



Stroke related knowledge, prevention practices and associated factors among stroke patients in Taizhou, China

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ARTICLE INFO

Keywords:

Stroke
Knowledge
Prevention practice
Factors
China

ABSTRACT

Stroke is characterized by high morbidity, high mortality and high disability rate, which is a major health problem worldwide. However, most community-based studies report a lack of public knowledge related to stroke. The aim of this study is to investigate stroke-related knowledge and prevention practices among stroke patients in Taizhou, China. A face-to-face survey was conducted and questionnaires were completed by 156 S patients from June 27 to August 30, 2022. A generalized linear model was applied to explore the factors influencing prevention practices. Among the total participants, 36.5% and 40.4% of them had good knowledge of the stroke-related warning signs and risk factors, respectively. Participants who had good stroke prevention practices accounted for 57.7%. The higher score of stroke-related knowledge among inpatients, the better their prevention practices ($B = 0.16$, 95 %CI: 0.05 ~ 0.28). In addition, those with age ≥ 60 ($B = 1.20$, 95 %CI: 0.42 ~ 1.97), females ($B = 0.93$, 95 %CI: 0.24 ~ 1.61), having physical activities ($B = 1.01$, 95 %CI: 0.33 ~ 1.68), or without underlying diseases ($B = -1.67$, 95 %CI: -2.42 ~ -0.92) were also related with prevention practices. In general, this survey indicated that the stroke-related knowledge and prevention practices of participants were not good enough. Stroke related knowledge, age, sex, physical activity, and underlying disease were significant factors related to stroke prevention practices. These findings suggest the need to focus on stroke health education for stroke patients.

1. Introduction

Stroke is a major health-related problem that causes death and long-term disability worldwide (Chen et al., 2020). Globally, 6.55 million people died from a stroke in 2019, and 143 million disability-adjusted life years (DALYs), nearly a third of which occurred in China (Campbell and Khatri, 2020; Collaborators GS, 2021). In addition, most strokes occur in low- and middle-income countries, and the incidence of stroke has more than doubled in low- and middle-income countries over the past four decades (Feigin et al., 2009). With the increase in the global population and the elderly population, the global stroke burden is significantly increasing (Kim et al., 2020; Thayabaranathan et al., 2022). Stroke remains a global health and social problem, and the situation is expected to worsen in the coming years as the population ages.

From the medical emergency viewpoint, stroke needs prompt

medical attention. Stroke treatment is a complicated dynamic process, in which time is the most important issue affecting the appropriate effectiveness of acute stroke interventions and determining the ultimate outcome of patients (Evenson et al., 2009). Effective treatment within 4.5 h of symptom onset of acute ischemic stroke can improve clinical prognosis and further survival, and reduce dependence on activities of daily living (Hacke et al., 2008). The narrow window for thrombolytic therapy requires timely arrival at the hospital. However, most stroke victims failed to reach a hospital within the treatment window (Pulvers and Watson, 2017). There are many factors associated with delays in seeking treatment for stroke. It is believed that the main factor is the public's poor levels of knowledge regarding stroke symptoms and prevention practices (Jones et al., 2010; Faiz et al., 2014). Therefore, better awareness of stroke-related symptoms or warning signs were significantly correlated with public knowledge of stroke and appropriate

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<https://doi.org/10.1016/j.pmedr.2023.102340>

Received 9 March 2023; Received in revised form 18 July 2023; Accepted 19 July 2023

Available online 20 July 2023

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action (Mosley et al., 2014; Soto-Cámara et al., 2020; Saade et al., 2022).

There is an urgent need to improve the early identification of stroke-related signs and symptoms and to address delays in seeking treatment. In addition, effective management of stroke depends largely on public awareness of its warning signs, which facilitates early detection and improved response rates (Alhowaymel et al., 2023). Recent years have seen a large number of studies focused on stroke-related knowledge and awareness (Ding et al., 2023; Liu et al., 2021; Khalil and Lahoud, 2020). For example, a survey among primary healthcare providers showed that their stroke management knowledge level was mild to moderate (Ding et al., 2023). In addition, the previous community-based study has reported that the general public presented a lack of stroke-related knowledge (Khalil and Lahoud, 2020). Moreover, stroke has also become the leading cause of disability-adjusted life years (DALYs) in China, with 45.9 million DALYs in 2019 (Wang et al., 2022). Hence, the aim of this study was to investigate the knowledge of warning signs and risk factors in stroke patients, as well as their prevention behaviors towards suspicious events. To understand the related influencing factors of these patients could provide a reference for formulating intervention measures for stroke patients' cognitive function.

2. Materials and methods

2.1. Study design and population

We organized a hospital-based cross-sectional face-to-face investigation on the Wen-Juan-Xing platform (Changsha Ranxing Information Technology Co., Ltd., Hunan, China). The target population was stroke patients at a tertiary hospital in Taizhou, Zhejiang, China. Participants answered the questionnaire by accessing a Uniform Resource Location (URL) or scanning a Quick Response (QR) code on their mobile phones or computer between June 27 and August 30, 2022. We used multiple linear regression model to calculate the effects of predictors on the outcome, assuming the effect size level of 0.18, the significance level of 0.05, the power of 0.95, and the number of potential predictors of 7 (knowledge, age, sex, address, monthly household income, physical activity, and underlying disease). The target sample size was 129 participants. We allowed for a 15% participant dropout (reluctance to participate in surveys) and selected 152 participants as a conservative sample size. The sample size was calculated using the software G.Power 3.1.9.6. A logical check was made on the data. Outliers were eliminated before data analysis. The time taken to complete the questionnaire was also checked. Those who answered within 120 s were excluded. We obtained 156 valid questionnaires.

2.2. Ethical consideration

This study was exempted from informed consent and approved by the Ethics Committee of Taizhou Hospital of Zhejiang Province (Approval number: K20221032). All procedures were conducted in accordance with the guidelines of our institutional Ethics Committee and in compliance with the principles of the Declaration of Helsinki. Information about all respondents was recorded anonymously.

2.3. Data collection

The main contents of the questionnaire were adapted from the previous research (Arisegi et al., 2018; Abate et al., 2019; Tibebu et al., 2021; Workina et al., 2021), which contained basic demographic information, stroke knowledge, and stroke prevention practices. First, basic demographic information was collected, including participants' age, sex, education, occupation, and other social demographics. Second, stroke-related knowledge was comprised of two parts, including warning signs and risk factors related to stroke. Knowledge of warning signs was assessed by 8 items with 3 possible answers: "Yes", "No", or "I don't know". For each item, participants who answered correctly can obtain

scores of 1. The overall sum score was produced by taking the sum of the total items. Risk factors related to stroke were measured by 12 items and assessed similarly. Respondents who had a score equal to or greater than the mean value were considered to have good stroke knowledge (Arisegi et al., 2018). Third, prevention practices related to stroke consisted of 9 items. We evaluated the item statements in the same way as stroke-related knowledge. Detailed information of the questionnaire can be found in the [supplementary materials](#).

2.4. Statistical analysis

Categorical variables of the basic demographic characteristics were summarized in frequency and percentage. A generalized linear regression model was adopted to identify the potential predictor variable. Variables considered statistically significant should have a P -value < 0.05 . All statistical analyses were implemented via R software, version 4.1.0 (R Project for Statistical Computing).

3. Results

3.1. Basic characteristics of stroke patients

Table 1 showed that the age of the respondents ranged from 31 to 92 years old, with a mean age of 66.2 (SD = 11.9). Among all the participants, men accounted for 59%. The majority resided in rural areas (80.1%). 29.5% of patients had BMI ≥ 25 kg/m². In addition, more than half of the stroke patients had a primary or below education level (68.6%), and most of them were farmers (60.3%). The percentage of monthly household income under 5000 CNY was 66%. In addition, participants who had physical activity, smoking history, alcohol intake history, and underlying disease accounted for 53.2%, 41.0%, 35.9%, and 71.8% respectively.

3.2. Knowledge of stroke warning signs or symptoms

Only 36.5% of stroke patients had good knowledge of the stroke-related warning signs or symptoms (Table 2). The warning signs or

Table 1

Basic characteristics of the participants (n = 156) in Taizhou, Zhejiang, China: 2022.

Characteristics	Category	Frequency (%)
Age (years)	<60	40 (25.6)
	≥ 60	116 (74.4)
Gender	Male	92 (59.0)
	Female	64 (41.0)
BMI	<25	110 (70.5)
	≥ 25	46 (29.5)
Address	Urban	31 (19.9)
	Rural	125 (80.1)
Education	Primary or below	107 (68.6)
	Junior Secondary or above	49 (31.4)
Occupation	White-collar	28 (17.9)
	Farmer	94 (60.3)
	Others	34 (21.8)
Monthly household income (CNY)	<5000	103 (66.0)
	≥ 5000	53 (34.0)
Physical activity	Yes	83 (53.2)
	No	73 (46.8)
Smoking history	Yes	64 (41.0)
	No	92 (59.0)
Alcohol intake history	Yes	56 (35.9)
	No	100 (64.1)
Underlying disease	Yes	112 (71.8)
	No	44 (28.2)

"Others" for occupation includes freelancers, the self-employed, retirees, and the unemployed. Underlying disease includes hypertension, diabetes, cardiovascular and cerebrovascular diseases, chronic respiratory diseases, chronic kidney disease, chronic liver disease, and cancer.

Table 2
Participants' knowledge of stroke warning signs or symptoms (n = 156) in Taizhou, Zhejiang, China: 2022.

Variables	Category	Frequency (%)
Sudden dizziness	Yes	104 (66.7)
	No	10 (6.4)
	I don't know	42 (26.9)
Sudden headache	Yes	16 (10.3)
	No	24 (15.4)
	I don't know	116 (74.3)
Sudden loss of memory	Yes	14 (9.0)
	No	24 (15.4)
	I don't know	118 (75.6)
Sudden weakness on half body	Yes	128 (82.0)
	No	4 (2.6)
	I don't know	24 (15.4)
Sudden loss of consciousness	Yes	28 (18.0)
	No	27 (17.3)
	I don't know	101 (64.7)
Sudden loss of vision or double vision	Yes	27 (17.3)
	No	29 (18.6)
	I don't know	100 (64.1)
Sudden difficulty in speaking	Yes	61 (39.1)
	No	42 (26.9)
	I don't know	53 (34.0)
Sudden numbness on one side of the face	Yes	138 (88.5)
	No	4 (2.5)
	I don't know	14 (9.0)
Knowledge grade	Good	57 (36.5)
	Poor	99 (63.5)

symptoms related to stroke most commonly known to the participants include sudden dizziness (66.7%), sudden weakness on half body (82.0%), and sudden numbness on one side of face (88.5%). However, other stroke related symptoms were little known to the respondents, including sudden headache (10.3%), sudden loss of memory (9.0%), sudden loss of consciousness (18%), sudden loss of vision or double vision (17.3%), and sudden difficulty in speaking (39.1%).

3.3. Knowledge of stroke risk factors

More than half of the respondents (59.6%) did not know any of the listed stroke-related risk factors (Table 3). The common risk factors known by respondents were advancement in age (78.9%), smoking (48.1%), eating foods with too much fat (61.5%), hypertension (82.1%), and family history of stroke (76.9%).

3.4. Prevention practices related to stroke

Participants who had good stroke prevention practices accounted for 57.7% (Table 4). More than half of the participants had the following prevention practices, including attending follow-up clinic (57.1%), taking medicine as directed (57.1%), checking blood pressure regularly (74.4%), eating fruits and vegetables regularly (54.5%), avoiding fatty foods (51.9%), avoiding or quitting smoking (64.1%), and reducing alcohol intake (71.8%).

3.5. Factors associated with prevention practices related to stroke

A generalized linear regression analysis was conducted with prevention practices as the dependent variable. The results were summarized in Table 5, which showed that the higher the score of knowledge of risk factors among inpatients, the better their prevention practices (B = 0.16, 95 %CI: 0.05 ~ 0.28, P = 0.005). In addition, age, sex, physical activity, and underlying disease were also risk factors. Those with age ≥ 60 (B = 1.20, 95 %CI: 0.42 ~ 1.97), females (B = 0.93, 95 %CI: 0.24 ~ 1.61), having physical activities (B = 1.01, 95 %CI: 0.33 ~ 1.68), or without underlying diseases (B = -1.67, 95 %CI: -2.42 ~ -0.92) were

Table 3
Participants' knowledge of stroke risk factors (n = 156) in Taizhou, Zhejiang, China: 2022.

Variables	Category	Frequency (%)
Advancement in age	Yes	123 (78.9)
	No	3 (1.9)
	I don't know	30 (19.2)
Obesity	Yes	39 (25.0)
	No	12 (7.7)
	I don't know	105 (67.3)
Smoking	Yes	75 (48.1)
	No	8 (5.1)
	I don't know	73 (46.8)
Excessive alcohol intake	Yes	46 (29.5)
	No	12 (7.7)
	I don't know	98 (62.8)
Eating foods with too much fat	Yes	96 (61.5)
	No	10 (6.4)
	I don't know	50 (32.1)
Hypertension	Yes	128 (82.1)
	No	5 (3.2)
	I don't know	23 (14.7)
Hyperlipidemia	Yes	32 (20.5)
	No	19 (12.2)
	I don't know	105 (67.3)
Diabetes	Yes	30 (19.2)
	No	19 (12.2)
	I don't know	107 (68.6)
Family history of stroke	Yes	120 (76.9)
	No	14 (9.0)
	I don't know	22 (14.1)
Lack of exercise	Yes	22 (14.1)
	No	24 (15.4)
	I don't know	110 (70.5)
Carotid artery stenosis	Yes	24 (15.4)
	No	17 (10.9)
	I don't know	115 (73.7)
Heart disease	Yes	24 (15.4)
	No	16 (10.3)
	I don't know	116 (74.3)
Knowledge grade	Good	63 (40.4)
	Poor	93 (59.6)

related with prevention practices.

4. Discussion

Good awareness of the warnings and risk factors associated with stroke is essential for early stroke prevention. In this study, we investigated stroke-related knowledge and prevention practices, and analyze associated factors among stroke patients. The findings showed that only 36.5% of the respondents had good knowledge of stroke-related warning signs or symptoms. On the whole, knowledge of warning signs and stroke risk factors was poor among the stroke patients in this study. This finding was aligned with the earlier research concentrating on participants with high blood pressure, which reported that their knowledge level of warning signs and risk factors related to stroke was inadequate (Bhat et al., 2021; Houessou et al., 2021; Melak et al., 2021). However, the proportion was lower than the previous research conducted among hypertension patients in Ethiopia (40.7%) (Woldetsadik et al., 2022). One possible explanation for these findings is that most participants may have lacked information as a result of insufficient knowledge of stroke warning signs and risk factors. This will leave a huge educational gap for the residents of these areas, who may struggle to acquire adequate knowledge.

We also presented that most participants had poor prevention practices toward stroke events, which is similar to the previous study (Dar et al., 2019). A possible explanation is the low level of knowledge of the respondents. Another reason may also be due to the lack of educational courses associated with stroke for individuals. The investigation

Table 4
Participants' prevention practices related to stroke (n = 156) in Taizhou, Zhejiang, China: 2022.

Variables	Category	Frequency (%)
Attend follow-up at clinic	Yes	89 (57.1)
	No	64 (41.0)
	I don't know	3 (1.9)
Take medicine as directed	Yes	89 (57.1)
	No	63 (40.4)
	I don't know	4 (2.5)
Check blood pressure regularly	Yes	116 (74.4)
	No	36 (23.1)
	I don't know	4 (2.5)
Take regular physical activity	Yes	33 (21.2)
	No	49 (31.4)
	I don't know	74 (47.4)
Eat fruits and vegetables regularly	Yes	85 (54.5)
	No	67 (43.0)
	I don't know	4 (2.5)
Avoid fatty foods	Yes	81 (51.9)
	No	68 (43.6)
	I don't know	7 (4.5)
Avoid or quit smoking	Yes	100 (64.1)
	No	46 (29.5)
	I don't know	10 (6.4)
Reduce alcohol intake	Yes	112 (71.8)
	No	29 (18.6)
	I don't know	15 (9.6)
Reduce salt consumption	Yes	73 (46.8)
	No	55 (35.2)
	I don't know	28 (18.0)
Practice grade	Good	90 (57.7)
	Poor	66 (42.3)

Table 5
Generalized linear regression analysis of factors associated with prevention practices (n = 156) in Taizhou, Zhejiang, China: 2022.

Variables	Category	Coefficient (95 %CI)	P-value
Constant term		3.69 (2.29 ~ 5.08)	<0.001
Knowledge of risk factors		0.16 (0.05 ~ 0.28)	0.005
Age	<60 (ref)		
	≥60	1.20 (0.42 ~ 1.97)	0.003
Sex	Male (ref)		
	Female	0.93 (0.24 ~ 1.61)	0.009
Address	Urban (ref)		
	Rural	-0.80 (-1.69 ~ 0.09)	0.079
Monthly household income	<5000 (ref)		
	≥5000	-0.55 (-1.30 ~ 0.20)	0.155
Physical activity	No (ref)		
	Yes	1.01 (0.33 ~ 1.68)	0.004
Underlying disease	Yes (ref)		
	No	-1.67 (-2.42 ~ -0.92)	<0.001

also showed that the higher the score of knowledge of risk factors among inpatients, the better their prevention practices. This means that in some cases, good knowledge leads to better performance (Buang et al., 2019). Training programs are essential to enhance their actual stroke prevention behaviors. Considering that knowledge related to stroke is key to changing behavior, hence, it is necessary for people to have sufficient and accurate information about stroke and its risk factors to strengthen public awareness and practices of prevention.

In this study, participants over 60 years old showed a higher score of prevention practices toward stroke events than those less than 60 years old. This finding is consistent with the previous research conducted in India that reported more than half of respondents over 60 years old had well prevention practices against stroke (Sinha et al., 2020). Our findings can be attributed to the fact that older adults may be more consistent with stroke prevention than younger adults. In addition, sex, physical activity, and underlying disease were also risk factors

associated with prevention practices. Compared to males, female participants had better practices toward stroke prevention. A previous meta-analysis indicated that women had better stroke knowledge than men in most studies, despite a general lack of knowledge in both genders (Stroebele et al., 2011). Those who are physically active also performed better. Promoting physical activity is one of the strategies to prevent stroke (Pancioli et al., 1998). Participants with underlying diseases would take better prevention behaviors than those without. People with underlying diseases pay more attention to their diet and adopt better lifestyle habits.

This investigation has reported the knowledge of risk factors and warning signs of stroke, as well as the prevention practices towards a possible stroke event. This information forms the basic backbone of the decision-making process and delays in getting stroke patients to hospital, and has a very important impact on arrival times, which are a key aspect of improving clinical outcomes of patients. However, this study also had several limitations. First of all, only the most common stroke risk factors were collected, without recording the prevalence of patients' diets or psychosocial factors. Second, this study was conducted at a tertiary medical center in a single geographic area in Taizhou, China. In addition, the research was based on a relatively small sample, which made it difficult to generalize the conclusion. Of note, there was inevitable selection bias in this survey, considering that the study population was selected on a convenient and voluntary basis. Moreover, future analysis is needed to further segment patients with different underlying diseases. At the same time, some intervention trials can be designed to study the relevant influencing factors. Hence, in the future, studies with more samples from more regions to verify the findings are required.

5. Conclusion

This study displayed a low level of knowledge of stroke-related warning signs, risk factors, and prevention practices among hospitalized patients in Taizhou, China. The results showed that the higher the score of knowledge of risk factors among inpatients, the better their prevention practices. In addition, age, sex, physical activity, and underlying disease were also risk factors associated with prevention practices. This study demonstrates the importance of further improving patients' awareness of stroke-related knowledge. Therefore, regular health education programs, especially for underserved populations, are therefore essential to improve understanding of stroke prevention and to improve prevention practices among respondents. Knowing the stroke-related warning signs and being aware of how to deal with a possible stroke event can reduce the delay between the event and admission to the hospital, allowing patients to receive timely medical attention.

Funding

This study was not supported by research funding from any agency.

Ethics approval

This study was exempted from informed consent and approved by the Ethics Committee of Taizhou Hospital of Zhejiang Province (Approval number: K20221032) in China. All procedures were performed following the guidelines of our institutional ethics committee, in adherence to the tenets of the Declaration of Helsinki.

CRediT authorship contribution statement

Junbo Liang: Conceptualization, Methodology, Writing – original draft. **Chengwen Luo:** Data curation, Software, Methodology, Writing – original draft. **Shaofa Ke:** Visualization, Investigation. **Tao-Hsin Tung:** Supervision, Validation, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgments

We would like to thank participants for their cooperation and support. We would also like to thank Xiaomei Xie for questionnaire collection.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2023.102340>.

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