stroke) and confusion which impair the capacity to give consent were excluded.

Sampling and Data Collection

A probability-based systematic sampling method was initially decided to be used in this research. The first five stroke patients attending each clinic fulfilling the inclusion and exclusion criteria were to be given sequential numbers and one number to be selected via a random number generator as the first participant to be recruited from that clinic. Thereafter, every other patient satisfying the inclusion and exclusion criteria was to be recruited into the study until the required sample size was completed. However, due to the CoVID-19 pandemic situation in the country during the period of data collection and practical difficulties imposed by pandemic lockdown the sampling method was switched to multistage random sampling. Accordingly, two out of the four consultants holding Neurology Clinics, NHSL, Colombo were randomly selected. Thereafter, the clinic records of all the post-stroke patients currently attending their clinics were accessed and a list of patients with contact numbers conferring to the inclusion and exclusion criteria was formed listed under sequential numbers. Thereafter, 180 patients were randomly selected using a random number generator (allocating 144 participants for entry and 36 patients considering for a non-response rate of 20%). These patients were contacted via phone at a convenient time for the patient and study instruments were administered upon the acquisition of informed consent.

Ethical clearance was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Colombo (MFC/AL/2017/1290) and administrative clearance was acquired from the director of the National Hospital of Sri Lanka, Colombo, and permission from the consultants of all four neurology clinics.

Study Instruments

The study instrument used for the purpose of this study comprised of three separate sections, all of which were interviewer administered to the participants. (Figure 1) None of the three sections of the study instrument involved any manuals in requiring training of investigators. However, a discussion amongst the investigators took place to consistency and advice was obtained from a consultant psychiatrist to gain insight regarding this process.

- Section A – A questionnaire developed by the investigators under the supervision of a consultant psychiatrist to identify the various factors listed under the socio-demographic, health related, stroke related, behavioral, stressful life event, and family and caregiver factorial domains.

- Section B – Interviewer administered Kessler's psychological distress scale (K- 10) standardized and validated for the Sri Lankan population. (9)
- Section C – Interviewer administered 10-item Barthel Index standardized and validated for the Sri Lankan population by Lekamwasam et al. (2011) and the modified Rankin scale. (10)

Data Analysis

Dichotomization of the Dependent Variable

Data was analyzed descriptively and analytically by the SPSS statistical software version 26. The validation of the K-10 to the Sinhala speaking population of Sri Lanka by Wijerathne et al. (2005), presented a cutoff of ≥22 to categorize patients as 'distressed' or 'non- distressed', which was used to differentiate the distressed patients from the non-distressed patients. (9)

Descriptive Analysis

The descriptive analysis of results was done using frequency distributions for basic sociodemographic and stroke related details. Numerical variables were described via means and SDs and categorical variables via proportions.

Statistical Analysis

Factors affecting PsyD were evaluated under several domains (Figure 2). Out of them, four domains which were not directly related to the health of the patient were first analyzed, followed by two health related domains (the stroke related and other health related factors). Accordingly, two main statistical methods were used; bivariate analysis using chi-square tests and simple logistic regression followed by multivariate analysis by multiple logistic regression.

For each of the domains, categorical variables were subjected to initial bivariate analysis using Chi-square tests (and Fisher's exact tests when necessary) to identify the association between the factors of each domain on the level of PsyD. Significance was expressed in the form of *p* values and values of < 0.05 were considered as statistically significant in all associations.

Bivariate Analysis

The bivariate analysis of continuous independent variables (age, number of stroke events, time since last stroke event, level of dependence on Activities of Daily Living and the level of disability) were carried out using simple logistic regression where the results were presented in the form of odds ratio with 95% confidence intervals while considering *p* values <0.05 as significant. The level of PsyD persisted to become the dependent variable of all the analysis.

Multivariate Analysis

Under multivariate analysis, a hierarchical binary logistic regression analysis was carried out. Initially, the factors age, gender and history of psychiatric disorders were entered into the model since they were strong confounders as repeatedly identified in literature (11). Thereafter, the other independent predictors which were identified to be significant using bivariate analysis were included into the second block with the rest of the predictors in the third block in order to assess for confounding amongst variables in bivariate analysis. Predictors in the second and third blocks were added in a stepwise manner into the process of analysis. Accordingly, after assessment of multicollinearity and exclusion of any outliers, a final single model was formed by isolating the factors that are

proven to be significant even after undergoing multivariate analysis ($p < 0.05$). The goodness-of-fit of the model was assessed using the Hosmer-Lemeshow test.

RESULTS.

Study Sample

The study included 177 subjects with a response rate of 67.8 %. The ages of the participants ranged from 27 to 91 with a mean age of 59.7 years, standard deviation of 12.3 years and normal distribution. 27.5 % (n = 33) of the patients were employed and 93.3% (n = 112) of the total sample had received formal secondary education. Majority of the participants had ischemic stroke (85%, n = 102).

The K-10 scores of the study sample ranged from 10 to 47 (total range of the scale is 10 – 50), with a mean score of 16.7 and a standard deviation of 8.4 indicating an acceptably wide distribution. Based on the cut-off, 23.3% (n = 28) of the study sample was found to be distressed.

Results of Bivariate Analysis

Socio-demographic factors, presence of at least one stressful life event and family and caregiver related factors did not possess statistically significant associations with PsyD according to the results of the bivariate analysis using chi-square tests and simple logistic regression (all *p* values > 0.05)**.** The chi square analysis revealed that history of psychiatric disease (*p* value = 0.003), first-degree relatives with psychiatric diseases (*p* value = 0.034) (under health-related factors), the frequency of engaging in physical/leisure activities prior to stroke (*p* value < 0.05) (under lifestyle related factors) to be significantly associated with PsyD**.** Under stroke-related factors: time since last stroke event (*p* value = 0.036, level of disability (*p* value < 0.000) and level of dependence (*p* value = 0.021) were significantly associated with PsyD during simple logistic regression **(Tables 1).**

Results of Multivariate Analysis

The multivariate logistic regression analysis showed a statistically significant influence of younger age (*p* value = 0.010), female gender (*p* value = 0.005), presence of a history of psychiatric disease (*p* value = 0.009), being the sole source of income to the family (*p* value = 0.019) and increasing level of disability (*p* value < 0.001) on the presence of PsyD ($\chi 2$ (5) = 68.0, $p < 0.001$). The model was checked and cleared from potentially significant outliers and the variance inflation factors of the five predictors during the collinearity statistics were; 1.045, 1.166, 1.064, 1.159 and 1.094 respectively, well below the standard cutoff for significant correlation between predictors.(1: no correlation, 1 – 5 moderate correlation with no significant impact on the model, >5: severe correlation with imprecise model) The Hosmer-Lemeshow Goodness-of-fit test for the model displayed a χ^2 (8) = 4.1 and $p = 0.852$ and the Omnibus Chi-square value was χ^2 (5)= 68.0 with a *p* value < 0.001. The overall prediction percentage of the model was 92.6%, well above the standard cutoff of 80%. The model was able to explain 77.2% of the variance (Negelkerke R^2) with a sensitivity of 73.3% and specificity of 96.6%. **(Table 2)**

DISCUSSION.

This study was carried out to assess the prevalence and the associated factors of PsyD among the post-stroke patients attending the Neurology Clinics of the NHSL, Colombo. The cross-sectional study design facilitated the investigators to compare distressed and non-distressed patients and the strength of each factor in its influence on the presence of psychological.

The prevalence of PsyD in the current study is comparable to that reported in other local and international studies. The differences could be attributed to the differences in the sample sizes, age ranges of participants and other restrictions in inclusion criteria. (8) (12) (13)

Under the different variables, factors like age and gender were discussed frequently in past studies with contrastingly different results with some presenting young age as a risk factor and others as a protective factor or as insignificant. However, in the present study age was recognized to be statistically significant in the final model of binary logistic regression (OR = 0.87: 95% CI: 0.79 – 0.97; p = 0.010). This might confirm the findings of the systematic review by Hackett and Anderson (2005), where age is considered as a crucial demographic factor that is to be mandatorily included in multivariate analysis (11). Thus, the contrasting findings in different studies might be due to the confinement to bivariate analysis in most studies and not including multivariate analyses.

In the current study, gender was not found to have a statistically significant influence on PsyD in the initial bivariate analysis while female gender was found to be significant in multivariate analysis. Similarly, 13 out of 21 studies reviewed by Robinson and Jorge, 2016, did not find gender as a significant predictor on PSD, in their initial analyses.(14)

Studies by Ferro et al., 2016 and Mirolovics et al., 2020, indicate higher educational levels as a protective factor for PsyD which was not identified by this study neither in bivariate nor multivariate analysis (15) (16). This could be attributed due to differences in the study samples, specifically due to lower proportions of participants with lower educational levels which could have affected the findings (proportion of participants with an educational level less than Grade 5 was 6.7%).

The current study did not identify the level of income as a significant predictor of PsyD, which was different from studies conducted by Mirolovics et al., 2020, which recognized higher economic status to be associated with lower PsyD [15]. This association could have been due to the costs of medication and acquisition of health facilities which play a significant role in the long-term management of stroke. However, this might not be relevant in the local setting due to the presence of a free health care service in the country indicative of the non-significant results.

Furthermore, a study conducted in China, identified hypertension to be significantly associated with PsyD in both bivariate and multivariate analyses. However, none of these factors were found to have a statistically significant association with PsyD in the present study. In the Chinese study, only young patients in the age range of 20 to 44 years were considered which could have had a significant influence on the results, as younger patients being an economically driving force in all societies will be greatly impacted by the presence of other chronic conditions in addition to the stroke itself. This is further gratified by the absence of age adjustment in none of the regression models where hypertension was found to be statistically significant (model for the Symptom Checklist 90 Revised and the model for anxiety).

A meta-analysis carried out by Mitchell et al., 2017, identified both past personal and family history of depression as key risk factors for post-stroke depression, adjustment disorder and anxiety. (17) Even though, family history of psychiatric disorders was statistically significantly associated with PsyD only in the initial bivariate analysis in this study, significant results were found regarding past personal history of psychiatric disorders in both bivariate and multivariate analyses.

When considering behavioral factors, a Norwegian study exploring the association between pre-stroke physical activity with symptoms of anxiety and depression 3 months post-stroke, identified higher activity levels prior to the stroke event to be protective against post-stroke depression in their multivariate analysis despite 41.5% of the study population, not having a significant reduction or increase in the level of physical activity following the stroke event. This contrasts with the present study which found no significant association between the engagements in physical activities prior to the stroke event with the presence of PsyD. However, the frequency of physical activities prior to the stroke event was significantly associated with PsyD in the bivariate model (it was not included in the final regression model due to effects of multicollinearity). Here, higher frequencies of physical activity prior to the stroke event were associated with the presence of distress which could be associated with the mental stress in such patients due to limitation of activity following the disabilities imposed on them by the cerebrovascular accident. However, other factors under this domain such as religious activities which were specifically included to suit the local cultural setting but not openly discussed in literature; were insignificant in their results.

Under family and caregiver factors even though certain studies state the importance of family members and friends in relieving the internal isolation experienced by patients, a quantitative analysis of this by means of the marital status, number of family members and dependents came out to be insignificant. (18)

Stroke related factors were considered as one of the most highly debated factors in literature. For example, regarding the time since the last stroke event, some studies presented that depressive symptom decreased with the time since stroke while others expressed otherwise. In the initial bivariate analysis of this study via simple logistic regression an increase in the time since the last stroke event (in years) was associated with a reduction in PsyD (OR = 0.74; 95% CI:0.56 – 1).

Unlike other factors of the same domain, stroke related disability and dependence on the Activities of Daily Living (ADL) were both consistently associated with higher levels of distress and depression in post-stroke patients. The systematic review by Hackett and Anderson (2005) identifies disability status to be a factor that should be prioritized by both researchers and clinician in detection of depression among post-stroke patients (11). Similarly, disability status assessed by the modified Rankin scale was identified to be a statistically significant predictor of PsyD in both bivariate and multivariate analysis in the current study ($p < 0.001$).

Accordingly, these factors identified can be utilized at the point of discharge in the early rapid recognition of patients for referrals and during follow-up care so that limited psychiatric resources could be efficiently channeled to prioritize patients who are at a comparatively high level of risk.

Throughout the interpretation of the results of the final logistic regression model, the wide confidence intervals obtained for the different predictors, particularly for the presence of a history of psychiatric disorders, female gender and the being the sole source of income, even after assessments for multicollinearity and outliers should be given due significance. While it is in congruence with the similar findings in literature discussed above with very strong associations established with the dependent variable, imprecision due to small size should always be considered and noted.

It is notable that there were several limitations in the study with relevance to; (1) inability to obtain an adequate sample size due to pragmatic issues from the pandemic situation which could potentially have had a significant impact on the statistical analysis as well, (2) low response rate of 67.79%, (3) absence of temporal associations between the predictors and outcomes due to the study design, (4) inability to generalize findings outside the study setting due to the absence of multiple center involvement in the study setting, (5) inability to assess the added impact of the CoVID-19 pandemic on patients, (6) change in the sampling method to multistage random sampling and data collection via phone calls over direct face-to-face interviews due to the pandemic. Hence, further research should be encouraged particularly by incorporating clinical assessment to the screening tools in the assessment of PsyD and by including details regarding stroke subtype classifications and stroke severity assessments via radiological and clinical data. Furthermore, such studies should be expanded to a multi-center level and incorporate direct investigator-participant interactions to reduce bias and expand generalizability. Moreover, it will be important to explore the challenges faced by post-stroke patients who are not apparently psychologically distressed and the factors that influence poor outcomes in them as well.

CONCLUSION.

In conclusion, this study conducted to make a wholistic approach on the psychological consequences of stroke on patients revealed a significant prevalence of PsyD amongst post-stroke patients in the outpatient setting and was associated with several health and non-health related factors. These findings comparable with international studies shed light on the Sri Lankan perspective and has a multitude of clinical implications in the long-term care of these patients specially in low-income settings. However, several limitations owing to pandemic situation in which the study was conducted and inherent characteristics of the design itself directs potential for further research on this topic. Nevertheless, this study landmarked as potentially the first of its kind in Sri Lanka for the best of our knowledge, can direct the course of neuropsychiatric care of post-stroke patients by transcending beyond clinical and sociodemographic characteristics to include caregiver as well as family related data to identify patients at risk.

SUMMARY – ACCELERATING TRANSLATION

Prevalence and Associated Factors of Psychological Distress of Patients with Stroke Attending a Neurology Clinic – A Descriptive Cross-sectional Study

Aims: To assess the prevalence of psychological distress and identify the factors associated with it among the post-stroke patients attending the Neurology Clinics of the National Hospital of Sri Lanka (NHSL), Colombo.

Background – A multitude of factors affect the prognosis of psychological distress among post- stroke patients. Existing studies have primarily focused on post-stroke anxiety or depression using non-specific scales. These scales may not fully represent the outcomes. Even though many factors are known to be associated with psychological distress, there are a lot of controversies regarding many factors. Very few studies have accounted for the effects of confounding in their analysis in identifying potential predictors.

Outcomes of the Study – Psychological distress is a significant issue in the current context accounting for approximately ¼ of the post-stroke patients. Age, gender, being the sole source of income, history of psychiatric disorders and the level of disability assessed by the modified Rankin Scale were identified as statistically significant predictors of psychological distress via binary logistic regression analysis.

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1 **FIGURES AND TABLES.**

2 **Figure 2.** Classification of variables included into the main domains assessed.

Study Variables		
Socio-Demographic	**Health Related**	**Stroke Related**
Gender	Hypertension	Number of stroke events
Age	Dyslipidemia	Time since the last stroke event
Ethnicity	Diabetes Mellitus	Type of stroke
Highest Level of Education	History of Psychiatric Disorders prior to stroke	Dominance of the side effected
Monthly Household Income	Family History of Psychiatric Disorders	Follow-up care received
Employment Status		Membership of the stroke support group
Behavioural	**Family and Caregiver**	**Stroke related Disability**
Status of smoking	Marital status	Barthel Index
Frequency of smoking	Sole source of income	Modified Rankin Scale
Effect of stroke on frequency of smoking	Number of children	
Status of alcohol consumption	Presence of caregiver	
Frequency of alcohol consumption	Association with the caregiver	
Effect of stroke on alcohol consumption	Time spent with the caregiver	
Status of engagement in physical/leisure activities		
Frequency of engagement in physical/leisure activities		
Effect of engagement in physical/leisure activities		
Status of religious activities		
Frequency of religious activities		
Effect of stroke on religious activities		

Figure 1: Conceptual framework for Psychological Distress among Stroke Patients

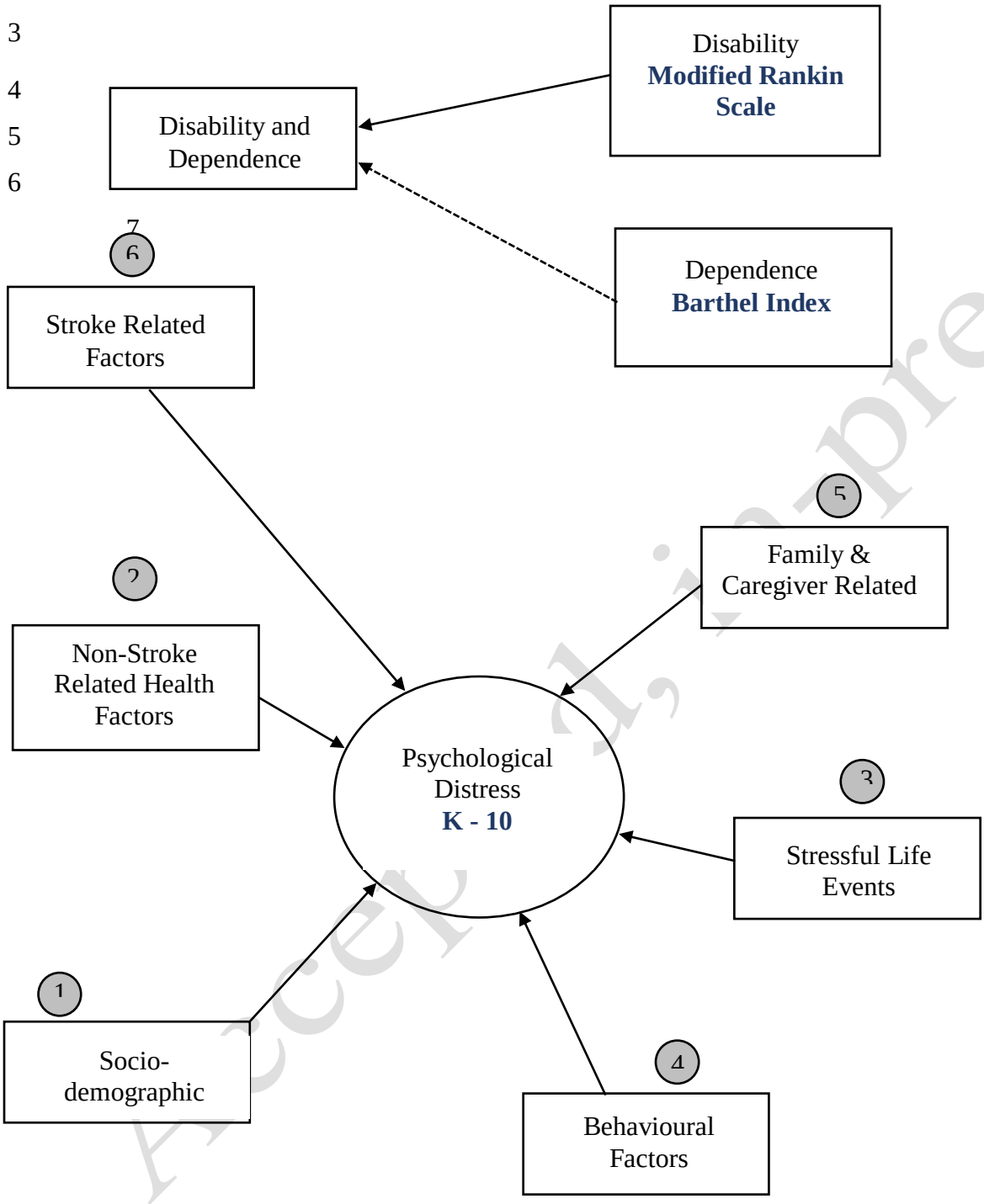

Figure Legend:
The presence of psychological distress assessed via K – 10, was hypothesized to be influenced by factors under 6 domains (stroke and non-stroke related health factors considered collectively as health factors). Blocks refer to the clusters of variables, solid arrows refer to expected causal effects, dashed arrows refer to components of a cluster and text in bold refer to study instruments used. Data regarding the content numbered 1 – 6 were obtained from Section A of the questionnaire.

Table 1: Three continuous variables (time since the last stroke event, level of dependence and level of disability) associated with psychological distress of stroke patients (n = 120)

Predictor	*p*	OR	95% CI for OR
Time since last stroke event[a]	*0.036*	0.74	0.56 – 0.98
Level of Dependence[b]	0.021	0.99	0.97 – 1.00
Level of Disability[c]	$p < 0.000$	2.01	1.46 – 2.78

OR = Odds Ratio; CI = Confidence Interval; [a] Omnibus $\chi^2(1) = 10.95$, $p < 0.05$, $R^2 = 0.124$ (Negelkerke); [b] Omnibus $\chi^2(1) = 5.189$, $p < 0.05$, $R^2 = 0.065$ (Negelkerke), level of dependence regarding activities of daily living was assessed using the Barthel Index Score; [c] Omnibus $\chi^2(1) = 21.195$, $p < 0.05$, $R^2 = 0.248$ (Negelkerke), level of disability was assessed based on the Modified Rankin Scale

Table 2: Results of the Multivariate Regression Analysis (n = 112) on predictors of psychological distress.

Predictor	*p*	Unadjusted OR	Adjusted OR	95% CI
History of Psychiatric Disorders[a]	0.009	5.15	172.59	3.64 – 8174.42
Yes				
Age	0.010	-0.13	0.87	0.79 – 0.97
mRS	*p < 0.001*	2.57	13.05	3.59 – 47.36
Gender[b]	0.005	4.26	70.94	3.73 – 1348.89
Female				
Sole Source of Income[c]	0.019	3.21	24.70	1.67 – 362.01
Yes				
Constant	0.045	-4.77	0.008	

OR = Odds Ratio; CI = Confidence Interval; mRS = modified Rankin Scale; Omnibus χ^2 (5) = 68.022, p < 0.001, R^2 = 0.772 (Negelkerke)
Reference levels of the independent categorical levels
[a] absence of a history of psychiatric diseases; [b] male gender; [c] Not the sole source of income