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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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