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Evaluation of the knowledge, attitude and practice towards ischaemic stroke among healthcare workers in neurology and neurosurgery department: a cross-sectional study in Shaanxi province, China

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ABSTRACT

Objectives Healthcare workers play an important role in the timely recognition and treatment of patients who had an ischaemic stroke. However, their knowledge, attitude and practice (KAP) towards ischaemic stroke have not been well studied. This study aimed to assess the KAP towards ischaemic stroke among healthcare workers in the neurology and neurosurgery department in Shaanxi province, China.

Design Cross-sectional study.

Setting Medical centres in Shaanxi province.

Participants Healthcare workers in the neurology and neurosurgery department at Shaanxi province.

Primary and secondary outcome measures Demographic characteristics and KAP towards ischaemic stroke were collected by a self-designed questionnaire.

Results A total of 259 (96.6%) valid questionnaires were collected. Their mean KAP scores were 19.56±3.72 (total score: 23), 36.56±3.56 (total score: 40) and 27.45±3.00 (total score: 30), respectively. Multivariate logistic regression analysis demonstrated that education (bachelor's degree or above vs college or below: OR=2.704 (1.286–5.685), p=0.009), gender (female vs male: OR=0.401 (0.227–0.710), p=0.002) and professional title (intermediate vs no title: OR=0.280 (0.107–0.731), p=0.009) were independently associated with good knowledge; knowledge score (OR=1.266 (1.157–1.387), p<0.001) and hospital (private hospital vs public hospital: OR=0.544 (0.313–0.944), p=0.030) were independently associated with good attitude; and attitude score (OR=1.480 (1.326–1.652), p<0.001), gender (female vs male: OR=0.511 (0.264–0.993), p=0.047) and occupation (other healthcare workers vs physicians: OR=0.252 (0.129–0.495), p<0.001) were independently associated with good practice.

Conclusion The healthcare workers in the neurology and neurosurgery department demonstrated a satisfactory KAP towards ischaemic stroke. Targeted and tailored training programmes might be an optional way to improve their practice.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Used a self-designed questionnaire for a holistic understanding of KAP towards ischaemic stroke among healthcare workers.
⇒ High response rate (99.6%) with 259 participants, enhancing reliability within Shaanxi province.
⇒ Identified independent factors associated with good KAP through logistic regression analysis.
⇒ Conducted only in Shaanxi province, limiting applicability to broader populations.
⇒ Reliance on self-reported data may overestimate favourable attitudes or practices.

INTRODUCTION

Stroke is the leading cause of death and disability worldwide. Ischaemic stroke is defined as an episode of neurological dysfunction caused by infarction of the brain, spinal cord or retina, and it accounts for around 70% of all strokes.[1 2] The Global Burden of Disease Study (2016) estimated that the global lifetime risk of stroke was approximately 25% from the age of 25 years onwards, of which China had the highest estimated risk of 39.3%.[3] The incidence of ischaemic stroke in China is also higher than the global average, and it caused around 1.03 million deaths in 2019.[4 5] There are important differences in the stroke burden among different Chinese regions, with a prevalence varying from 1.66% in Guangdong and Guangxi to 4.07% in Heilongjiang, with Shaanxi (2.64% in 2015), Shandong (2.66% in 2015) and Xinjiang (2.34% in 2015) showing the largest increases (>20%) from 2012 to 2015.[6] Furthermore, the increasing ageing population with cardiovascular diseases may further intensify the burden of ischaemic stroke on the healthcare system.

Rapid recognition, diagnosis and timely evidence-based treatment of ischaemic stroke are essential in the reduction of morbidity and mortality.[7] For instance, timely treatments, including intravenous thrombolysis and endovascular thrombectomy, can effectively reduce disability.[8 9] However, barriers and challenges at various levels (ie, patient, health system, health professionals and health policy) impede the best practice of stroke management.[10] A study reported that limited knowledge of stroke care interventions among health professionals was one of the major barriers to optimal care.[10] Healthcare professionals play a critical role in the management of ischaemic stroke, from diagnosing and providing acute care to implementing preventive and rehabilitative interventions. Therefore, it is essential to enhance their knowledge, attitude and practice (KAP) towards ischaemic stroke to improve the quality of care.

A KAP survey is a quantitative method that is widely used for health-related topics based on the principle that knowledge has an influence on behaviour and practice of disease management.[11] Multidisciplinary teamwork is essential to effectively manage ischaemic strokes: the treating physician is responsible for the overall management of the patient's recovery in the acute phase of hospitalisation, and nurses are important in observing the patient's condition and assisting them in their activities of daily living.[12] Healthcare workers from the imaging laboratory are also critical personnel when continuously monitoring the disease.[12] Furthermore, all healthcare providers are responsible for educating the general public about stroke prevention and raising awareness.[13 14] Nonetheless, a recent study has found that community physicians in China had insufficient knowledge of stroke at baseline,[15] but the exact KAP situation of healthcare workers in general remains unknown. Programmes and interventions to advance ischaemic stroke care might be warranted in healthcare workers.

Although China has one of the highest risks of ischaemic stroke worldwide, the KAP of ischaemic stroke among Chinese healthcare workers has not been well studied. Previously available studies focused on specific categories of healthcare workers (eg, nurses or emergency nurses) or aspects of stroke (eg, stroke-related dysphagia or early stroke management).[16–18] Therefore, this study aimed to assess the KAP towards ischaemic stroke among healthcare workers in the neurology and neurosurgery department in Shaanxi province, China. We hypothesised the findings might assist scholars in identifying the KAP gaps in ischaemic stroke management, and the results might provide a reliable basis for improving ischaemic stroke care management.

METHODS

Study design and participants

This cross-sectional study was conducted in Shaanxi province between September and December 2022, and the participants were physicians and other healthcare workers (including nurses and medical technicians). The inclusion criterion was participants with the appropriate professional qualifications (eg, physician qualification, nurse qualification, medical examiner qualification, etc) and on active employment by the participating hospitals. The exclusion criterion was physicians, nurses or technicians from departments other than the neurology department and the neurosurgery department. Of note, physicians working in the neurology and neurosurgery departments are also those treating patients who had a stroke in the emergency department, this restrictions were not for the other healthcare professionals.

Questionnaire

A structured questionnaire was designed by the investigators based on publications on similar topics and the Chinese guidelines for the diagnosis and treatment of ischaemic stroke.[15 19] The questionnaire was reviewed by two neurology experts and revised accordingly based on the comments. This step was used to exclude the questions that were inappropriate, uncertain or inaccurate, guaranteeing content validity. The final questionnaire (online supplemental materials) consisted of four dimensions: demographic characteristics (age, gender, education, professional title, working experience, department and type of hospital), knowledge dimension, attitude dimension and practice dimension. For professional titles, a senior title refers to attending physician or higher or nurse supervisor or higher, a junior refers to resident physician or regular nurse and none refers to intern or nurse in training. The knowledge dimension consists of 23 questions, scoring 1 point for correct answers and 0 points for wrong or unclear answers, ranging from 0 to 23 points. The attitude dimension contains 8 questions using a 5-point Likert scale ranging from strongly agree (5 points) to strongly disagree (1 point), with a score range of 8–40 points. The practice dimension contains 6 questions using a 5-point Likert scale, ranging from always (5 points) to never (1 point), with a score range of 6–30 points.

Questionnaire distribution

The questionnaire was distributed via the Sojump (https://www.wjx.cn/). The link and QR code of the questionnaire were distributed to the hospital directors and department heads, who distributed them to the potential participants. The link was also sent to eligible healthcare workers via social networks. The participants completed the questionnaire by clicking on the link.

Quality control

The questionnaire could be completed only once for a given IP address. Incomplete questionnaires were excluded. The questionnaires with obvious patterns of completion (eg, all first choices for the KAP items) were considered invalid. Questionnaires with logic errors (eg, impossible age) were also considered invalid.

Sample size

The sample size was determined to be 5–10 times the number of KAP items based on the method used in quantitative surveys.[20] Since this study had 37 KAP items, the minimal sample size was 185–370 participants. It is a semi-quantitative sample size estimation that is often used for KAP studies.[21–25]

Statistical analysis

The SPSS V.26.0 software (IBM) was used for statistical analysis. Continuous data were expressed as mean±SD, compared by independent t-test or one-way analysis of variance. Categorical data were expressed as n (%). Pearson's correlation analysis was used to analyse the correlation between knowledge scores, attitude scores and practice scores. The KAP scores were converted to a binary variable according to their median, and multivariate logistic regression analysis was used to explore variables independently associated with their KAP. Likelihood Ratio (LR) forward selection procedure ($p<0.05$) was used to select the factors included in the multivariate logistic regression. A two-sided $p<0.05$ was considered statistically significant.

Confirmatory factor analysis (CFA) was conducted to confirm the factorial structure of the KAP. Several model fit indices were used to examine the goodness of fit of the model: minimum discrepancy function by df divided (CMIN/df), root mean square error of approximation (RMSEA), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI). Construct reliability (CR) was calculated for convergent validity and average variance extracted for discriminant validity.

Patient and public involvement

No patients were involved.

RESULTS

Participants' characteristics

A total of 268 questionnaires were collected. There were eight incomplete questionnaires, and one was completed using an obvious repeated pattern. Therefore, 259 questionnaires were valid, with an effective rate of 96.6%. The Cronbach's α for the valid questionnaires was 0.880, indicating an acceptable internal consistency of the instrument. Most participants (44.0%) were aged 40–50 years, followed by under 40 (34.7%) and over 50 (21.2%) years. Over half of the participants were men (67.6%), had a bachelor's degree or above (50.6%), were other healthcare workers (60.6%) and were from public hospitals (62.9%). Around 29% had junior titles, followed by 24.7% with senior titles, 24.3% with no professional titles and 22% with intermediate titles. The majority of participants (64.9%) had equal to or over 16 years of work experience (table 1).

KAP towards ischaemic stroke

An average score of 19.6±3.7 (median: 21) was obtained in participants' knowledge of ischaemic stroke (table 1). Most of participants were aware that 'final identification and confirmed diagnosis of ischaemic stroke requires the support of brain imaging examination' (97.3%), 'primary prevention of ischaemic stroke includes lifestyle improvement and control of risk factors/causes' (96.9%) and 'patients with symptoms consistent with acute ischaemic stroke should be evaluated with cranial imaging immediately on arrival at the hospital to shorten the time from admission to completion of imaging evaluation' (95.8%); however, relatively fewer participants were aware that 'when stent-based thrombectomy fails to achieve satisfactory reperfusion and the patient is still within the 6-hour time window for arterial thrombolysis, the practice of remedial treatment with arterial administration of recombinant tissue plasminogen activator (rt-PA) is currently limited to clinical experience and has no clear scientific evidence' (66.0%), 'atherosclerotic large-vessel occlusion requires routine application of tirofiban after mechanical embolization' (67.2%) and 'local anaesthesia, conscious sedation or general anaesthesia are all reasonable options for the treatment of anterior circulation large-vessel occlusion' (69.5%) (online supplemental table 1). Participants with male gender, bachelor's degree or above, senior titles, occupation of physicians and working in public hospitals were likely to have higher scores in the knowledge dimension (table 1). Gender differences were also observed in specific knowledge items (online supplemental table 1).

The participants' attitudes and practice scores towards ischaemic stroke were 36.6±3.6 (median: 37) and 27.5±3.0 (median: 29), respectively. The majority of participants had overall positive attitudes and good practices (online supplemental tables 2 and 3). In the attitude dimension, most of the participants strongly agreed that 'more knowledge about ischaemic stroke needs to be disseminated to the public' (86.5%) and 'primary physicians require further training on ischaemic stroke' (84.9%); however, relatively fewer participants strongly agreed that 'I am confident enough in recognising ischaemic stroke' (56.0%) and 'I am confident enough in dealing with ischaemic stroke patients' (56.0%) (online supplemental table 2). In the practice dimension, the majority of participants rated always when asked 'I will remind patients with ischaemic stroke to have regular reviews' (73.4%), while relatively fewer participants rated always when asked 'I will recommend patients to receive thrombolysis or thrombectomy' (57.9%) (online supplemental table 3). Participants younger than 40 years, male participants, those with bachelor's degrees or above, those with senior titles, physicians and those from public hospitals were more likely to have higher attitude and practice scores. Participants with 11–15 years of working experience were more likely to have higher practice scores (table 1).

Table 1 Distribution of participants' baseline information and knowledge, attitude and practice scores

		Knowledge		Attitude		Practice	
	N (%)	Mean±SD	P value	Mean±SD	P value	Mean±SD	P value
Total	259 (99.6)	19.56±3.722		36.56±3.564		27.45±2.999	
Age (years)			0.410		0.001		0.000
<40	90 (34.7)	19.98±3.557		37.64±2.81		28.38±2.466	
40–50	114 (44.0)	19.36±3.747		36.2±3.345		27.05±3.062	
>50	55 (21.2)	19.27±3.94		35.53±4.58		26.75±3.32	
Gender			0.002		0.040		0.002
Male	175 (67.6)	20.05±3.581		36.87±3.408		27.85±2.87	
Female	84 (32.4)	18.54±3.823		35.9±3.807		26.62±3.108	
Education			0.000		0.000		0.000
College or below	128 (49.4)	18.7±4.165		35.45±4.054		26.16±3.257	
Bachelor's degree or above	131 (50.6)	20.4±3.017		37.65±2.596		28.71±2.509	
Professional title			0.001		0.000		0.000
None	63 (24.3)	19.22±4.168		35.62±4.038		25.87±3.215	
Junior title	75 (29.0)	19.15±3.604		35.68±4.011		26.92±3.178	
Intermediate title	57 (22.0)	18.65±4.32		37.21±2.678		28.12±2.501	
Senior titles	64 (24.7)	21.17±2.02		37.94±2.569		29.02±1.873	
Working experience (years)			0.151		0.093		0.045
≤5	15 (5.8)	18.2±3.913		36.8±2.908		27.6±3.135	
5–10	30 (11.6)	19.4±4.492		37.83±2.842		27.97±2.566	
11–15	46 (17.8)	20.52±2.614		37±2.906		28.35±2.532	
≥16	168 (64.9)	19.44±3.786		36.19±3.841		27.1±3.13	
Occupation			0.000		0.001		0.000
Physicians	102 (39.38)	20.59±2.715		37.38±2.666		28.90±1.917	
Other healthcare workers	157 (60.61)	18.89±4.122		36.03±3.960		26.50±3.196	
Hospital			0.039		0.001		0.002
Public hospitals	163 (62.9)	19.94±3.345		37.17±3.188		27.9±2.808	
Private hospitals	96 (37.1)	18.9±4.224		35.53±3.934		26.69±3.17	

Characteristics related to KAP towards ischaemic stroke

A significant positive correlation was found between knowledge–attitude (r=0.393, p<0.001), knowledge–practice (r=0.383, p<0.001) and attitude–practice (r=0.577, p<0.001) (table 2). Multivariate logistic regression analysis demonstrated that higher education (bachelor's degree or above vs college or below: OR=2.704 (1.286–5.685), p=0.009) was independently associated with good knowledge, while women (OR=0.401 (0.227–0.710), p=0.002) and professional title (intermediate vs none title, OR=0.280 (0.107–0.731)) were independently associated with poor knowledge. The higher knowledge scores (OR=1.260 (1.154–1.377), p<0.001) and higher education (bachelor's degree or above vs college or below: OR=2.286 (1.320–3.958), p=0.003) were independently associated with good attitude. The higher attitude score (OR=1.497 (1.329–1.687), p<0.001) was independently associated with good practice, while women (OR=0.448 (0.231–0.870), p=0.018) and other healthcare workers (OR=0.189 (0.097–0.369), p<0.001) were independently associated with poor practice (table 3).

Among physicians, women (OR=0.372 (0.145–0.957), p=0.040) were independently associated with good knowledge. The higher knowledge scores (OR=1.500 (1.209–1.862), p<0.001) were independently associated with a good attitude, while private hospitals (OR=0.104 (0.020–0.541), p=0.007) were independently associated with a poor attitude. The higher attitude scores were

Table 2 Correlation analysis among knowledge, attitude and practice

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.393*	1	
Practice	0.383*	0.577*	1

*P<0.001.

Table 3 Multivariate logistic regression analysis of knowledge, attitude and practice scores

Characteristics	Multivariate logistic regression	
	OR (95% CI)	P value
Knowledge*		
Gender		
Male	REF	–
Female	0.401 (0.227 to 0.710)	0.002
Education		
College or below	REF	–
Bachelor's degree or above	2.704 (1.286 to 5.685)	0.009
Professional title		0.024
None title	REF	–
Junior title	0.726 (0.353 to 1.490)	0.382
Intermediate title	0.280 (0.107 to 0.731)	0.009
Senior title	0.725 (0.267 to 1.967)	0.527
Attitude†		
Knowledge	1.260 (1.154 to 1.377)	<0.001
Education		
College or below	REF	–
Bachelor's degree or above	2.286 (1.320 to 3.958)	0.003
Practice‡		
Attitude	1.497 (1.329 to 1.687)	<0.001
Gender		
Male	REF	–
Female	0.448 (0.231 to 0.870)	0.018
Occupation		
Physicians	REF	–
Other healthcare workers	0.189 (0.097 to 0.369)	<0.001

*The median for knowledge was 21, and 125 (48.26%) participants demonstrated a lower knowledge score (<21).
†The median for attitude was 37, and 110 (42.47%) participants demonstrated a lower attitude score (<37).
‡The median for the practice was 29, and 124 (47.88%) participants demonstrated a lower practice score (<29).

independently associated with good practice (OR=1.371 (1.150–1.633), p<0.001) (table 4).

Among other healthcare workers, women (OR=0.374 (0.183–0.765), p=0.007) and professional title (intermediate title vs none title: OR=0.159 (0.046–0.554), p=0.004) were independently associated with poor knowledge, while higher education (bachelor's degree or above vs college or below: OR=5.196 (1.715–15.736), p=0.004) was independently associated with good knowledge. The higher knowledge scores (OR=1.276 (1.138–1.430), p<0.001) and professional title (intermediate title vs none title: OR=5.104 (1.370–19.021), p=0.015; senior title vs none title: 7.050 (1.328–37.428), p=0.022) were

Table 4 Multivariate logistic regression analysis of KAP scores among physicians

Characteristics	Multivariate logistic regression	
	OR (95% CI)	P value
Knowledge*		
Gender		
Male	REF	–
Female	0.372 (0.145 to 0.957)	0.040
Attitude†		
Knowledge score	1.500 (1.209 to 1.862)	<0.001
Hospital		
Public hospital	REF	–
Private hospital	0.104 (0.020 to 0.541)	0.007
Practice‡		
Attitude score	1.371 (1.150 to 1.633)	<0.001

*The median for knowledge was 21 among physicians, and 41 (40.20%) physicians demonstrated a lower knowledge score (<21).
†The median for attitude was 38 among physicians, and 47 (46.08%) physicians demonstrated a lower attitude score (<38).
‡The median for the practice was 30 among physicians, and 34 (33.33%) physicians demonstrated a lower practice score (<30).

independently associated with good attitude, while older age (40–50 vs <40: OR=0.170 (0.057–0.511), p<0.002; >50 vs <40: OR=0.167 (0.051–0.555), p=0.003) and women (OR=0.360 (0.155–0.834), p=0.017) were independently associated with poor attitude. The higher attitude scores (OR=1.395 (1.245–1.562), p<0.001) were independently associated with good practice (table 5).

Subgroup of non-physician healthcare workers

Online supplemental table 4 shows the characteristics and KAP scores of the non-physician participants (nurses and medical technicians). Most (49.0%) were aged 40–50 years, followed by above 50 (29.9%) and below 40 (21.0%) years. Over half of the participants were men (61.8%), had a college degree or below (76.4%) and were from private hospitals (53.5%). Around 37% had junior titles, followed by 40% with no titles, 14.7% with intermediate titles and 8.3% with senior titles. The majority of participants (75.8%) had equal to or over 16 years of work experience.

Confirmatory factor analysis

The results of CFA are presented in online supplemental figure 1. The model fit indices were as follows: CMIN/df=2.203; RMSEA=0.068; IFI=0.739; TLI=0.718; and CFI=0.735 (online supplemental table 5). The CR was 0.9306, demonstrating good construct validity.

DISCUSSION

The present study demonstrated satisfactory KAP towards ischaemic stroke among healthcare workers in the neurology and neurosurgery department. The findings

Table 5 Multivariate logistic regression analysis of KAP scores among other healthcare workers

Characteristics	Multivariate logistic regression	
	OR (95% CI)	P value
Knowledge*		
Gender		
Male	REF	–
Female	0.374 (0.183 to 0.765)	0.007
Education		
College or below	REF	
Bachelor's degree or above	5.196 (1.715 to 15.736)	0.004
Professional title		
None title	REF	
Junior title	0.625 (0.293 to 1.335)	0.225
Intermediate title	0.159 (0.046 to 0.554)	0.004
Senior title	0.450 (0.088 to 2.303)	0.338
Attitude†		
Knowledge score	1.276 (1.138 to 1.430)	<0.001
Gender		
Male	REF	
Female	0.360 (0.155 to 0.834)	0.017
Age (years)		
<40	REF	–
40–50	0.170 (0.057 to 0.511)	0.002
>50	0.167 (0.051 to 0.555)	0.003
Professional title		
None title	REF	
Junior title	0.945 (0.409 to 2.183)	0.895
Intermediate title	5.104 (1.370 to 19.021)	0.015
Senior title	7.050 (1.328 to 37.428)	0.022
Practice‡		
Attitude score	1.395 (1.245 to 1.562)	<0.001

*The median for knowledge was 20 among other healthcare workers, and 75 (47.77%) of them demonstrated a lower knowledge score (<20).
†The median for attitude was 37 among other healthcare workers, and 76 (48.41%) of them demonstrated a lower attitude score (<37).
‡The median for the practice was 27 among other healthcare workers, and 34 (46.50%) of them demonstrated a lower practice score (<27).

might assist scholars in identifying the knowledge gaps in ischaemic stroke management, and the results may provide a reliable basis for improving ischaemic stroke care management.

The average score for the knowledge dimension was over 19 points out of 23 questions, which is higher than the stroke-related knowledge reported in similar studies in China, where the correct rate for stroke recognition and management knowledge was as low as 24% among community healthcare professionals.[15 26] It might be because participants in the present study were healthcare workers from public hospitals or private medical institutions, and they might have received more comprehensive training and might have had better knowledge about stroke care management compared with community physicians and nurses. Community hospitals in China usually are non-academic centres. Such hospitals usually lack the infrastructure for proper continuing education activities, and the healthcare workers must seek continuous education by themselves. Hence, although the present study did not examine training, lower exposure to education opportunities can affect the general healthcare knowledge of the workers. Nonetheless, the positive knowledge outcome was comparable with similar studies in other Asian countries (ie, Malaysia and Indonesia).[27 28]

The present study also identified pharmaceutical interventions that participants had poorer knowledge about, including tirofiban, rt-PA and anaesthetics. Evidence-based treatment of ischaemic stroke is of critical importance to improve mortality and morbidity; therefore, additional training and education are required to further strengthen the related knowledge in this population. The factors associated with a higher knowledge of ischaemic stroke management were higher educational level, male gender and having a non-middle title. A higher educational level and less clinical experience were previously identified as factors associated with better stroke management.[26 28] With the new and emerging stroke therapies and clinical guidelines, junior professionals might be more accustomed to the use of these therapies compared with senior healthcare workers.[28] Gender has not been identified as a factor related to stroke knowledge in previous relevant studies of healthcare workers, but a study in China showed that male patients had greater stroke knowledge compared with female patients, which might be attributed to male participants' higher educational level and income.[29] In the present study, the female gender was independently associated with lower knowledge scores, irrespective of the occupation. Although a feminisation of the healthcare workforce is being observed in China, a study showed that lower-rank positions have been feminised first, probably owing to the social and familial norms restraining the advancement of women's careers and training.[30] Indeed, about 70% of physicians in China are working>50 hours/week, which is incompatible with the traditional familial view of having and raising children. In theory, male and female healthcare workers have equal career advancement opportunities, but the advancement system based on academic publications in China might favour males, and some female healthcare workers can be tempted to leave the public system for the private sector.[31] The gender disparity should be considered when designing stroke-related training programmes. Flexible online training could be more suitable for women having to manage their professional and familial schedules. Furthermore,

physicians and those from public hospitals also tended to have higher knowledge scores, which is consistent with previously reported findings.[26 27]

Almost all the participants provided positive answers to questions in attitude and practice dimensions, confirming previous studies.[28 32 33] Roebers *et al* reported positive attitudes and current practice of stroke management in primary care physicians, and they also found a significant positive relationship between attitude and practice.[33] Kusuma *et al* demonstrated that the majority of primary care physicians' attitudes and practice towards stroke were in a good category, and significant correlations were found between knowledge–attitude, knowledge–practice and attitude–practice.[28] In the present study, a higher attitude score was associated with a higher knowledge score and a higher education level; a higher practice score was associated with a higher attitude score, male gender and being a physician.

The present study also found significant correlations between knowledge–attitude, knowledge–practice and attitude–practice. This finding reaffirmed the relationship between KAP and that adequate knowledge can lead to a positive attitude to inform better practices.[34 35] However, the correlation was the strongest between attitude and practice, and knowledge was not a significant factor influencing practice. This outcome reflects a potential knowledge–practice gap that was widely addressed in the literature.[36 37] The strategies to bridge the knowledge–practice gap include revision of the curriculum and having a liaison between the education and the practice.[36] In addition, the correlation between attitudes and practice is stronger than between knowledge and practice, indicating that attitudes also play an important role in practice. Therefore, even though educational activities such as continuous education could improve practice towards stroke, such interventions should include a motivational component as well to cultivate positive attitudes.

The present study demonstrated that KAP was different between physicians and other healthcare workers (nurses and medical technicians), while the multivariate analysis showed that the occupation was only independently associated with practice rather than with knowledge and attitude. Previous studies demonstrated that nurses and medical technicians have competent knowledge of stroke care, and they have aspired to improve stroke treatment services.[26 38] Due to the different clinical roles of different healthcare professionals, physicians might receive more comprehensive training and have hands-on experience with patients who had an acute ischaemic stroke; therefore, physicians might have better practice compared with nurses and medical technicians despite having similar levels of knowledge and attitude. Nonetheless, the present study showed that nurses and medical technicians had good knowledge and positive attitudes towards ischaemic stroke, which were positively correlated with practice. These staff can achieve their professional potential with organisational support and an acceptable work environment, and they can play an important role in ischaemic stroke care.[38] Targeted and tailored training programmes, in the form of continuous education activities (eg, lectures and online training), should be provided to nurses and medical technicians to enhance their practice of ischaemic stroke management. Female gender negatively affected the knowledge scores among physicians, while female gender, a lower education level, and professional titles were associated with lower knowledge scores among nurses and medical technicians. These findings provided important evidence for identifying individuals with poor ischaemic stroke-related knowledge in these two subgroups.

The present study has several limitations. First, this study was conducted in a single province in China, and the results might not be generalised to the whole country. The participants were mainly physicians and nurses, with very few of the other professionals; therefore, the participants were categorised as physicians versus others. Although the physicians working in the neurology and neurosurgery departments were seeing patients in the emergency department, the nurses and medical technicians were only from the neurology and neurosurgery departments. Furthermore, considering the number of healthcare workers in China, the sample size was small but fell within the minimal sample size of 185–370 participants. Second, the questionnaire was not pilot-tested, but Cronbach's α for the valid questionnaires was 0.880, indicating an acceptable internal consistency. Third, due to the self-reporting nature of the study, the results might deviate from the actual practice. Furthermore, most participants provided positive answers in the attitude and practice dimensions, and the results might be affected by the social desirability bias. Fourth, although the effective rate was high (96.6%), the exact number of individuals who received or saw the invitation but did not complete the questionnaire is unknown. Therefore, there was probably a non-response bias, but it cannot be evaluated. Fifth, individuals of different occupations (ie, physicians, nurses, technicians, etc) may have diverse educational backgrounds and clinical experiences related to ischaemic stroke and, therefore, different levels of KAP. However, we only compared between physicians and non-physician healthcare workers. Future studies should explore the KAP towards ischaemic stroke in more well-defined occupation groups. Finally, characteristics, including the exact location of the participants within the province and clinical specialty, were not collected.

In conclusion, this cross-sectional study demonstrated satisfactory KAP towards ischaemic stroke among physicians and other healthcare workers in the neurology and neurosurgery department in Shaanxi province. While participants had satisfactory overall knowledge of ischaemic stroke care, further education is needed in the weaker areas, such as pharmaceutical treatments. This study also revealed various factors associated with the level of KAP. It is important to take these factors

into account when designing training programmes for ischaemic stroke care. Furthermore, it was found that occupation was associated with practice rather than with knowledge and attitude, indicating that non-physician healthcare workers may require additional hands-on training to enhance their practice. Nonetheless, nurses and medical technicians had acceptable knowledge and a positive attitude towards ischaemic stroke, highlighting their importance in ischaemic stroke management. Future studies should explore effective interventions to enhance KAP in this population. Interviews and focus groups, along with a more comprehensive questionnaire that includes more detailed characteristics and application and analysis questions, could be organised to obtain a better understanding of the KAP in this population.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study was approved by the medical ethics committee of The First People's Hospital of Xianyang (IRB# 0028-22-9R0), and written informed consent was obtained from all participants. All methods were performed in accordance with the relevant guidelines. The research was carried out and all procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

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NOTE: The original questionnaire was in Chinese and that the study was conducted in Chinese. The English translation is not a validated translation of the original questionnaire. It is provided for indicative purposes only.

Dear Participants：

We are the researchers of * Hospital and we invite you to participate in our study.

To provide the basis for developing scientific intervention strategies, which may help more people and upgrading medical standards in the future, this study needs to investigated the knowledge, attitude, and practice toward ischemic stroke among the healthcare workers. Your participation in this study is voluntary and this study has been ethically approved by the Medical Ethics Committee. If you agree to participate in this study, please refer to the following instructions.

1. Please complete the questionnaire,there is no absolute right or wrong answer, you just need to fill in according to your actual situation. You can ask us any questions during the answering process, and when you are finished, please submit it in time.

2. This study is a simple questionnaire, it will not cause harm to your physical and psychological condition, but it may involve some privacy question, such as your gender, age, etc. We will keep it strictly confidential and will not disclose your information, please feel free to fill it out.

3. As a participant, You can stay informed about information and progress related to this study. If you decide to withdraw from it, please inform us than your data will not be included in the results.

Finally, we sincerely thank you for taking the time out of your busy schedule to support our scientific study!

□ I have knowledge of and consent to the use of the collected data for scientific study.

Informed Consent Signature:

Date of participation: Year Month Day

Part I Basic Information

1.Your gender:	a.Male b.Female
2.Your age:	_____Years
3.Your education:	a.Junior college/Below b.Bachelor's degree c.Master's degree/Above
4.Your professional title:	a.None b.Primary title c.Middle title d.Vice-senior Title e.Senior Title
5.Your years of work:	a.≤5 years b.5-10 years c.11-15 years d.≥16 years
6.Your occupation:	a.Physicians b.Other healthcare workers (including nurse and medical technicians)
7.Type of hospital you work in:	a. Public Primary Hospitals b. Public Secondary Hospitals c. Public Tertiary hospitals d. Public Specialist Hospitals e. Private medical institutions

Part II Knowledge

1. Identification of Ischemic stroke can be divided into simple identification, specialty identification and image identification	**a.Correct**	**b.Wrong**	**c. Unclear**
2.Simple identification of ischemic stroke includes BEFAST test, FAST (Face-Arm-Speech Test) and the "Stroke 1-2-0".	**a.Correct**	**b.Wrong**	**c. Unclear**
3.Patients diagnosed with stroke at the primary diagnosis should be promptly referred to a higher level hospital and clarify whether it is an ischemic stroke or not	**a.Correct**	**b.Wrong**	**c. Unclear**
4.Overexertion, diarrhea, cold, and staying up late are common precipitating factor of ischemic stroke; inarticulateness and numbness and weakness of limbs are common precursors of ischemic stroke.	**a.Correct**	**b.Wrong**	**c. Unclear**
5.According to the category of neurological deficits, symptoms of ischemic stroke include higher cortical, motor, and sensory d ysfunction; according to the dysfunction caused by the damage to brain tissue innervated by different vascular regions, the sym ptoms of ischemic stroke can be subdivided into ischemic stroke within internal carotid artery system and vertebrobasilar ische mic stroke	**a.Correct**	**b.Wrong**	**c. Unclear**
6.Final identification and confirmed diagnosis of ischemic stroke requires the support of brain imaging examination	**a.Correct**	**b.Wrong**	**c. Unclear**
7.Patients with symptoms consistent with acute ischemic stroke should be evaluated with cranial imaging immediately upon arrival at the hospital to shorten the time from admission to completion of imaging evaluation	**a.Correct**	**b.Wrong**	**c. Unclear**

8.Non-contrast CT (NCCT) and Cranial MRI can effectively exclude intracranial hemorrhage and occupying lesions before endovascular treatment	**a.Correct**	**b.Wrong**	**c. Unclear**
9.The stroke patients, caused by acute anterior circulation large vessel occlusion, received the treatment of stent-based thrombectomy device in combination with intravenous thrombolysis has higher reperfusion rate and better prognosis than those received the treatment of Intravenous thrombolysis only, without significant increase in safety endpoint events.	**a.Correct**	**b.Wrong**	**c. Unclear**
10.Combination of aspiration and stent-based thrombectomy is not only used for remedial treatment after failed mechanical thrombectomy or failed aspiration, but is increasingly being used as a first reperfusion protocol In clinical.	**a.Correct**	**b.Wrong**	**c. Unclear**
11.When stent-based thrombectomy fails to achieve good reperfusion and the patient is still within the 6-h time window for arterial thrombolysis, the practice of remedial treatment with arterial administration of rt-PA is currently limited to clinical experience and has no clear evidence-based medical basis.	**a.Correct**	**b.Wrong**	**c. Unclear**
12.Local anaesthesia, conscious sedation or general anaesthesia are all reasonable options for the treatment of anterior circulation large vessel occlusion	**a.Correct**	**b.Wrong**	**c. Unclear**
13.The best way for perioperative anaesthetic management of Interventional treatment of posterior circulation large vessel occlusion is still unclear, the choice of anaesthesia can be individualised to take into account the patient's situation and the	**a.Correct**	**b.Wrong**	**c. Unclear**

conditions of the interventional catheterisation unit			
14.Direct aspiration may be more effective for larger and more rigid thromboembolisms	**a.Correct**	**b.Wrong**	**c. Unclear**
15.Angioplasty and stenting are commonly used for the remedial treatment of failed thrombectomy in large vessel occlusive stroke	**a.Correct**	**b.Wrong**	**c. Unclear**
16.Contraindications of early endovascular intervention include Severe active bleeding, Significant bleeding tendency, Severe cardiac, hepatic, and renal organ insufficiency, and the Expected survival of less than 90d	**a.Correct**	**b.Wrong**	**c. Unclear**
17.The prehospital transport of acute ischemic stroke can be divided into drip and ship mode and mothership mode	**a.Correct**	**b.Wrong**	**c. Unclear**
18.For thrombectomy after the 6-hour window, a multimodal imaging examination is mandatory	**a.Correct**	**b.Wrong**	**c. Unclear**
19.For large vessel occlusion strokes within 4.5 to 24 h of onset, direct endovascular treatment can be performed after adequate evaluation	**a.Correct**	**b.Wrong**	**c. Unclear**
20.Atherosclerotic large vessel occlusion requires routine application of tirofiban after mechanical embolization	**a.Correct**	**b.Wrong**	**c. Unclear**
21.After reperfusion, intensive antihypertensive therapy is required	**a.Correct**	**b.Wrong**	**c. Unclear**
22.Primary prevention of ischemic stroke includes lifestyle improvement, control of risk factors/causes	**a.Correct**	**b.Wrong**	**c. Unclear**
23.Secondary prevention of ischemic stroke requires additional Specialty specific treatment in addition to primary prevention	**a.Correct**	**b.Wrong**	**c. Unclear**

Part III Attitude

1.More knowledge about ischemic stroke needs to be disseminated to the public	a.Strongly Agree	b.Agree	c.Neutral	d.Disagree	e.Strongly Disagree
2.Primary doctors need more training on ischemic stroke	a.Strongly Agree	b.Agree	c.Neutral	d.Disagree	e.Strongly Disagree
3.On-site handling of ischemic stroke is more important than in-hospital treatment	a.Strongly Agree	b.Agree	c.Neutral	d.Disagree	e.Strongly Disagree
4.Primary doctors need more accurate early identification of stroke caused by large vessel occlusion	a.Strongly Agree	b.Agree	c.Neutral	d.Disagree	e.Strongly Disagree
5.Primary doctors should pay more attention to early assessment of vascular for ischemic stroke	a.Strongly Agree	b.Agree	c.Neutral	d.Disagree	e.Strongly Disagree
6.Emergency doctors are more critical than neurologists in the diagnosis and treatment of ischemic stroke	a.Strongly Agree	b.Agree	c.Neutral	d.Disagree	e.Strongly Disagree
7.I am confident enough in recognizing ischemic stroke	a.Strongly Agree	b.Agree	c.Neutral	d.Disagree	e.Strongly Disagree
8.I am confident enough in deal with the ischemic stroke patients	a.Strongly Agree	b.Agree	c.Neutral	d.Disagree	e.Strongly Disagree

Part IV Practice

1.I will pay more attention to patients at risk of stroke in my daily work	a.Always	b.Often	c.Sometimes	d.Seldom	e.Never
2.I will recommend patients to receive thrombolysis or thrombectomy therapy	a.Always	b.Often	c.Sometimes	d.Seldom	e.Never
3.I will remind patients with ischaemic stroke to have regular reviews	a.Always	b.Often	c.Sometimes	d.Seldom	e.Never
4.For patients in primary/secondary prevention, I would remind their families to take specific preventive measures	a.Always	b.Often	c.Sometimes	d.Occasionally	e.Never
5.I am happy to receive training in ischaemic stroke management	a.Always	b.Often	c.Sometimes	d.Occasionally	e.Never

6. I am happy to disseminate the knowledge about ischemic stroke to patients and others around me.	a.Always	b.Often	c.Sometimes	d.Occasionally	e.Never

The original questionnaire (in Chinese)

亲爱的参与者：

我们是*医院的科研人员，诚挚邀请您参与我们的课题研究。本研究旨在了解您对于缺血性卒中的知识，态度以及行为意愿，为制定科学的策略提供依据，这可能在未来帮助到更多的人，提升医疗水平。您参与这项研究是自愿的，本研究已通过伦理审查委员会的审查，如果您同意参与本研究，请参阅以下说明。

1.请您完成问卷，答案无关对错，您只需要根据实际情况填写。回答过程中的任何问题您都可以向我们提出，完成后，请您及时提交。

2.本研究是简单的问卷调查，不会对您的身体和心理状况造成伤害，但会涉及一些隐私问题，如您的性别、年龄等，我们会严格保密，不会泄露您的信息，请您放心填写。

3.作为参与者，您可以随时了解与本研究相关的信息和研究进展，如果您决定退出研究，请告知我们，您的数据将不包含在研究结果中。

最后，衷心感谢您能百忙之中抽出时间支持我们的科学研究！

☐我已知晓并同意将所收集的数据用于科学研究。

知情同意签字：

参与时间：　　年　　月　　日

第一部分 基本信息

1.您的性别：	a.男	b.女
2.您的年龄：	____岁	
3.您的教育程度：	a.大专及以下 b.本科 c.硕士及以上	
4.您的职称：	a.无职称 b.初级 c.中级 d.副高级 e.高级	
5.您的工作年限：	a.≤5 年 b.5-10 年	

	c.11-15 年
	d.≥16 年
6.您工作的类型：	a.医生
	b.其它医务工作者（如护士、医技工作者等）
7.您所工作的医院类型：	a.公立一级医院
	b.公立二级医院
	c.公立三级医院
	d.公立专科医院
	e.私立医疗机构

第二部分 知识

1.缺血性卒中识别可以分为简易识别法、专科识别法和影像识别法	**a.对**	**b.错**	**c. 不清楚**
2.缺血性卒中的简易识别包括 BEFAST 试验，FAST 试验（面-	**a.对**	**b.错**	**c. 不清楚**

臂-语言试验）以及“中风 1-2-0”			
3.基层诊断的卒中患者应及时转至上级医院，并明确是否为缺血性卒中	**a.对**	**b.错**	**c. 不清楚**
4.劳累、腹泻、寒冷、熬夜是缺血性卒中的常见诱因；头晕、头痛等是缺血性卒中的常见先兆。	**a.对**	**b.错**	**c. 不清楚**
5.根据神经功能缺损的类别划分，缺血性卒中的症状包括高级皮层、运动、感觉功能障碍症状；根据不同血管支配区所支配的脑组织受损后的功能障碍划分，又包括颈内动脉系统及椎-基底动脉系统缺血性卒中症状	**a.对**	**b.错**	**c. 不清楚**
6.缺血性卒中最终的鉴别和确诊需要头部影像学检查的支持	**a.对**	**b.错**	**c. 不清楚**
7.符合急性缺血性卒中症状的患者，应在到达医院后立即予以颅脑影像学评估，缩短从入院到完成影像学评估的时间。	**a.对**	**b.错**	**c. 不清楚**
8.头颅非增强 CT 平扫（non-contrast CT，NCCT）、头颅	**a.对**	**b.错**	**c. 不清楚**

MRI 均可以在血管内治疗前有效排除颅内出血及占位性病变			
9.采用支架样取栓器治疗急性前循环血管闭塞所致的卒中患者较静脉溶栓能明确增加患者的血管再通率、改善预后且安全终点事件无明显增加。	**a.对**	**b.错**	**c. 不清楚**
10.血栓抽吸联合支架取栓不仅可用于单纯机械取栓或血栓抽吸失败后的补救治疗，更越来越多地被临床作为首次再通方案使用	**a.对**	**b.错**	**c. 不清楚**
11.支架取栓手术未能达到良好再通，而患者仍处于发病 6h 动脉溶栓时间窗内，动脉予 rt-PA 行补救治疗的做法目前仅限于临床经验，尚无明确循证医学依据	**a.对**	**b.错**	**c. 不清楚**
12.前循环大血管闭塞治疗选择局部麻醉、清醒镇静或者全身麻醉都是合理的	**a.对**	**b.错**	**c. 不清楚**
13.后循环大血管闭塞介入治疗围手术期麻醉管理的最佳方式	**a.对**	**b.错**	**c. 不清楚**

尚不明确，可结合患者病情特点及介入导管室条件个体化选择麻醉方式			
14.对负荷较大、质地较硬的血栓栓塞，直接抽吸的取栓效果可能更具优势	**a.对**	**b.错**	**c. 不清楚**
15.血管成形及支架植入术常用于大血管闭塞卒中取栓失败的补救治疗	**a.对**	**b.错**	**c. 不清楚**
16.严重活动性出血或已知有明显出血倾向者，严重心、肝、肾等脏器功能不全，预期生存期小于 90d 为早期血管内接入治疗的禁忌症	**a.对**	**b.错**	**c. 不清楚**
17.急性缺血性卒中院前转运分为逐级转运（drip and ship）模式和直接转运（mothership）模式	**a.对**	**b.错**	**c. 不清楚**
18.对于 6 小时后取栓，必须经过多模式影像检查	**a.对**	**b.错**	**c. 不清楚**
19.对于发病 4.5~24h 内的大血管闭塞卒中，经过充分评估后，	**a.对**	**b.错**	**c. 不清楚**

可直接进行血管内治疗					
20.动脉粥样硬化性大血管闭塞，机械取栓后需要常规应用替罗非班	**a.对**	**b.错**	**c. 不清楚**		
21.血管再通后，需要强化降压治疗	**a.对**	**b.错**	**c. 不清楚**		
22.缺血性卒中的一级预防包括改良生活方式、控制危险因素/病因	**a.对**	**b.错**	**c. 不清楚**		
23.缺血性卒中的二级预防在一级预防外，还需要额外的专科特异性治疗	**a.对**	**b.错**	**c. 不清楚**		
第三部分 态度					
1.需要向公众普及更多的缺血性卒中知识	a.非常同意	b.同意	c. 一般	d.不同意	e.非常不同意
2.基层医生需要更多关于缺血性卒中的培训	a.非常同意	b.同意	c. 一般	d.不同意	e.非常不同意
3.缺血性卒中的现场处置比院内治疗更重要	a.非常同意	b.同意	c. 一般	d.不同意	e.非常不同意
4.基层医生需要更精准早期识别大血管闭塞引起的卒中	a.非常同意	b.同意	c. 一般	d.不同意	e.非常不同意

5.基层医生应更加注重缺血性卒中早期血管评估	a.非常同意	b.同意	c. 一般	d.不同意	e.非常不同意
6.急诊科医生在缺血性卒中的诊疗中比神经科医生更关键	a.非常同意	b.同意	c. 一般	d.不同意	e.非常不同意
7.我有足够的信心识别缺血性卒中	a.非常同意	b.同意	c. 一般	d.不同意	e.非常不同意
8.我有足够的信心处理缺血性卒中患者	a.非常同意	b.同意	c. 一般	d.不同意	e.非常不同意
第四部分 行为实践					
1.我在日常工作中会更关注有卒中风险的患者	a.总是	b.经常	c.有时	d.很少	e.从不
2.我会推荐患者接受溶栓或取栓治疗	a.总是	b.经常	c.有时	d.很少	e.从不
3.我会提醒缺血性卒中患者定期复查	a.总是	b.经常	c.有时	d.很少	e.从不
4.对处于一级/二级预防的患者，我会提醒他们的家人具体的预防措施	a.总是	b.经常	c.有时	d.偶尔	e.从不
5.我乐于接受缺血性卒中管理的培训	a.总是	b.经常	c.有时	d.偶尔	e.从不
6.我乐于向患者与身边的人普及缺血性卒中的知识	a.总是	b.经常	c.有时	d.偶尔	e.从不

Supplementary Table 1. Knowledge toward ischemic stroke

Knowledge	Correct N (%)	Mean ± SD	*P**
1. Identification of ischemic stroke can be divided into simple identification, special identification, and imaging identification.	244 (94.2)	0.92±0.28	0.939
2. Simple identification of ischemic stroke includes the balance, eyes, face, arm, speech, time (BEFAST) test, face, arm, speech, time (FAST) test, and the "Stroke 1-2-0".	239 (92.3)	0.87±0.33	0.454
3. Patients diagnosed with stroke at the primary diagnosis should be promptly referred to a higher-level hospital and clarify whether it is an ischemic stroke or not.	200 (77.2)	0.86±0.35	0.557
4. Overexertion, diarrhea, cold, and delayed sleep are common influential factors of ischemic stroke; inarticulateness and numbness and weakness of limbs are frequent precursors of ischemic stroke.	241 (93.1)	0.94±0.23	0.261

5. Based on the category of neurological deficits, symptoms of ischemic stroke include higher cortical, motor, and sensory dysfunction; based on the dysfunction caused by the damage to brain tissue innervated by different vascular regions, the symptoms of ischemic stroke can be subdivided into ischemic stroke within internal carotid artery system and vertebrobasilar ischemic stroke.	245 (94.6)	0.92±0.28	0.394
6. Final identification and confirmed diagnosis of ischemic stroke requires the support of brain imaging examination.	252 (97.3)	0.96±0.21	0.158
7. Patients with symptoms consistent with acute ischemic stroke should be evaluated with cranial imaging immediately upon admission to the hospital to shorten the time from admission to completion of imaging evaluation.	248 (95.8)	0.94±0.23	0.110
8. Non-contrast CT (NCCT) and cranial MRI can effectively exclude intracranial hemorrhage and occupying lesions before endovascular treatment.	231 (89.2)	0.85±0.35	0.414
9. Stroke patients, caused by acute anterior circulation large-vessel occlusion, who received	217 (83.8)	0.79±0.41	0.022

stent-based thrombectomy in combination with intravenous thrombolysis have higher reperfusion rates and better prognosis than those who received intravenous thrombolysis treatment only, without a significant increase in safety endpoint events.			
10. Combination of aspiration and stent-based thrombectomy is not only used for remedial treatment after failed mechanical thrombectomy or failed aspiration, but also is increasingly used as a first reperfusion protocol in clinical practice.	230 (88.8)	0.84±0.37	0.131
11. When stent-based thrombectomy fails to achieve satisfactory reperfusion and the patient is still within the 6-h time window for arterial thrombolysis, the practice of remedial treatment with arterial administration of rt-PA is currently limited to clinical experience and has no clear scientific evidence.	171 (66.0)	0.65±0.48	0.071
12. Local anesthesia, conscious sedation, or general anesthesia are all reasonable options for the treatment of anterior circulation large-vessel occlusion.	180 (69.5)	0.57±0.50	0.001
13. The best practice for perioperative anesthetic management of interventional treatment of	220 (84.9)	0.80±0.40	0.215

posterior circulation large-vessel occlusion is still unclear. The selection of anesthetics can be individualized by taking the patient's status and the conditions of the interventional catheterization unit into account the.			
14. Direct aspiration may be more effective for larger and more rigid thromboembolisms.	200 (77.2)	0.72±0.45	0.002
15. Angioplasty and stenting are commonly used for the remedial treatment of failed thrombectomy in large-vessel occlusive stroke.	218 (84.2)	0.82±0.38	0.015
16. Contraindications of early endovascular intervention include severe active bleeding, significant bleeding tendency, severe cardiac, hepatic, and renal organ insufficiency, and the expected survival of less than 90 days.	213 (82.2)	0.73±0.45	0.472
17. The prehospital transport of acute ischemic stroke can be divided into drip-and-ship mode and mothership mode.	224 (86.5)	0.82±0.38	0.072
18. For thrombectomy after the 6-h window, a multimodal imaging examination is mandatory.	222 (85.7)	0.82±0.39	0.130
19. For large-vessel occlusion strokes within 4.5-24 h of onset, direct endovascular treatment	226 (87.3)	0.83±0.37	0.035

can be performed after adequate evaluation.			
20. Atherosclerotic large-vessel occlusion requires routine application of tirofiban after mechanical embolization.	174 (67.2)	0.69±0.46	0.126
21. After reperfusion, intensive antihypertensive therapy is required.	182(70.3)	0.69±0.46	0.381
22. **Primary prevention of ischemic stroke includes lifestyle improvement and control of risk factors/causes.**	251 (96.9)	0.96±0.21	0.650
23. **Secondary prevention of ischemic stroke requires additional specific treatments in addition to primary prevention.**	237 (91.5)	0.89±0.31	0.682

***Comparison between males and females.**

Supplementary Table 2. Attitude toward ischemic stroke

Attitude, n (%)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean ± SD
1. More knowledge about ischemic stroke needs to be disseminated to the public.	224 (86.5)	33 (12.7)	2 (0.8)	0	0	4.80±0.43
2. Primary doctors need more training on ischemic stroke.	220 (84.9)	37 (14.3)	2 (0.8)	0	0	4.79±0.42
3.On-site handling of ischemic stroke is more important than in-hospital treatments.	158 (61.0)	47 (18.1)	25 (9.7)	28 (10.8)	1 (0.4)	4.40±0.92
4. Primary doctors need more accurate early identification of stroke caused by large-vessel occlusion.	195 (75.3)	55 (21.2)	6 (2.3)	3 (1.2)	0	4.65±0.61
5. Primary doctors should pay further attention to early assessment of vascular factors for ischemic stroke.	191 (73.7)	52 (20.1)	12 (4.6)	3 (1.2)	1 (0.4)	4.61±0.64
6. Emergency doctors are more critical than neurologists in the diagnosis	166 (64.1)	71 (27.4)	14 (5.4)	8 (3.1)	0	4.53±0.71

and treatment of ischemic stroke.						
7. I am confident enough in recognizing ischemic stroke.	145 (56.0)	80 (30.9)	29 (11.2)	5 (1.9)	0	4.21±0.83
8. I am confident enough in dealing with ischemic stroke patients.	145 (56.0)	57 (22.0)	42 (16.2)	14 (5.4)	1 (0.4)	4.04±1.02

Supplementary Table 3. Practice toward ischemic stroke

Practice, n (%)	Always	Often	Sometimes	Seldom	Never	Mean ± SD
1. I pay further attention to patients who are at risk of stroke in my daily work.	162 (62.5)	77 (29.7)	12 (4.6)	8 (3.1)	0	4.32±0.82
2. I recommend patients to receive thrombolysis or thrombectomy.	150 (57.9)	69 (26.6)	29 (11.2)	11 (4.2)	0	4.13±0.94
3. I remind patients with ischemic stroke to have regular reviews.	190 (73.4)	63 (24.3)	5 (1.9)	1 (0.4)	0	4.59±0.59
4. For patients in primary/secondary prevention, I remind their families to take specific preventive measures.	170 (65.6)	79 (30.5)	9 (3.5)	1 (0.4)	0	4.48±0.61
5. I am happy to receive training on ischemic stroke management.	180 (69.5)	62 (23.9)	13 (5.0)	3 (1.2)	1 (0.4)	4.47±0.78
6. I am happy to disseminate the knowledge about ischemic stroke to patients and others.	175 (67.6)	72 (27.8)	9 (3.5)	3 (1.2)	0	4.51±0.68

Supplementary Table 4. Distribution of other healthcare workers' (nurses and medical technicians) baseline information and KAP scores

	N (%)	Knowledge		Attitude		Practice	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Total	157	18.89±4.12		36.03±3.96		26.50±3.20	
Age (years)			0.805		0.002		0.167
<40	33 (21.02)	19.24±4.37		38.12±3.08		27.42±3.07	
40-50	77 (49.04)	18.69±4.15		35.64±3.48		26.18±3.11	
>50	47 (29.94)	18.96±3.96		35.19±4.74		26.38±3.36	
Gender			0.299		0.101		0.020
Male	97 (61.78)	19.15±4.28		35.39±4.06		26.97±3.17	
Female	60 (38.22)	18.45±3.84		38.08±2.77		25.75±3.11	
Education			0.142		<0.001		<0.001
College or below	120 (76.43)	18.62±4.19		35.39±4.06		26.01±3.24	
Bachelor's degree or above	37 (23.57)	19.76±3.81		38.08±2.77		28.11±2.45	
Professional title			0.010		0.012		0.020
None	63 (40.13)	19.22±4.17		35.62±4.04		25.87±3.22	

Junior title	58 (36.94)	19.00±3.52		35.33±4.18	26.40±3.29	
Intermediate title	23 (14.65)	16.52±5.28		37.52±3.01	27.30±2.87	
Senior titles	13 (8.28)	20.92±2.25		38.46±2.44	28.62±2.18	
Working experience			0.867		0.178	0.656
≤5 years	7 (4.46)	19.43±3.15		37.14±3.80	26.71±4.07	
5-10 years	16 (10.19)	18.25±5.20		37.38±3.22	27.00±2.83	
11-15 years	15 (9.55)	19.40±3.46		37.20±3.17	27.27±3.01	
≥16 years	119 (75.80)	18.87±4.12		35.63±4.10	26.33±3.23	
Hospital			0.387		0.074	0.541
Public hospitals	73 (46.50)	19.19±3.80		36.63±3.73	26.67±3.23	
Private hospitals	84 (53.50)	18.62±4.38		35.50±4.10	26.36±3.18	

Supplementary Table 5. Fit Indices for CFA Models

	Ref.	Measured results
CMIN/DF	1-3 excellent, 3-5 good	2.203
RMSEA	<0.08 good	0.068
IFI	>0.8 good	0.739
TLI	>0.8 good	0.718
CFI	>0.8 good	0.735
C.R.	>0.8 good	0.9306
AVE		0.265