ORIGINAL ARTICLE

Awareness of stroke warning signs and associated factors among community residents in Huanggang, China: A cross-sectional study

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ABSTRACT

Stroke is the leading cause of disability and death in China. Despite efforts by the Chinese government to prioritize this public health issue, Chinese residents face significant challenges related to poor awareness of the signs of stroke and delays in seeking treatment. This study aims to explore stroke awareness and associated factors among residents of one community in China. A cross-sectional design was performed on 760 residents in Huanggang, China, selected by the cluster sampling method. A self-administered questionnaire was used for data collection. Multiple logistic regression was applied to investigate factors influencing stroke awareness. The results revealed that most participants were male (65.0%) with a median age of 65 years; more than half (64.7%) had good stroke awareness. After adjusting for other covariates, stroke awareness was significantly positively associated with a history of vascular risk or previous stroke, stroke-related knowledge, stroke prevention behavior, and health belief model (HBM) constructs, including perceived benefits, self-efficacy, perceived susceptibility, perceived severity, and cues to action. However, good stroke awareness was negatively associated with perceived barriers. In conclusion, Huanggang residents had good stroke awareness, influenced by stroke-related knowledge, stroke prevention behavior, the HBM constructs, and other factors. Thus, consideration of these factors is important in developing targeted interventions to help individuals recognize the early symptoms of stroke and improve awareness that such symptoms need to be treated as a medical emergency.

Keywords:
health belief model; residents; stroke; stroke awareness; stroke warning signs

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INTRODUCTION

Stroke is a leading cause of death and disability in China, imposing a significant burden on public health and healthcare systems.[1] Despite advances in acute stroke management,[2] prehospital delay remains a critical barrier to timely treatment, particularly for ischemic stroke patients who require intravenous thrombolysis or endovascular therapy within a narrow therapeutic window.[3, 4] Studies indicate that delayed hospital arrival is common in China, with a substantial proportion of stroke patients failing to seek immediate medical attention.[5] Delays are often attributed to poor recognition of stroke symptoms, low awareness of the urgency of stroke treatment, and inadequate use of emergency medical services (EMS).[6, 7] Addressing prehospital delay is crucial for improving stroke outcomes and reducing the societal burden of the disease.[2, 4]

Stroke awareness, particularly the ability to recognize stroke warning signs, is a key determinant of timely healthcare-seeking behavior. Evidence suggests that individuals with higher stroke awareness are more likely to activate EMS and reach the hospital in time for acute interventions.[6, 8] However, stroke awareness varies widely across different populations and is influenced by multiple factors, including culture, socioeconomic status, education level, geographical location, and access to medical resources.[4, 9] Rural residents and individuals with lower education levels tend to have poorer awareness, contributing to disparities in stroke care.[10] Given the critical role of public awareness in improving prehospital stroke management, it is essential to identify the factors associated with stroke recognition and target at-risk populations with effective health education strategies.

Despite increasing research on stroke awareness in China, most studies have been conducted in large metropolitan areas, while data from developing regions remain limited. Huanggang, a city in central China, has a high stroke burden and a diverse population comprising both urban and rural residents, making it an important setting for investigating disparities in stroke awareness. Additionally, stroke awareness could be understood through the lens of the Health Belief Model (HBM), which posits that individuals' health-related behaviors are influenced by their perceptions of susceptibility, severity, benefits, and barriers.[11] However, limited research has applied the HBM theory to stroke education in community settings. To our knowledge, no prior studies have specifically examined community residents' stroke awareness in Huanggang. This study aimed to assess community residents' awareness of stroke warning signs and identify associated factors using the HBM framework. The findings will provide valuable insights for designing targeted educational interventions that address perceived barriers and benefits of stroke recognition, ultimately reducing prehospital delays and improving stroke outcomes.

METHODS

Study design and settings

This cross-sectional study was conducted from April to June 2024 at ten health clinics located in ten community areas in Huanggang, Hubei Province, China.

Study participants

Eligible participants were (1) community residents in Huanggang aged 18 years or above and (2) willing to participate; those who provided incomplete responses were excluded from the analysis. The sample size was calculated by using

PASS 15.0.5 software [12] with an estimator of the percentage of residents who identified stroke warning signs (15.6%) reported by Juan Yang et al.[13] Based on a 95% confidence interval and a precision of 3%, the minimum sample size was 661 residents, plus an additional 15% for nonresponse adjustment. The total sample size was 760 residents out of the 809 residents initially enrolled; 49 residents were excluded due to incomplete responses. A cluster sampling method was used to select eligible residents. The cluster was defined as a health clinic, which is the primary health service center for each community in China. We randomly selected one health clinic from each county in Huanggang, resulting in a total of 10 health clinics (Figure 1). Then, in each health clinic, residents who met the study criteria were selected by computer-generated random numbers until the required sample size was reached.

Figure 1. Map of the distribution of selected clinical clinics.

Instruments

The self-administered questionnaire was developed based on a literature review that consisted of six parts (Supplementary file 1):

Predictors

Part 1: Socio-demographic factors included age, sex, education, personal yearly income, marital status, and residential status; all variables were dichotomous. Body mass index (BMI: kg/m^2) was calculated as weight (kg) divided by height (m^2) and was classified using Chinese BMI classifications[14] for underweight (BMI< 18.5 kg/m^2), normal weight (BMI 18.5–23.9 kg/m^2), overweight (BMI 24–27.9 kg/m^2), and obese (BMI ≥ 28 kg/m^2). History of vascular risk factors was defined as having one of the following conditions: smoking, alcohol use, hypertension, diabetes, dyslipidemia, coronary heart disease, atrial fibrillation, and sleep disorders. An affirmative answer to any of these conditions was designated as having vascular risk factors. In addition, previous stroke history was captured by the question, "Have you had strokes in the past?" This variable was categorized as dichotomous (Y/N). Sources of stroke

information were defined by asking the respondents, "What are the main sources of information or knowledge about stroke that you have received?" This was a multiple-choice response, with possible answers including the internet, social media, radio or television, family and friends, pamphlets and newspapers, and medical professionals[15]. We divided this scale into two groups based on the median method. The median in this study was 3, so we used 3 as our cut-off point (i.e., ≥3 and <3 sources).

Part 2: Stroke-related knowledge was measured using a 17-item scale adapted from existing published literature, [16, 17] with all items judged as true or false. The scale was checked by three experts in neurology and health education; the index of item objective congruence was 0.70–1.00. Participants received one point for each correct response. The total score was computed by summing across all items. Respondents were deemed to have good stroke-related knowledge if their score was equal to or greater than the mean value. [18] The mean in this study was 8, so we used 8 as our cut-off point (i.e., good level ≥ 8 and poor level < 8). Cronbach's alpha was 0.76, indicating good internal consistency.

Part 3: The HBM constructs were measured using an HBM scale adapted from previous studies [11, 19] to measure participants' perceptions of risk, severity, benefits, and barriers to stroke awareness and prevention. The content validity index (CVI) of the original scale was 0.85, and the overall scale reliability was 0.87. The revised scale consisted of 25 items across six sub-scales: (1) Perceived susceptibility (five items); (2) Perceived severity (five items); (3) Perceived benefit (five items); (4) Perceived barrier (six items); (5) Self-efficacy (two items); and (6) Cues to action (two items). Items were rated on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score on each subscale indicated a stronger presence of the corresponding construct in the participants' responses. For the total scale, Cronbach's alpha was 0.83, and CVI was 0.89.

Part 4: Stroke prevention behavior was assessed using a 20-item scale adapted from existing published measures. [20] The CVI of the original scale was 0.85, and the overall scale reliability was 0.88. This scale consists of three sub-scales including nutrition (eight items), physical activity (eight items), and other lifestyle factors (four items) (e.g., low-salt diet, monitoring blood pressure, smoking, and excessive alcohol use), rated on a 4-point Likert scale ("1=never," "2=sometimes," "3=often," and "4=always,") with reverse scoring applied to the smoking and alcohol items. Higher scores indicated greater prevention behavior for stroke. Respondents were deemed to exhibit good prevention behavior if their score was equal to or greater than the mean value.[18] The mean in this study was 46, so we used 46 as our cut-off point (i.e., good ≥ 46 and poor < 46). Cronbach's alpha was 0.73, indicating good internal consistency.

Outcome variable

Part 5: **Awareness of warning signs.** We adopted the Chinese version of Juan Yang et al.'s stroke symptoms scale [13] to measure residents' awareness of early stroke warning signs. This scale is a commonly used international tool for stroke recognition and includes five typical stroke warning signs[21]: (1) sudden confusion or trouble speaking; (2) sudden blurred vision in one or both eyes; (3) sudden intense headache without apparent cause; (4) sudden vertigo, difficulty walking, and loss of balance; and (5) sudden numbness or weakness on one side of the face and/or limbs. The scale includes three possible answers ("yes," "no," or "do not know/not sure"); for each item, participants who

answered correctly could receive one point, and the total score was computed by summing the points received across all items. Respondents were deemed to have good stroke awareness if their score was equal to or greater than the median value.[18] The median in this study was 3, so we used 3 as our cut-off point (i.e., good level ≥3 and poor level <3). Cronbach's alpha was 0.72, indicating good internal consistency.

Data collection

The research team consisted of ten trained members, who were physicians or health managers from the ten selected health clinics. The tool used for data collection was "Questionnaire Star" (https://www.wjx.cn/), a software package with powerful features to design and administer questionnaires. The self-administered questionnaire was implemented for community residents who visited health clinics to seek medical advice and volunteered for this survey. Informed consent was obtained before participants started to answer the survey. The system reminded respondents of missing responses before submission. Only fully completed questionnaires could be submitted. The survey took approximately 10 to 15 minutes to complete.

Statistical analysis

Descriptive analyses were applied to analyze participants' characteristics. Chi-square tests were performed to examine differences in socio-demographics, sources of stroke information, stroke-related knowledge, stroke prevention behavior, and the HBM constructs between participants who had good and poor levels of stroke awareness. Independent-sample t-tests were performed to examine the differences in each sub-scale of the HBM scale. Then, the bivariate odds ratio (OR) was computed to assess the association between each predictor and stroke awareness. The adjusted OR was estimated from multivariable logistic regression to examine the association between socio-demographics, sources of stroke information, stroke-related knowledge, stroke prevention behavior, the HBM constructs, and stroke awareness after adjustment for all other predictors. The outcome variable's reference group was poor stroke awareness. The variables were entered into the model as follows: in Model 1, socio-demographics, sources of stroke information, and stroke-related knowledge were added to the model; in Model 2, we added stroke prevention behavior to Model 1; in Model 3 (the final model), we added the HBM constructs to Model 2. All statistical analyses were conducted using SPSS version 23.0 (IBM Corp., Armonk, NY, USA), with a P-value < 0.05 being considered statistically significant.

Ethics Approval

After receiving information on the research, all participants provided their written informed consent. We administered a self-reported questionnaire to the participants for data gathering. The ethics of this study were reviewed and approved by the Ethics Committees for Research Involving Human Subjects at Mahasarakham University and Huanggang Central Hospital (ref. no. 271-136/2024, HGYY-KY-2023-008-1).

RESULTS

The majority of respondents (65.0%) were male, with a median age of 65 years. Approximately 64.7% of them had good awareness of stroke warning signs. Their ability to identify various stroke warning signs ranged from 34.2% to 82.1%. The most commonly identified warning sign was sudden numbness or weakness on one side of the face and/or limbs (82.1%), followed by sudden confusion or trouble speaking (77.4%). Only 34.2% considered a sudden, intense headache without an apparent cause to be a warning sign of stroke (Figure 2). More than half (56.2%)

had good stroke-related knowledge, but their understanding of early treatment methods and the time window for ultra-early therapy was very limited. Additionally, the HBM constructs showed that the mean (standard deviations; SD) scores of perceived susceptibility, perceived severity, perceived barriers, perceived benefits, perceived self-efficacy, and cues to action were 15.9 (SD=3.2), 16.8 (SD=4.0), 16.1 (SD=4.2), 18.0 (SD=4.1), 6.6 (SD=1.5) and 6.4 (SD=1.3), respectively. In addition, the comparison of all predictor variables between participants with good and poor awareness of stroke warning signs showed statistically significant differences for residence, previous stroke history, history of vascular risk factors, stroke-related knowledge, stroke prevention behavior, and HBM constructs ($P < 0.05$; Table 1).

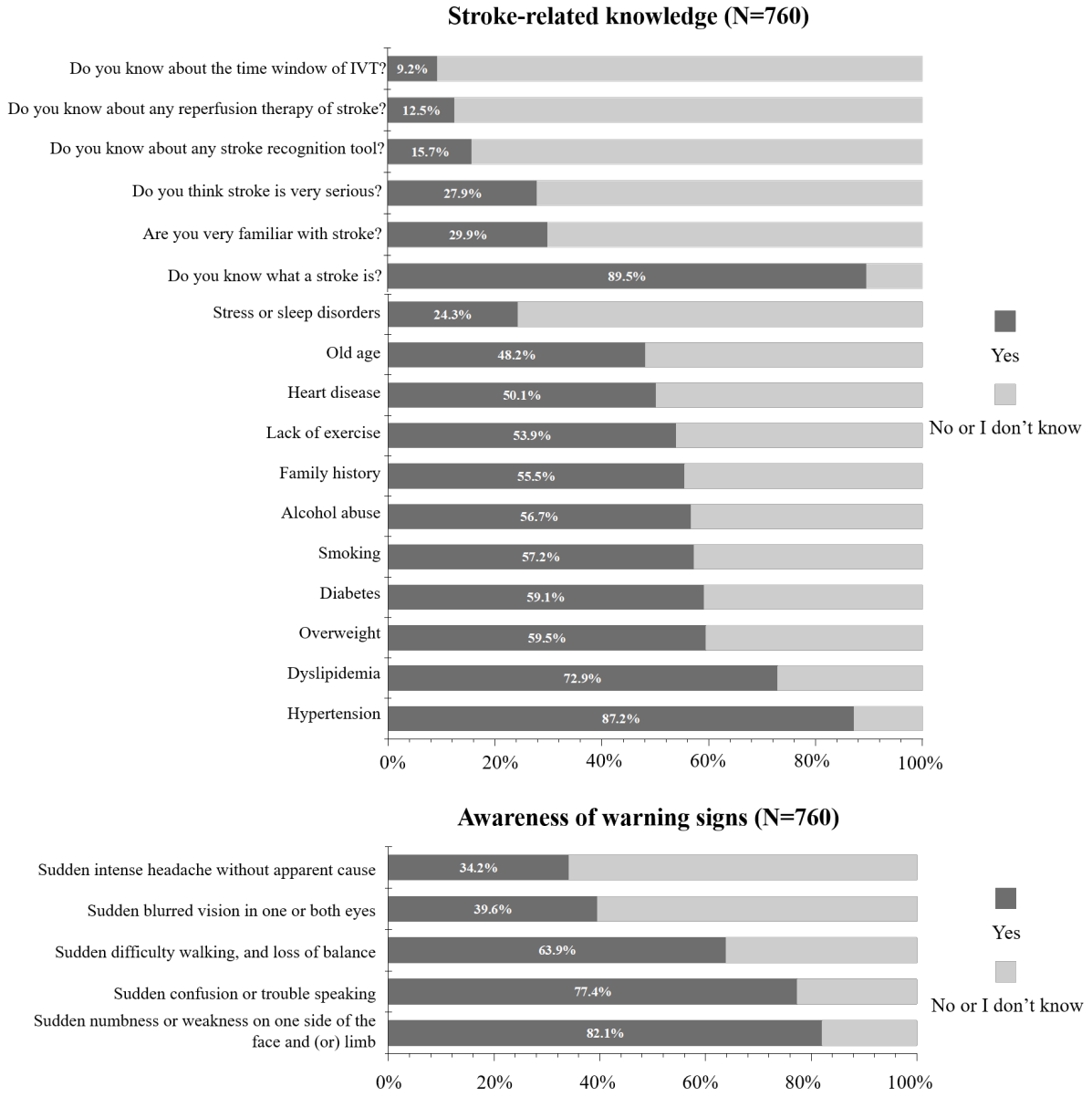

Figure 2. Percentages (%) of responses regarding stroke-related knowledge and awareness of warning signs.

Table 1. Distribution of sociodemographic characteristics, stroke-related knowledge, stroke prevention behavior, and the HBM constructs by stroke awareness of warning signs.

Variables	Total (n=760)	Stroke awareness of warning signs		
		Poor (n=268)	Good (n=492)	*P*-Value
Socio-demographic factors				
Age (y), n (%)				
<65	377 (49.6)	144 (53.7)	233 (47.4)	0.093[a]
≥65	383 (50.4)	124 (46.3)	259 (52.6)	
Sex, n (%)				
Female	266 (35.0)	93 (34.7)	173 (35.2)	0.899 [a]
Male	494 (65.0)	175 (65.3)	319 (64.8)	
Education, n (%)				
Illiteracy or primary school	417 (54.9)	152 (56.7)	265 (53.9)	0.450 [a]
Middle school or above	343 (45.1)	116 (43.3)	227 (46.1)	
Personal annual income (CNY), n (%)				
<5000	136 (17.9)	39 (14.6)	97 (19.7)	0.076 [a]
≥5000	624 (82.1)	229 (85.4)	395 (80.3)	
Marital status, n (%)				
Married	682 (89.7)	242 (90.3)	440 (89.4)	0.706 [a]
Others (unmarried, divorced, or widowed)	78 (10.3)	26 (9.7)	52 (10.6)	
Previous stroke history, n (%)				
No	604 (79.5)	232 (86.6)	372 (75.6)	<0.001 [a*]
Yes	156 (20.5)	36 (13.4)	120 (24.4)	
Vascular risk factors history, n (%)				
No	77 (10.1)	38 (14.2)	39 (7.9)	0.006 [a*]
Yes	683 (89.9)	230 (85.8)	453 (92.1)	
Body mass index (kg/m^2), n (%)				
<24	401 (52.8)	137 (51.1)	264 (53.7)	0.503 [a]
≥24	359 (47.2)	131 (48.9)	228 (46.3)	
Residential status, n (%)				
Urban area	391 (51.4)	122 (45.5)	269 (54.7)	0.016 [a*]
Rural area	369 (48.6)	146 (54.5)	223 (45.3)	
Sources of stroke information, n (%)				
<3	581 (76.4)	212 (79.1)	369 (75.0)	0.203 [a]
≥3	179 (23.6)	56 (20.9)	123 (25.0)	
Stroke-related knowledge levels, n (%)				
Poor	332 (43.8)	156 (58.2)	176 (35.8)	
Good	428 (56.2)	112 (41.8)	316 (64.2)	<0.001 [a*]
Stroke prevention behavior levels, n (%)				
Poor	477 (62.8)	203 (75.7)	274 (55.7)	
Good	283 (37.2)	65 (24.3)	218 (44.3)	<0.001[a*]
The HBM constructs, mean ± SD				
Perceived susceptibility	15.9 ± 3.2	14.6 ± 3.3	16.5 ± 3.0	<0.001[b*]
Perceived severity	16.8 ± 4.0	15.3 ± 3.8	17.6 ± 4.0	<0.001 [b*]
Perceived barriers	16.1 ± 4.2	17.0 ± 4.2	15.6 ± 4.1	<0.001 [b*]
Perceived benefits	18.0 ± 4.1	16.8 ± 4.1	18.7 ± 3.9	<0.001 [b*]
Perceived self-efficacy	6.6 ± 1.5	6.3 ± 1.4	6.7 ± 1.5	<0.001 [b*]
Cues to action	6.4 ± 1.3	6.0 ± 1.2	6.6 ± 1.3	<0.001 [b*]

Note: CNY, Chinese Yuan; Values are presented as number (%) or mean ± standard deviation (SD)
[a] P value for Chi-square test; [b] P value for independent t-tests; *Statistically significant at P < 0.05.

Bivariate model: The results showed that individuals who lived in urban areas, had a history of vascular risk or previous stroke, and had better stroke-related knowledge or stroke prevention behavior were significantly more likely to report good stroke awareness. In terms of the HBM constructs score, perceived benefits, self-efficacy, perceived susceptibility, perceived severity, and cues to action were positively associated with good stroke awareness. Conversely, perceived barriers were negatively associated with good stroke awareness. There was no association between stroke awareness and age, sex, education, personal yearly income, marital status, BMI, or sources of information (Table 2).

Multivariate models: Model 1 showed that good stroke awareness was positively associated with better stroke-related knowledge and a history of vascular risk or previous stroke. In model 2, stroke prevention behavior was added to model 1, and the results indicated that better stroke prevention behavior was significantly related to better stroke awareness. In model 3, HBM constructs were added to model 2. The results revealed that five out of the six HBM constructs showed a significantly positive association with good stroke awareness, with the exception of perceived barriers, which was negatively associated with good stroke awareness after controlling for other predictors. Furthermore, individuals with a history of vascular risk or previous stroke and good levels of stroke-related knowledge or stroke prevention behavior also had good stroke awareness.

Table 2. Odds ratios and 95% confidence intervals from binary logistic regression for stroke awareness of warning signs among community residents

Variables	Bivariate		Model 1		Model 2		Model 3	
	Unadjusted OR (95%CI)	*P*-Value	Adjusted OR (95%CI)	*P*-Value	Adjusted OR (95%CI)	*P*-Value	Adjusted OR (95%CI)	*P*-Value
Age<65 (ref: ≥65,y)	0.78 (0.58-1.04)	0.094	0.89 (0.64-1.25)	0.508	0.92 (0.65-1.29)	0.609	0.96 (0.67-1.39)	0.838
Male (ref: female)	0.96 (0.71-1.32)	0.812	0.89 (0.63-1.25)	0.492	0.90 (0.64-1.29)	0.576	0.88 (0.60-1.29)	0.503
Illiteracy or primary school (ref: Middle school or above)	0.91 (0.68-1.23)	0.557	1.00 (0.69-1.46)	0.985	1.00 (0.69-1.46)	0.986	1.02 (0.68-1.53)	0.929
Personal yearly income <5000 (ref: ≥5000 CNY)	1.46 (0.97-2.19)	0.066	1.50(0.97-2.32)	0.067	1.55(1.00-2.41)	0.049	1.40 (0.87-2.24)	0.167
Married (ref: Others)	0.90 (0.55-1.47)	0.669	0.87 (0.51-1.47)	0.605	0.93 (0.54-1.58)	0.776	1.06 (0.60-1.89)	0.834
Previous stroke history (ref: no)	2.02 (1.35-3.02)	0.001	1.75 (1.15-2.66)	0.009	1.56 (1.01-2.41)	0.043	1.75 (1.10-2.79)	0.019
Vascular risk factors history (ref: no)	1.89 (1.18-3.04)	0.008	1.80 (1.09-2.96)	0.021	1.83 (1.10-3.02)	0.019	1.77 (1.03-3.05)	0.038
Body mass index ≥24 (ref: <24 (kg/m^2))	0.92 (0.69-1.24)	0.599	0.90 (0.65-1.23)	0.496	0.85 (0.61-1.17)	0.318	0.86 (0.60-1.21)	0.380
Urban (ref: rural)	1.44 (1.07-1.94)	0.016	1.24 (0.89-1.74)	0.205	1.24 (0.88-1.74)	0.220	1.17 (0.82-1.69)	0.389
Sources of stroke information ≥ 3 (ref: < 3)	1.24 (0.87-1.78)	0.239	0.79 (0.52- 1.18)	0.248	0.80 (0.53- 1.21)	0.293	0.74 (0.49- 1.16)	0.190
Stroke-related knowledge level								
Good (ref: Poor)	2.50 (1.84-3.39)	<0.001	2.52 (1.77-3.57)	<0.001	2.18 (1.52-3.12)	<0.001	1.67 (1.12-2.49)	0.012
Stroke prevention behavior level								
Good (ref: Poor)	2.49 (1.78-3.46)	<0.001	—	—	1.92 (1.35-2.74)	<0.001	1.56 (1.05-2.33)	0.028
The HBM constructs								
Perceived susceptibility	1.21 (1.15-1.21)	<0.001	—	—	—	—	1.09 (1.02-1.16)	0.006
Perceived severity	1.16 (1.12-1.21)	<0.001	—	—	—	—	1.07 (1.02-1.13)	0.008
Perceived barriers	0.92 (0.89-0.96)	<0.001	—	—	—	—	0.95 (0.91-0.99)	0.026
Perceived benefits	1.12 (1.08-1.17)	<0.001	—	—	—	—	1.07 (1.02-1.11)	0.007
Perceived self-efficacy	1.21 (1.09-1.33)	<0.001	—	—	—	—	1.21 (1.08-1.36)	0.001
Cues to action	1.44 (1.27-1.63)	<0.001	—	—	—	—	1.33 (1.15-1.52)	<0.001

Note: OR, Odds ratios; CI, confidence intervals; ref, reference group; CNY, Chinese Yuan; Others: unmarried, divorced and widowed.

DISCUSSION

This study showed that most participants had a good awareness of stroke warning signs; the most frequently recognized warning sign was sudden numbness or weakness on one side of the face and/or limbs, while a sudden intense headache without apparent cause was less frequently recognized as a warning sign of stroke. In accordance with earlier studies,[22, 23] residents' recognition of stroke warning symptoms varies significantly; hemiplegia and speech disturbances were commonly recognized, while symptoms such as visual impairment and severe headache were less well-known. One explanation is that the former signs are more prevalent and noticeable, increasing the likelihood of detection; the latter signs are uncommon and atypical, making them easier to ignore.[24] This discrepancy indicates an urgent need for educational initiatives focused on raising awareness of these less common symptoms.[25]

Our results also found that higher stroke-related knowledge was associated with good stroke awareness, which aligns with previous research;[26, 27] participants with good stroke knowledge showed better recognition of stroke symptoms and responded appropriately to stroke emergencies. However, our participants had severely inadequate knowledge of thrombolysis, with only 9.2% being aware of the time window for intravenous thrombolysis and merely 12.5% understanding the concept of reperfusion therapy. These findings were consistent with other Chinese studies but were markedly lower than rates reported in high-income countries.[28, 29] This disparity may reflect historical emphasis on the knowledge of stroke warning signs and risk factors in education campaigns in China, with comparatively less attention given to thrombolysis knowledge.

Moreover, we also found that having a history of vascular risk factors or previous stroke events was related to higher stroke awareness. Numerous studies have corroborated this relationship.[9, 30] It is possible that a history of previous stroke and vascular risk factors encourages individuals to learn about stroke symptoms and can enhance citizens' understanding of warning symptoms.[30, 31] Some studies have indicated that individuals who have experienced their close friends or relatives having a stroke or who have vascular risk factors themselves would have regular appointments with doctors, where they can be educated.[31] This would encourage them to learn about stroke symptoms and how they should respond if such symptoms appear. Thus, these individuals have greater access to knowledge of vascular risk factors and experience with stroke, which enhances their stroke awareness.[9]

Furthermore, our results demonstrated that better stroke prevention behavior was significantly related to better stroke awareness, a relationship well supported by the literature.[32] Several factors may contribute to this relationship. First, stroke preventive behaviors, such as health education and lifestyle interventions, help raise public awareness of stroke risk factors and enhance sensitivity to early stroke warning symptoms.[33] For instance, combining lifestyle modifications with health education can improve individual stroke prevention awareness.[34] Additionally, by reducing exposure to stroke risk factors, these behaviors encourage individuals to become more attentive to their health and more knowledgeable about stroke, making it easier for them to recognize stroke symptoms early and take appropriate

action. For example, by managing chronic diseases such as hypertension or diabetes, individuals improve their health literacy, gaining greater awareness of stroke-related risks and secondary prevention. [35]

Moreover, our results indicated that citizens' stroke awareness was influenced by HBM constructs. Individuals with a higher perception of susceptibility, severity, benefits, self-efficacy, and cues to action had higher stroke awareness, while those with higher perceived barriers had lower stroke awareness. The results were in line with previous studies.[36, 37] The HBM plays an important role in health promotion by interpreting individual perceptions of health behaviors, thereby predicting and influencing their execution.[11] First, perceived susceptibility and perceived severity highlight an individual's understanding of stroke risk and the potential consequences of a stroke. The stronger these perceptions, the more sensitized the individual is to stroke, making them more likely to engage in preventive behaviors such as regular health check-ups, blood pressure control, and a balanced diet. [38, 39] Second, when individuals realize that preventive actions (such as health education and lifestyle modifications) can effectively reduce the occurrence of stroke, they are more willing to engage in stroke prevention activities. [40] If perceived barriers, such as difficulties in accessing medical care or lack of knowledge about emergency measures, are reduced, individuals are more likely to recognize stroke warning symptoms and take appropriate action. [41] Finally, self-efficacy and cues to action can significantly enhance stroke awareness, prompting individuals to stay vigilant about their health and maintain a healthy lifestyle.[42] Through these mechanisms, the HBM provides a theoretical foundation for improving individuals' awareness of stroke recognition and prevention.[11]

This study had some limitations. First, it was cross-sectional; as such, it did not establish direct causal relationships. Second, the data collection used self-reports, which may be impacted by social desirability bias. (To minimize the potential for self-report bias, validated and standardized instruments were used.) Third, the sample was limited to residents in Huanggang, Hubei Province; caution is necessary when generalizing the findings to other areas. Future studies should recruit a nationally representative sample. Despite these limitations, our study improves understanding of stroke awareness and its potential factors, and our findings should be taken into account when developing stroke education and prevention programs.

CONCLUSION

This study revealed that 64.7% of residents in Huanggang demonstrated good stroke awareness. The key factors influencing stroke awareness included stroke-related knowledge, stroke prevention behavior, and individual perceptions described by the HBM, such as perceived benefits, self-efficacy, susceptibility, and severity. Furthermore, a history of vascular risk factors or previous stroke was positively associated with better stroke recognition. These findings underscore the multifaceted nature of stroke awareness and emphasize the importance of targeting educational interventions based on individual health beliefs and behaviors. Given the critical role of early recognition in improving stroke outcomes, this work highlights the need for tailored public health campaigns that address both the knowledge gaps and the psychological factors influencing stroke recognition.

AUTHOR CONTRIBUTIONS

XW, TS and SY designed the study, analysed the data, served as the lead author and revised the manuscript. XW and SY assisted in data analysis and primarily

wrote the manuscript. XW, TS and SY designed and supervised the study, contributed to the local implementation of the study, assisted in the analysis and interpretation of the data and revised the manuscript. All authors read and approved of the final manuscript.

ETHICAL CONSIDERATION

The ethics of this study complied with the Declaration of Helsinki. Approval and ethical clearance were obtained from the Ethics Committee for Research Involving Human Subjects, Mahasarakan University, in Thailand (ethics number: 271-136/2024), on 25 April 2024 and the Ethics Committee for Research Involving Human Subjects, Huanggang Central Hospital, in China (ethics number: HGYY-KY-2023-008-1), on 18 April 2024.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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