Research Article

Potential Factors for Psychological Symptoms at Three Months in Patients with Young Ischemic Stroke

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Objective. Psychological status plays a vital role in the recovery in young ischemic stroke patients. However, few reports on the psychological symptoms in Chinese young ischemic stroke patients have been published. In the present study, we aimed to outline the psychological status of young ischemic stroke patients and its risk factors at three months after their stroke. Methods. 364 patients with young ischemic stroke and 384 age-matched healthy controls were consecutively recruited from our study hospitals of the mainland of China between June 2018 and November 2020. Social demographic and clinical data were collected from all enrolled participants in the acute stage of their stroke, and their psychological variables were assessed via the Symptom Checklist 90 Revised (SCL-90-R) at three-month timepoint after their stroke. Multivariable logistic regression analyses were run to identify the independent factors for psychological variables in patients. Results. Compared with healthy controls, patients with young ischemic stroke had significantly higher total score of SCL-90-R and all subscale total scores (p < 0.01 or 0.05). 22.3% (81/364 cases) in young ischemic stroke patients had psychological abnormalities. Compared with young ischemic stroke patients without psychological symptoms (n = 283), patients with psychological symptoms (n = 81) had higher rate of married status (p = 0.03), rate of hypertension (p = 0.01), infarct size (p = 0.01), and the family dysfunction (p < 0.01). Multivariate logistic regression analyses revealed that the family dysfunction (odds ratio [OR], 2.50, 95% confidence interval [CI]: 1.71 to 3.54, p < 0.01), having hypertension (OR, 3.27, 95% CI: 1.92 to 4.27, p = 0.02), and ≥20mm³ infarct size (OR, 2.39, 95% CI: 1.53 to 3.45, p < 0.01) were independent factors for having psychological abnormalities in patients with young ischemic stroke at three months after their stroke. Single (OR, 1.23, 95% CI: 1.03 to 1.54, p = 0.01), poor family function (OR, 1.21, 95% CI: 1.05 to 1.45, p = 0.03), and ≥20mm³ infarct size (OR, 1.74, 95% CI: 1.14 to 2.31, p = 0.02) were independent factors for having depression in patients with psychological symptoms. The family dysfunction (OR, 2.32, 95% CI: 1.51 to 2.80, p < 0.01) and hypertension (OR, 2.41, 95% CI: 1.54 to 3.46, p = 0.03) were independent factors for emerging somatization and anxiety in patients with psychological symptoms, respectively. Conclusions. At three months after their stroke, young ischemic stroke patients had psychological problems and risk factors for developing them.
**1. Introduction**

Stroke is one leading cause of death in adults worldwide [1, 2] and is one of the main causes of death and a significant contributor to disability in adults in China, characterized by high rates of morbidity, fatality, and disability, bringing a severe economic burden [3–5]. Among the stroke population, the incidence of stroke in older adults decreases while the incidence of young adult stroke is increasing, around 1 in 10 about a young adult [1]. Youth adult stroke often occurs in adults aged 18 to 60 years, especially 18 to 45 years [6]. Moreover, there is a trend that stroke occurs in individuals at a younger age [6, 7]. Most importantly, stroke in young adults has a considerable socioeconomic influence associated with high health-care costs and tremendous loss of labor productivity [4, 6, 8, 9]. Therefore, any potential characteristics of the young adults’ stroke still need to be further emphasized [10].

The negative emotion is one of the most symptoms emerging in patients with stroke [10, 11]. Unfortunately, the current optimal management of young adult patients with stroke, unlike treatment for older adults, is unknown [1, 12]. The available recovery strategy for young stroke patients does not provide psychological intervention [10]. The related risk factors on young adult patients have been summarized in the recent review [1], as there is no report on the psychological symptoms and its risk factors in young ischemic stroke patients.

The recovery for young ischemic stroke patients relies on not only physical rehabilitation but also psychological situation [1, 10, 13, 14]. Recent studies have shown that the post-stroke psychological status plays a role in the recovery of young ischemic stroke patients in the clinical practice setting [10, 15], while family support and social support are important factors associated with psychological status for persons who can find assistance from outside when they need help [16–18]. These aforementioned studies suggest that the post-stroke psychological level is necessarily explored in young ischemic stroke patients for their recovery. Here, we conducted a prospective study to investigate the psychological status and its risk factors in these populations.

**2. Methods**

2.1. Clinic Setting. All 364 patients and 384 age-matched healthy controls were consecutively recruited from our study hospitals and their health management departments, including 5 comprehensive hospitals of the mainland of China between June 2018 and November 2020. The study protocols were approved by the Local Ethics Committees of Xuanwu Hospital, Capital Medical University (LYS2018008) and Dongyang People’s Hospital, Wenzhou Medical University (2017-KY-036 and 2018-YX-051). All subjects provided written informed consent. This research was conducted by the Helsinki Declaration.

2.2. Participants. Patients were consecutively enrolled the study if they met the following criteria: (a) aged 18 to 45 years, (b) satisfied the stroke diagnostic criteria formulated by the Chinese cerebrovascular disease classification and were confirmed by magnetic resonance imaging or computed tomography scan [19], (c) could answer questionnaires independently, and (d) knew his/her illness. The exclusion criteria were (a) presence of the other nonvascular causes (such as primary brain tumor, brain metastases, subdural hematoma, postictal paralysis, and brain trauma) related to brain dysfunction; (b) a previous history of depression, psychosis, and dementia; (c) could not understand and complete the examination; and (d) refused to provide written consent.

2.3. Measures. At the baseline (i.e., in the acute stage of stroke), the following basic data were collected. Sociodemographic and clinical data were collected from all enrolled participants in the acute stage of their stroke, including age, sex, living area (i.e., urban and rural), education status (i.e., junior high school and lower, senior high school and higher), marital status (i.e., married, unmarried, divorced, and widowed), having medical insurance (yes or no), monthly income (>6,000 Yuan, ≤6,000 Yuan), smoke and drink dependence (yes or no), hypertension (yes or no), diabetes (yes or no), atrial fibrillation (yes or no), the National Institute of Health Stroke Scale (NIHSS) [20], the modified Rankin Scale (mRS) [21], the Barthel Index (BI), infarct location (i.e., cortex, white matter lesions, basal ganglia + thalamus, brain stem, and cerebellum) [22, 23], and infarct size (≥20 mm³ or <20 mm³) calculated in three days after stroke onset by manually delineating the hypodense infarcted area(s) on hyperintense area(s) on axial diffusion weighted imaging slices on magnetic resonance imaging (MRI) [24, 25].

At three-month time after their stroke, all participants’ psychological state was evaluated. In details, the psychological status, family function, and social support were assessed via the Symptom Checklist 90 Revised (SCL-90-R), the family function assessment scale (FFAS), and the social support rating scale (SSRS) at three months after stroke, respectively. After obtaining written informed consent, as explained by our study alliance doctors, all participants were administered via the questionnaires for their clinical assessment. The qualified raters were trained to give information about the questionnaire to the participants, who were permitted to complete the questionnaire by themselves without time restriction and in a state where patients were willing to cooperate.

The SCL-90-R is a 5-point scale, 90-item self-report tool that measures the degree of symptoms on different dimensions such as somatization, obsessive-compulsive, depression, anxiety, phobic anxiety, hostility, interpersonal sensitivity, paranoid ideation, and psychoticism [26]. It is widely used to screen psychological symptoms, and the Chinese version of the SCL-90-R is reported [27] with favorable validity and reliability [28]. Higher scores indicate more significant psychological symptoms. For Chinese, the total score of SCL-90-R is over 160, which is regarded as the criteria of an individual who has abnormal psychological status [29]. The results on SCL-90-R of the study were compared with the previously reported standard models of 1986 [30] and 2006 [31].

FFAS is a 3-point scale (0—not at all, 1—sometimes, 2—often), 5 items self-report instrument to evaluate family functioning via five dimensions, including adaption, cooperation, growth, affection, and intimacy. The total score of FFAS is 10.
points, and the higher total score indicates better family func-
tion. The criteria for a good family function, moderate
impairment in family function, and severe impairment in
family function are 7–10 points, 4–6 points, and 0–3 points
of the FFAS total score, respectively [16].

SSRS is a 10-item self-reported tool that evaluates the
degree of an individual’s social support over the past year.
The tool comprises three subscales: subjective support, objec-
tive support, and utilization of support [17]. Subjective sup-
port means perceived social support that individual feel
supported, cared, and helped by his/her family members,
friends, and colleagues (e.g., how many close friends do you
have? (1) None, (2) 1–2, (3) 3–5, and (4) 6). Objective support
refers to visible, practical, and direct support (e.g., the
recourses where you got financial and reliable support when
you needed help?). The employment of support means the
level of social support applied (how do you get help when
in need? (1) I am self-dependent, (2) I seldom ask for help
from others, (3) I sometimes ask for help from others, (4) I
often ask for help from my relatives and friends.). The SSRS
total score ranges from 12 to 66 points, and higher scores
on this tool indicate a higher degree of social support. The
SSRS has been shown to have good reliability and validity,
with Cronbach’s α ranging from 0.825 to 0.896 [18]. The
results of SSRS are classified into three different levels in
our study. It is generally considered <20 points that indicate
that the individual has obtained less social support, 20–30
points suggest that the individual has accepted general social
support, and >30 points indicate that the individual has
received satisfactory social support [18].

### 2.4. Statistical Analysis
In this study, a two-tailed significance level of overall $p < 0.05$ was considered statistically sig-
ificant. SAS, version 9.4 (SAS Institute Inc.), was used.
Continuous data are shown as the means ± standard
deviation. Two-sample Wilcoxon tests for two groups were
applied to evaluate different across groups according to vari-
ous variables, such as sex, living in rural areas, educational
level, marital status, medical insurance, monthly income,
subsistence dependence (smoke, alcohol drink), hypertension,
diabetes, atrial fibrillation, infarct location, family function,
and social support and subscales of SCL-90-R. Subgroup
analyses were performed for young adult stroke patients with
and without psychological symptoms. We performed multi-
variable logistic regression analyses using stepwise variable
selection, and all variables were entered into the model to
explore independent impact factors for psychological status.
$p < 0.15$ was used for variable selection.

### 3. Results

#### 3.1. Comparisons between Young Ischemic Stroke Patients and Age-Matched Young Healthy Controls
In this sample, a total of 364 young adult stroke patients were included, with
an age of $31.8 ± 6.3$ years (from 20 to 44 years). The positive
detection rate of psychological abnormalities in young stroke
patients was 22.3% (81/364 cases), with the reference of 160
as the cut-off value in China [28]. The SCL-90-R total score
and subfactors were presented in Table 1. In comparison
with the age-matched healthy controls during the same study
period, the young patients in our study had higher scores on

### Table 1: Comparisons of SCL-90-R between young ischemic stroke patients and age-matched young healthy controls.

| Features                        | Healthy ($n = 384$) | Patients ($n = 364$) | $p^{1}$ |
|---------------------------------|--------------------|----------------------|--------|
| Age (years), mean ± SD          | 31.9 ± 6.1         | 31.8 ± 6.3           | 0.85   |
| Male sex, % ($n$)               | 33.8 (130)         | 36.5 (133)           | 0.44   |
| Urban residents, % ($n$)        | 92.4 (355)         | 97.2 (354)           | 0.52   |
| Senior high school or higher, % ($n$) | 93.5 (359) | 93.1 (339)           | 0.84   |
| Married, % ($n$)                | 42.2 (162)         | 70.3 (256)           | <0.01  |
| Had medical insurance, % ($n$)  | 98.7 (379)         | 98.6 (359)           | 1.00   |
| Monthly income >6000 yuan, % ($n$) | 57.3 (220) | 56.9 (207)           | 0.91   |
| Total SCL-90-R scores, mean ± SD| 98.6 ± 16.9        | 147.4 ± 26.1         | <0.01  |

#### Subscales of SCL-90-R

| Subject                          | Healthy ($n = 384$) | Patients ($n = 364$) | $p^{1}$ |
|----------------------------------|---------------------|----------------------|--------|
| Somatization, mean ± SD          | 1.1 ± 0.4           | 1.8 ± 0.5            | <0.01  |
| Obsessive-compulsive, mean ± SD  | 1.2 ± 0.3           | 1.7 ± 0.3            | <0.01  |
| Interpersonal sensitivity, mean ± SD| 1.2 ± 0.3        | 1.5 ± 0.2            | <0.01  |
| Depression, mean ± SD            | 1.1 ± 0.3           | 1.7 ± 0.3            | <0.01  |
| Anxiety, mean ± SD               | 1.1 ± 0.3           | 1.8 ± 0.5            | <0.01  |
| Hostility, mean ± SD             | 1.0 ± 0.3           | 1.8 ± 0.4            | <0.01  |
| Phobic anxiety, mean ± SD        | 1.0 ± 0.4           | 1.8 ± 0.4            | <0.01  |
| Paranoid ideation, mean ± SD     | 1.0 ± 0.4           | 1.1 ± 0.1            | 0.02   |
| Psychoticism, mean ± SD          | 0.9 ± 0.2           | 1.4 ± 0.1            | <0.01  |

Abbreviations: SCL-90-R: Symptom Checklist 90 Revised; SD: standard deviation; $^{1}$p value was obtained using chi-square tests or Fisher’s exact tests for categorical variables and Mann–Whitney U tests for continuous variables.
3.2. Clinical Characteristics between Young Ischemic Stroke Patients with and without Psychological Symptoms. Based on the SCL-90-R total score of 160 as a cut-off, all patients were classified into two subgroups as patients with and without psychological symptoms showing in Table 2. Marital status (p = 0.03), hypertension (p = 0.01), infarct size (p = 0.01), and percentage of patients with different levels of FFAS scores (p < 0.01) were found significantly different between two subgroups.

3.3. Multivariate Regression Analysis. The multivariate logistic regression analyses (Table 3) showed that the family dysfunction (odds ratio [OR], 2.50, 95% confidence interval [CI], 1.71 to 3.54; p < 0.01), having hypertension (OR, 3.27; 95% CI, 1.92 to 4.27; p = 0.02), and ≥20 mm³ infarct size (OR, 2.39, 95% CI: 1.53 to 3.45, p < 0.01) were risk factors for psychological symptoms among young ischemic patients.

Table 2: Comparisons on clinical characteristics between young ischemic stroke patients with and without psychological symptoms.

| Characteristics                  | Patients without psychological symptoms (n = 283) | Patients with psychological symptoms (n = 81) | p
|----------------------------------|-------------------------------------------------|---------------------------------------------|---
| Age (years), mean ± SD           | 31.8 ± 6.3                                      | 31.9 ± 6.2                                  | 0.46
| Male sex, % (n)                 | 37.1 (105)                                      | 34.6 (28)                                   | 0.68
| Urban residents, % (n)           | 97.2 (275)                                      | 97.5 (79)                                   | 1.00
| Senior high school or higher, % (n) | 93.6 (265)                             | 91.4 (74)                                   | 0.47
| Married, % (n)                  | 67.5 (191)                                      | 80.2 (65)                                   | 0.03
| Had medical insurance, % (n)    | 98.9 (280)                                      | 97.5 (79)                                   | 0.34
| Monthly income > 6000 yuan, % (n) | 55.8 (158)                             | 60.5 (49)                                   | 0.45
| Smoker, % (n)                   | 23.3 (66)                                       | 14.8 (12)                                   | 0.10
| Drinker, % (n)                  | 24.4 (69)                                       | 29.6 (24)                                   | 0.34
| Hypertension, % (n)             | 10.2 (29)                                       | 21.0 (17)                                   | 0.01
| Diabetes, % (n)                 | 12.4 (35)                                       | 12.4 (10)                                   | 1.00
| Atrial fibrillation, % (n)      | 20.1 (57)                                       | 18.5 (15)                                   | 0.75
| Infarct location, % (n)         |                                                |                                             | 0.06
| Cortex                           | 32.5 (92)                                       | 21.0 (17)                                   | 0.06
| White matter lesions            | 4.6 (13)                                        | 0.0 (0)                                     | 0.00
| Basal ganglia + thalamus         | 32.5 (92)                                       | 39.5 (32)                                   | 0.47
| Brain stem                       | 23.3 (66)                                       | 29.6 (24)                                   | 0.25
| Cerebellum                       | 7.1 (20)                                        | 9.9 (8)                                     | 0.00
| Infarct size mm³, mean ± SD      | 20.63 ± 30.48                                    | 31.87 ± 43.71                               | 0.01
| NIHSS score, mean ± SD           | 2.8 ± 3.3                                       | 2.6 ± 3.2                                   | 0.61
| mRS score, mean ± SD             | 2.5 ± 0.8                                       | 2.5 ± 0.7                                   | 0.78
| Bl score, mean ± SD              | 82.9 ± 24                                       | 81.7 ± 27.6                                 | 0.70
| Total SCL-90, mean ± SD          | 134.8 ± 7.6                                     | 191.6 ± 18.5                                | <0.01
| FFAS total score, mean ± SD      | 4.5 ± 1.5                                       | 4.4 ± 2.2                                   | 0.75
| 7-10                             | 15.6 (44)                                       | 24.7 (20)                                   | <0.01
| 4-6                              | 52.3 (148)                                      | 30.7 (25)                                   | 0.01
| 0-3                              | 32.2 (91)                                       | 44.4 (36)                                   | 0.01
| SSRS total score, mean ± SD      | 34.7 ± 10.2                                     | 33.2 ± 11.3                                 | 0.27
| <20                             | 9.2 (26)                                        | 7.4 (6)                                     | 0.09
| 20-30                           | 22.6 (64)                                       | 34.6 (28)                                   | 0.01
| >30                             | 68.2 (193)                                      | 28.0 (47)                                   | 0.01
| Subjective support, mean ± SD    | 20.1 ± 5.2                                      | 19.3 ± 5.8                                  | 0.22
| Objective support, mean ± SD     | 8.1 ± 3.3                                       | 7.5 ± 3.6                                   | 0.16
| Utilization of support, mean ± SD| 6.5 ± 2.0                                       | 6.4 ± 2.3                                   | 0.85

Abbreviations: SD: standard deviation; NIHSS: National Institute of Health Stroke Scale; mRS: the modified Rankin Scale; Bl: Barthel Index; FFAS: the Family function assessment scale; SSRS: the Social support rating scale; 1 p was obtained using chi-square tests or Fisher’s exact tests for categorical variables and Mann–Whitney U tests for continuous variables.
In depression models, being single (OR, 1.23, 95% CI: 1.03 to 1.54, \( p = 0.01 \)), the family dysfunction (OR, 1.21, 95% CI: 1.05 to 1.45, \( p = 0.03 \)), and \( \geq 20 \text{ mm}^3 \) infarct size (OR, 1.74, 95% CI: 1.14 to 3.13, \( p = 0.02 \)) were selected as independent factors for patients with psychological symptoms. For somatization and anxiety, the family dysfunction (OR, 2.32, 95% CI: 1.51 to 2.80, \( p < 0.01 \)) and hypertension (OR, 2.41, 95% CI: 1.54 to 3.46, \( p = 0.03 \)) were predictors among patients with psychological symptoms, respectively.

### 4. Discussion

The study showed that young ischemic adult stroke patients at three-month timepoint after their stroke had obvious psychological symptoms with an incidence of 22.3%, and the patients with psychological symptoms had higher percentages of married status, hypertension, family dysfunction, and large infarct size. The family dysfunction, having hypertension, and larger infarct size were prominently risk factors for those young patients developing psychological symptoms at three months after stroke.

Around one-fifth of patients with young ischemic stroke had psychological symptoms after three months of onset. This means that those young stroke patients are commonly comorbid with psychological abnormalities, which may negatively affect their quality of life and recovery outcome [5, 32] and might develop into various mental disorders after stroke [1]. Unlike older adults, as a particular social group, young people bear greater social responsibility. Therefore, it is of great significance to formulate strategies for youth stroke health care, which needs physical rehabilitation and psychological support. This concept of mixture intervention and rehabilitation needs to be gradually established for young stroke patients.

Our study found that young adult stroke patients with psychological symptoms had larger infarct size and higher percentages of having hypertension and family dysfunction than those in patients without psychological symptoms. There are no differences on clinical features, including infarct locations, NIHSS score, mRS score, BI score, diabetes, atrial fibrillation, smoking, and drinking, and social supports, including subjective support, objective support, and utilization of support. These results indicated that two groups with and without psychological symptoms had similar disease features when their acute stages of stroke and the same social supports around them after three months. We further revealed that large infarct size, hypertension, and family dysfunction at the onset of stroke were risk factors for having psychological abnormalities among patients. Being single, the family dysfunction, and large infarct size were risk predictors for patients with psychological symptoms to have depressive symptoms. And the family dysfunction was a risk of emerging somatization and hypertension for anxiety in patients with psychological symptoms. These findings implied that the aforementioned variables might be associated with future intervention targets for young stroke patients.

Our results were consistent with the previous reports that a good family function is a crucial protector for family members to cope with emergencies and alleviate their psychological stressors [33, 34]. Importantly, the family function is closely related to individual health status, disease occurrence, and recovery [34]. The possible reasons for family function’s role in an individual psychological situation may involve that family members have close relationships with each other and have subjective satisfaction with family functions. The close relations among family members do benefit to reduce the psychological stress and avoid the occurrence of negative emotions. Furthermore, the patient in good family function can obtain other family members’ immediate assistance and relieve his/her psychological stress associated with stroke.

Our study did not find that social support was different among two groups in young adult stroke patients. This may indicate that subjects in our study have necessary social support for their daily life. Indeed, satisfactory social support means that individuals could obtain social support from the outside when they need help [35] and avoid the occurrence of adverse psychological problems [36, 37]. In addition, social support theory holds that social support can alleviate individual stress in adverse events and is a protective factor
for individuals’ physical and mental development [36–38]. Moreover, social support is closely related to the individual’s ability to respond to adverse events [39].

The study had some limitations. First, the study was a cross-sectional design, which is hard to verify the causal relationships of hypertension, infarct size, family functioning, and psychological status in young stroke patients. Second, abnormal psychological status may cause poor family function. Therefore, longitudinal studies are needed to clarify the causality in young stroke patients. Third, the study had an uneven number of samples in subgroups divided by clinical variables, especially marital status. Therefore, the results of the spousal situation in this study will need to be further verified. These limitations need to be further explained for developing effective strategies for young stroke patients.

The study provided meaningful evidence for young stroke patients for their further intervention, and some strengths should be emphasized. Our study is the first report on young Chinese stroke patients who had abnormal psychological status at three months after their stroke. The results benefit these patients’ recovery after stroke via caring for psychological status. In addition, our study was conducted in outpatient clinic settings. The results had general application into other common outpatient settings.

5. Conclusions

In conclusion, young Chinese adult stroke patients had obvious psychological symptoms at three-month timepoint after their stroke, severe family dysfunction, hypertension, and large infarct size were risk predictors of emerging psychological abnormalities in Chinese young adult stroke patients three months later after their stroke. Therefore, further prevention and intervention strategies on psychological symptoms should focus on bettering family function, controlling hypertension, and positively intervening in primary vascular diseases associated with young ischemic stroke, to enhance their recovery after stroke.

Data Availability

The materials in this manuscript are available from the corresponding author on reasonable request.

Conflicts of Interest

All authors declare that they have no conflict of interest.

Authors’ Contributions

Dongjian Xu, Xi Chu, Kun Wang, Lianyan Wei, Yunyun Xu, Xiaomin Huang, Jinna Li, Lina Xu, Hong Liu, Xiaohei Liu, Haixia Leng, Qing Xue, Mao Peng, and Longbin Jia carried out the data collection, data analysis, and revised the paper. Lu Yin analyzed the experiments. Hongxing Wang conceived and designed the experiments.

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References

[1] M. S. Ekker, E. M. Boot, A. B. Singhal et al., "Epidemiology, aetiology, and management of ischaemic stroke in young adults," The Lancet Neurology, vol. 17, no. 9, pp. 790–801, 2018.
[2] Y. J. Jang, D. Park, H. S. Kim et al., "Assessment of the implementation of critical pathway in stroke patients: a 10-year follow-up study," BioMed Research International, vol. 2020, Article ID 3265950, 9 pages, 2020.
[3] L. P. Liu, L. K. Wong, D. Z. Wang, and Z. R. Miao, "Current status of endovascular procedures in management of ischemic stroke in China," CNS neuroscience & therapeutics, vol. 20, no. 6, pp. 483–484, 2014.
[4] V. L. Feigin, G. A. Roth, M. Naghavi et al., "Global burden of stroke and risk factors in 188 countries, during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013," Lancet Neurology, vol. 15, no. 9, pp. 913–924, 2016.
[5] W. Wang, B. Jiang, H. Sun et al., "Prevalence, incidence, and mortality of stroke in China: results from a nationwide population-based survey of 480 687 adults," Circulation, vol. 135, no. 8, pp. 759–771, 2017.
[6] W. W. Zhang, Z. Zhang, and Q. Bi, "A nation-wide multicentre related factor investigation in 2359 cases of young stroke," Chinese journal of clinical rehabilitation, vol. 7, pp. 2694-2695, 2003.
[7] B. Nawaz, G. E. Eide, A. Fromm et al., "Young ischaemic stroke incidence and demographic characteristics - the Norwegian stroke in the young study - a three-generation research program," European Stroke Journal, vol. 4, pp. 347–354, 2019.
[8] N. A. Maaijwee, L. C. Rutten-Jacobs, R. M. Arntz et al., "Long-term increased risk of unemployment after young stroke: a long-term follow-up study," Neurology, vol. 83, pp. 1132–1138, 2014.
[9] Z. Chen, B. Jiang, X. Ru et al., "Mortality of stroke and its subtypes in China: results from a nationwide population-based survey," Neuroepidemiology, vol. 48, pp. 95–102, 2017.
[10] H. Wang, W. Zhang, X. Yang et al., "Deeply understanding clinic status of post-stroke depression: a clinic syndrome following brain injury," Zhonghua Yi Xue Za Zhi, vol. 99, pp. 1611–1614, 2019.
[11] M. L. Hackett, S. Kohler, J. T. O’Brien, and G. E. Mead, "Neuropsychiatric outcomes of stroke," The Lancet Neurology, vol. 13, no. 5, pp. 525–534, 2014.
[12] L. L. Liu, Z. F. Mou, H. X. Yang, M. SHI, H. WAN, and Y. WANG, "Relevant study of mental health and coping style in patients with cerebral stroke," China Medical Herald, vol. 12, pp. 51–54, 2015.
[13] N. A. Maaijwee, L. C. Rutten-Jacobs, P. Schaapsmeersders, E. J. Van Dijk, and F. E. de Leeuw, "Ischaemic stroke in young adults: risk factors and long-term consequences," Nature Reviews Neurology, vol. 10, pp. 315–325, 2014.
[14] K. E. D’Anci, S. Uhl, J. Oristaglio, N. Sullivan, and A. Y. Tsou, "Treatments for poststroke motor deficits and mood disorders: a systematic review for the 2019 U.S. Department of Veterans Affairs and U.S. Department of Defense Guidelines for stroke rehabilitation," *Annals of internal medicine*, vol. 171, pp. 906–915, 2019.

[15] R. G. Robinson and R. E. Jorge, “Post-stroke depression: a review,” *American Journal of Psychiatry*, vol. 173, pp. 221–231, 2016.

[16] Z. J. Zhang, *Manual of behavioural medicine scale*, China Medical Electronic Audiovisual Press, Beijing, 2005.

[17] S. Y. Xiao, "Theoretical basis and application of the Social Support Rating Scale," *Journal of Clinical Psychology*, vol. 4, pp. 98–100, 1994.

[18] J. W. Liu, F. Y. Li, and Y. L. Lian, “The reliability and validity of the social support rating scale,” *Journal of Xinjiang Medical University*, vol. 31, pp. 1–3, 2008.

[19] Neurology CSo, "Chinese cerebrovascular disease classification 2015," *Chinese Journal of Neurology*, vol. 50, pp. 168–171, 2017.

[20] H. X. Wang, K. Wang, W. R. Zhang et al., "Protocol on transcranial alternating current stimulation for the treatment of major depressive disorder: a randomized controlled trial," *Chinese medical journal*, vol. 133, no. 1, pp. 61–67, 2020.

[21] Y. Fang, S. Xu, J. Lu et al., “Validation and comparison of aneurysmal subarachnoid hemorrhage grading scales in angiogram-negative subarachnoid hemorrhage patients,” *BioMed Research International*, vol. 2020, Article ID 9707238, 9 pages, 2020.

[22] C. Lin, R. Sangha, J. Lee et al., "Infarct location is associated with quality of life after mild ischemic stroke," *International journal of stroke*, vol. 13, no. 8, pp. 824–831, 2018.

[23] W. K. Tang, X. X. Liu, H. Liang et al., “Location of acute infarcts and agitation and aggression in stroke,” *The Journal of Neuropsychiatry and Clinical Neurosciences*, vol. 29, no. 2, pp. 172–178, 2017.

[24] J. Saito, T. Koyama, and K. Domen, “Long-term outcomes of FIM motor items predicted from acute stage NIHSS of patients with middle cerebral artery infarct,” *Annals of Rehabilitation Medicine*, vol. 42, no. 5, pp. 670–681, 2018.

[25] M. Geurts, F. E. Scheijmans, T. van Seeters et al., “Temporal profile of body temperature in acute ischemic stroke: relation to infarct size and outcome,” *BMC Neurology*, vol. 16, no. 1, p. 233, 2016.

[26] U. Adilay, B. Guclu, M. Goksel, and S. Keskil, “The correlation of SCL-90-R anxiety, depression, somatization subscale scores with chronic low back pain,” *Turkish Neurosurgery*, vol. 28, pp. 434–438, 2018.

[27] Z. Y. Wang, “Symptom Check List (SCL-90),” *Shanghai Archives of Psychiatry*, vol. 2, pp. 68–70, 1984.

[28] S. Chen and L. Li, “Re-testing reliability, validity, and norm applicability of SCL-90,” *Chinese Journal of Nervous and Mental Diseases*, vol. 29, pp. 323–327, 2003.

[29] X. Y. Dai, *Manual of common psychological assessment scale*, People’s Military Medical Publishing House, Beijing, 2012.

[30] H. Jin, W. Y. Wu, and M. Y. Zhang, "Preliminary analysis of SCL-90 assessment results of Chinese normal healthy individuals," *Chinese Journal of Nervous and Mental Diseases*, vol. 12, pp. 260–263, 1986.

[31] H. J. Tong, “A Research of twenty years’ vicissitude: SCL-90 and its norm,” *Psychological Science*, vol. 33, pp. 928–930, 2010.

[32] L. J. Li, X. M. Yao, B. Y. Guan, Q. Chen, N. Zhang, and C. X. Wang, “Persistent depression is a predictor of quality of life in stroke survivors: results from a 5-year follow-up study of a Chinese cohort,” *Chinese medical journal*, vol. 132, pp. 2206–2212, 2019.

[33] Y. P. Li, T. Liu, and X. B. Jiang, “Correlation study on family function and psychological status of college nursing students,” *China Journal of Health Psychology*, vol. 20, pp. 1752–1754, 2012.

[34] Y. Zhang, “Family functioning in the context of an adult family member with illness: a concept analysis,” *Journal of Clinical Nursing*, vol. 27, no. 15-16, pp. 3205–3224, 2018.

[35] J. Lin, Y. Su, X. Lv et al., “Perceived stressfulness mediates the effects of subjective social support and negative coping style on suicide risk in Chinese patients with major depressive disorder,” *Journal of affective disorders*, vol. 265, pp. 32–38, 2020.

[36] N. Muramatsu, H. Yin, and D. Hedeker, "Functional declines, social support, and mental health in the elderly: does living in a state supportive of home and community-based services make a difference?" *Social Science & Medicine*, vol. 70, no. 7, pp. 1050–1058, 2010.

[37] H. Tough, J. Siegrist, and C. Fekete, "Social relationships, mental health and wellbeing in physical disability: a systematic review," *BMC Public Health*, vol. 17, no. 1, p. 414, 2017.

[38] G. Yuan, W. Xu, Z. Liu, and Y. An, "Resilience, posttraumatic stress symptoms, and posttraumatic growth in Chinese adolescents after a tornado: the role of mediation through perceived social support," *The Journal of nervous and mental disease*, vol. 206, no. 2, pp. 130–135, 2018.

[39] A. Y. Karahan, S. Kucuksen, H. Yilmaz, A. Salli, T. Gungor, and M. Sahin, "Effects of rehabilitation services on anxiety, depression, care-giving burden and perceived social support of stroke caregivers," *Acta Medica*, vol. 57, no. 2, pp. 68–72, 2014.