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Factors Related to Depression among Caregivers Attending Post-Ischemic Stroke Patients

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Abstract

BACKGROUND: Stroke is known as chronic disease, leading to disability which makes help from caregivers become necessary. Attending stroke patients possess certain challenges and burdens toward the caregivers.

AIM: We aim to investigate risk factors related to depression among caregivers attending post-ischemic stroke.

METHODS: Eighty-three caregivers and post-ischemic stroke patients were collected consecutively from the Neurology Department of Universitas Sumatera Utara Hospital, Medan, Indonesia. Linear regression was used to analyze the data.

RESULTS: Our multivariate study shows that patient's age, caregiver's gender, patient's gender, and modified Barthel Index are associated with depression with adjusted R2 of 59.3%.

CONCLUSION: Early detection and intervention should be addressed regularly for caregivers attending post-stroke patients.

Introduction

Caregiving is often linked to personal satisfaction of helping relieving someone else's or our loved one's burden. This has shown to be related to more positive feeling as the caregivers often feel the importance of their presence and that their act is needed by others. On the other hand, caregiving takes numerous efforts that may become a stressor for the caregiver. This type of stressor is tend to be persistent and uncontrollable, therefore, one-third of caregivers reported that their daily caregiving practice contributes to great deal of burden [1], [2].

Stroke is acute neurology deficit that is related to damage blood flow to the brain. Damaged blood flow is linked to endothelial dysfunction due to thrombus and increased viscosity of the blood [3]. Stroke has been known as the leading cause of death and contributes to increased prevalence of disability and approximately US$ 59,800 to US$ 230,000 cost [4]. Hemorrhagic stroke comprises 14% of all stroke cases and as its name suggests, hemorrhagic stroke causes bleeding in brain parenchyma, subarachnoid, or subdural part of the brain. On the other hand, ischemic stroke is marked by inadequacy of blood flow to any area of the brain due to occlusion or endothelial dysfunction which causes neuronal viability cannot be maintained [3], [4]. Unlike hemorrhagic stroke that causes high mortality, ischemic stroke in particular is responsible for nearly 85% disability cases [5], which is the reason why we chose to study ischemic stroke patients.

Among post-ischemic stroke patients, recovery time refers to time taken for rehabilitation that begins right after the patients are hemodynamically stable which may take weeks or months [6], [7]. A study by Berg *et al*. in Finlandia involving 98 caregivers attending first onset ischemic stroke patients assessed with Beck Depression Inventory (BDI) found that 30–33% of the caregivers reported depressive symptoms with even worse severity compared to depression occurring in the patient [8]. Previous meta-analysis study by Loh *et al*. in 2016 also noted that depression is found in 40% of caregivers. They found that Caucasian female caregivers are more likely to develop depression [9]. Therefore, we believe that depression is actually

common among caregivers attending post-stroke patients and that psychiatry support is necessary. To address more appropriate intervention, acknowledging risk factors related to depression among these caregivers are necessary.

Methods

This cross-sectional multivariate study was conducted from November 2020 to January 2021 at Universitas Sumatera Utara Hospital. Our study is a type of dyadic study in which both caregivers and their attended patients were assessed at the same type [10], [11]. Linear regression which is known as dependency-based multivariate analysis was used in the study [12], [13].

Our study involved caregivers attending post-ischemic stroke patients visiting neurology outpatient clinic at Universitas Sumatera Utara Hospital that fulfilled inclusion and exclusion criteria. Inclusion criteria for caregivers involved in as in the following: (1) Caregivers age 17–60 years old [14], [15], [16], (2) graduated at least from senior high school, (3) fluent in Indonesian language, (4) willing to participate in the study, and (5) spend at least 21 h of attending the patient in a week [17]. As for the patient, we only included those who visited the clinic with the caregiver and those with modified Barthel Index of <20. Formal caregiver [18] with any disability who attends more than 1 patient is excluded from the study. Post-stroke patient with a history of multiple stroke and other comorbidities (except hypertension and diabetes mellitus) is not included in the study.

Sample was collected consecutively and a total of 83 subjects were involved in the study. Subjects were given informed consent before the study and were requested to fill in personal data on participant's form. Direct interview was conducted in accordance with COVID-19 health protocols. Depression severity was assessed using BDI-II, on the other hand, daily living activity among post-stroke patients was assessed using modified Barthel Index.

BDI-II is a self-report questionnaire developed by Farinde in 1961, which is widely used to assess depression severity in individuals of above 13 years of age. It consisted of 21 questions with maximum total score of 63 and minimum score of 0. Each question items are scored from 0 to 3 to reflect the intensity of the symptoms [19]. In Indonesia, BDI II has been validated by Ginting *et al*. in 2012. They found Cronbach's alpha of 0.91 in depressive individuals [20]. In Indonesia, cutoff point of BDI-II is 17 [21]. On the other hand, Indonesian version of modified Barthel Index was first developed to assess the degree of dependency of stroke patients in conducting their activities of daily living. This instrument is valid and reliable to be used in stroke patients [11].

Once data have been collected, it is analyzed further using SPSS version 23. Independent variables are gender of patient and caregiver, relationship of caregiver-patient, age of caregiver and patient, caregiver's education, caregiver's income, patient's onset, length of caregiver-patient relationship, working duration, and Indonesian version of modified Barthel Index. While, on the other hand, depression score assessed by BDI-II is the dependent variable. Linear regression was used in this study after the following prerequisites are met; (1) normal residual spread can be proved by histogram, (2) residual mean from descriptive statistic equals to 0, (3) no outlier (as shown in casewise diagnostic), (4) constant (as shown in scatter graph between residues and independent variable), (5) independent (as shown by Durbin-Watson test), (6) no indication of multicollinearity (as proved by Pearson and correlation test on independent variables), and (7) linearity between independent and dependent variables (as shown in scatter graph). Kolmogorov–Smirnov test was conducted initially to assess normality of the data. When data are normally distributed, Pearson test can be used, while, on the other hand, when data are not normally distributed, Spearman will be used. Only independent variables with $p < 0.25$ that will be proceeded for further analysis using linear multivariate regression [22], [23].

Results

More than half of caregivers that we interviewed are female (n = 58, 69.88%) and already married (n = 66, 79.52%). We also found that more than half of the caregivers are actually the spouse of the stroke patients (n = 47, 56.63%). About 75.90% of post-stroke patients we met are male (n = 63). Median of caregivers age is 45 years old, and most spent 12 years pursuing their education. They also admit of receiving around IDR 2.3 million. On the other hand, most post-ischemic stroke patients are already 58 years old, and the oldest patient we found is 70 years of age. Most of these patients have suffered from stroke for 16 weeks and spent 7 h a day with their caregivers. We found that majority of these patients have Barthel Index of 9 (Table 1).

We also conducted bivariate analysis for each of the variables consisting of four categorical and eight numerical variables (Tables 2 and 3). Only independent variables with $p < 0.25$ were proceeded in the study for regression test. Independent t-test was used when both independent and dependent variables distribute normally, while Mann–Whitney U-test was used when data distribution is not normal [22]. We found that caregivers marital status has $p = 0.367$, therefore, this variable was excluded from the study. We also found that patients onset has $p = 0.373$, therefore, it was also excluded from the study.

Table 1: Caregivers and their patients characteristics

Variable	Value (n = 83)	
	Median	n (%)
Caregivers age (years)	45 (18–60)	
Caregivers gender		
Male		25 (30.12)
Female		58 (69.88)
Caregivers relation to patient		
Spouse		47 (56.63)
Child/child in law		36 (26.37)
Caregivers education (spent years)	12 (12–16)	
Caregivers monthly income (IDR million)	2.3 (1–8.95)	
Patients age	58 (46–70)	
Patients gender		
Male		63 (75.90)
Female		20 (24.10)
Patients onset (months)	16 (1–145)	
Length of caregiver-patient relation (months)	11 (1–120)	
Caregivers working duration (daily)	7 (3–8)	
Barthel Index	9 (2–16)	
Caregivers marital status		
Married		66 (79.52)
Not married		17 (20.48)

Backward method was used to achieve the fittest model, as for this study, we performed this test 7 times before getting the fittest model. We finally found that model 1 was shown to pose the highest determinant coefficient of 59.3%.

Table 2: Bivariate analysis of categorical independent variables and BDI-II

Variable	Mean ± SD	p
BDI-II	17.63 ± 8.88	
Caregivers gender[a]		
Male	14.84 ± 9.42	<0.001
Female	18.83 ± 8.43	
Caregiver-patients relation[a]		
Spouse	18.94 ± 8.88	0.125
Child/child in law	15.92 ± 8.71	
Patients gender[b]		
Male	16.78 ± 8.52	0.155
Female	20.30 ± 9.67	
Caregivers marital status[b]		
Married	18.08 ± 8.92	0.367
Not married	15.88 ± 8.74	

[a]Independent t-test, [b]Mann–Whitney U-test, BDI: Beck Depression Inventory.

Variables that are still included in the study after these multiple tests are patients age, caregivers gender, patients gender, and modified Barthel Index. From Table 4, it is also shown that adjusted R^2 is 59.3% with Durbin-Watson test showed 1.955, therefore, zero residue was achieved.

Table 3: Bivariate analysis of numerical independent variables and BDI-II

Variable	Mean ± SD	r	Median	p
BDI-II	17.63 ± 8.88			
Caregivers age		0.28	45 (18–60)	0.010
Caregivers education		–0.164	16 (12–16)	0.138
Caregivers monthly income		–0.147	2,3 (1–8,95)	0.184
Patients age		0.308	58 (46–70)	0.005
Patients onset		–0.099	16 (1–145)	0.373
Length of caregivers-patient relation		–0.152	11 (1–120)	0.171
Caregivers daily working duration		0/203	7 (3–8)	0.065
Barthel Index		–0.685	9 (2–16)	<0.0001

r = Pearson correlation determinant coefficient, BDI: Beck Depression Inventory.

From Table 5, we also succeed to show that no outlier was also achieved as the difference from minimum value (–2.553) and maximum value (2.328) is within the interval of −3 < SD <3. Other pre-requisites, such as linearity, normal distribution, and constancy, were fulfilled as shown in the figures below. We found that independent risk factors related to depression among caregivers are patients age, gender of both caregivers and patients, and Barthel Index (Table 6). The scatterplot and histogram for statistical analysis can be seen on (Figures 1-3), precisely.

Table 4: Model summary of the seventh linear regression

Model	R	R square	Adjusted R square	Std. error of the estimate	Durbin-Watson
1	0.783a	0.613	0.593	5.663	1.955

Table 5: Residual statistics

Variable	Minimum	Maximum	Mean	Std. deviation	n
Predicted value	1.70	31.94	17.63	6.951	83
Residual	–14.456	13.184	0.000	5.523	83
Std. predicted value	–2.292	2.059	0.000	1.000	83
Std. residual	–2.553	2.328	0.000	0.975	83

Discussion

Barthel Index is a common instrument used to assess physical limitation which is the most common effect of stroke experienced by post-stroke patients. This physical limitation is often related to the requirement of caregiver.

Table 6: Multivariate analysis

BDI-II score	Correlation coefficients	Multivariate regression β	p
Constant		20.942	0.001
Patients age	0.166	0.225	0.027
Caregivers gender	0.279	–1.575	0.002
Patients gender	–0.343	5.363	<0.001
Barthel Index	–0.650	–7.073	<0.001

Adjusted R^2 59.3%, BDI: Beck Depression Inventory.

Daily caregiver work is tremendous which is related to the development of depression among caregivers. Studies also showed that stroke is more common in women which also are related to depression severity among the caregivers [24]. Female caregiver is also more likely to develop depression. This has been linked to neurohormonal aspect, as well as the fact that most female caregivers have multiple responsibilities, including taking care of their own family and earning money for their family. In our study, we found that female caregiver is more likely to develop depression which is supported with the study from Loh *et al*. in 2016, indicating that female is positively correlated with depression severity (p = 0.00087) [9].

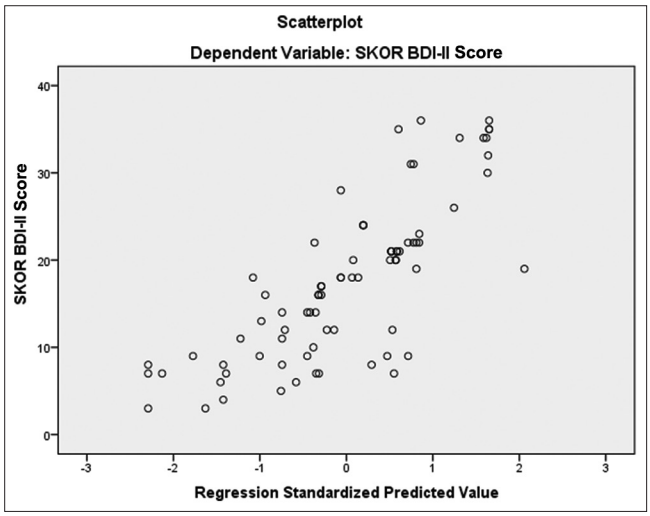

Figure 1: Linearity as shown from scatterplot

We also noted that patient's age is linked to depression severity among caregivers, as increasing age is linked to multimorbidity, thus making caregiving practice even harder [10]. In clinical perspective, depression is viewed as neurotransmitter abnormality in the brain related to monoamine (serotonin, noradrenaline, and dopamine). It has also been associated with decreased hippocampal volume and other structures, including prefrontal cortex, subgenual and anterior cingulate cortex, as well as ganglia basali [25]. As for Barthel Index, we found that increased Barthel Index is related to less severe depression which is similar to the previous study from Em *et al*. in 2017 ($p < 0.001$) [26].

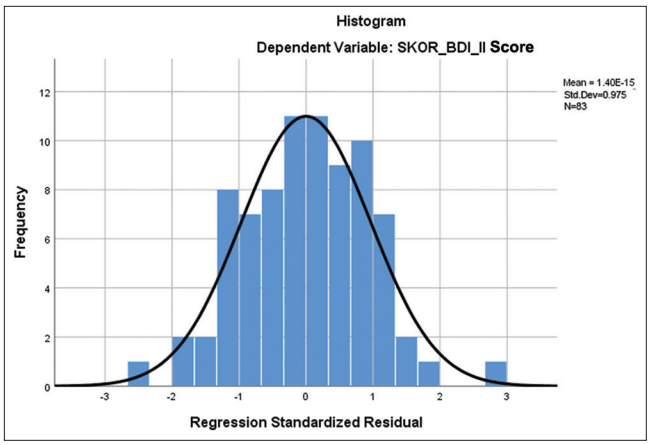

Figure 2: Residual normality as shown in histogram

The strength of our study is that ours is the first dyadic study conducted in North Sumatera and that restriction was applied to control confounding factors. Yet, we are also aware that cross-sectional approach that we chose may not be able to completely establish cause-effect relationship as temporality is not achieved. Another consideration is that caregivers that we interviewed may have reported less severe symptoms to appear as stronger and more courageous person (faking good). As we are limited in resource, we can only conduct the study at one center.

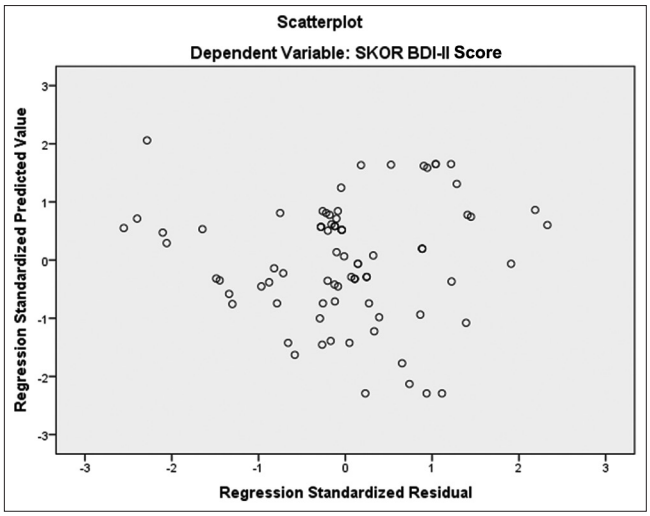

Figure 3: Scatterplot showing no certain shape indicating that constancy is achieved

Conclusion

We found that independent risk factors related to depression among caregivers are patients age, gender of both caregivers and patients, and Barthel Index. Early detection and intervention should be addressed regularly for caregivers attending post-stroke patients.

Declarations

Authors' contributions

All authors contributed equally to this work.

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Ethics approval and consent to participate

The Research Ethics Committee approved this study at the Faculty of Medicine, Universitas Sumatra Utara, with the letter number 656/KEP/USU/2021 on November 24, 2020. All participants write and sign a consent to participate before attending this study. Data will not be shared to respect the privacy of the participant.

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