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Knowledge, Attitude and Practice Toward Intracerebral Hemorrhage Prevention Among Patients Taking Oral Anticoagulants

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Background: Intracerebral hemorrhage (ICH) affects up to 1% of chronic oral anticoagulation (OAC) users per year. This study explored the knowledge, attitude and practice (KAP) towards ICH prevention among patients taking OACs.

Methods: This multicenter cross-sectional survey was conducted at 4 hospitals from February to May 2023, and a self-administered questionnaire was developed to assess KAP toward ICH prevention among patients taking OACs. Structural equation modeling was used to assess the relationship between KAP.

Results: A total of 536 valid questionnaires (67.25%) were analyzed, from 43.8% participants on Warfarin, 40.5% on Rivaroxaban and 15.7% on Dabigatran. The average knowledge, attitudes and practice scores were 9.22, 24.11, and 28.01 out of 16, 35 and 40, respectively. Participants who received Rivaroxaban had lower knowledge scores but higher attitude and practice store compared to those who received Warfarin or Dabigatran (all $p < 0.001$). According to Structure Equation Modeling, attitude had direct positive effect on practice ($\beta = 0.694$ [0.603–0.804], $p = 0.012$), while knowledge had direct negative effect on attitude ($\beta = -2.077$ [−2.507–1.651], $p = 0.013$), as well as negative effect on practice, both direct ($\beta = -0.450$[−0.689–2.03], p=0.012), and indirect ($\beta = -1.441$ [−1.928–1.192], $p = 0.004$).

Conclusion: Patients taking OACs showed insufficient knowledge, negative attitude and proactive practice regarding ICH; practice scores were affected by age, type of anticoagulation medication, and attitude rather than knowledge.

Keywords: cerebral hemorrhage, anticoagulants, warfarin, dabigatran, rivaroxaban, knowledge, attitude, practice

Background

Chronic oral anticoagulation (OAC) is a treatment strategy used to prevent vein or arterial thrombosis, with main indications such as venous thromboembolism, atrial fibrillation, and heart valve replacement.[1] For a long time, vitamin K antagonists were the primary choice in this field, but in the last decade, clinical evidence has emerged for targeting specific factors, with direct OACs inhibiting thrombin and factor Xa.[2,3] Although the number of approved non-Vitamin K anticoagulants is still relatively small, their usage is actively expanding based on numerous randomized controlled trials.[4,5] Notably, non-inferior effects of direct OACs have been demonstrated in preventing venous thromboembolism, acute coronary syndrome, and thromboembolic events in patients with atrial fibrillation.[6] However, due to their comparatively recent introduction, the safety and benefit–risk balance of direct OACs are still closely monitored.

While OAC therapy can prevent thrombosis and extend patients' lives, it also carries a bleeding risk that can be equally life-threatening.[7,8] Intracerebral hemorrhage (ICH) is one of the most severe complications with high mortality, affecting up to 1% of OAC users per year.[9,10] Therefore, in patients at high risk of ischemic stroke or vascular events, OAC prescription needs to carefully consider the balance between anticoagulation and the possible risk of ICH.

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Furthermore, the discussion about whether the ICH risk is lower for direct OACs compared to vitamin K antagonists (warfarin) is ongoing.[8,11,12]

In the recently changed pharmacological landscape, timely knowledge is crucial for treatment compliance. Knowledge, Attitudes, and Practices (KAP) studies allow assessing the current state of knowledge and beliefs and analyzing the relationships between treatment understanding and adherence.[13] Previous studies on KAP toward OACs have reported a very low understanding of the mechanisms and dangers of anticoagulation treatment among patients receiving it.[14–16] Lower knowledge levels have been associated with less adherence to OAC treatment.[17] These discouraging results may be explained by the complexity of clotting cascade mechanisms and rapidly changing OAC treatment strategies, which are challenging to comprehend not only for patients but also for general practitioners and pharmacists.[13,18] Moreover, there are currently no established instruments to assess and compare patients' knowledge of OACs nor is there a common understanding of which coagulation-related questions are most important to be explained during hospital visits.[19] Thus, more discussion is needed to narrow the field and simplify educational interventions proposed for patients receiving OACs.

This study aims to explore the relationship between knowledge, attitude, and practice regarding the prevention of ICH among patients on oral anticoagulation, with a focus on less discussed factors that might be related to safe practice, as well as the patients' understanding of new direct OACs currently approved in China.

Methods

Study Design and Participants

This multicenter cross-sectional study was conducted at four hospitals: Changde People's Hospital of Xihu District (~200 beds), Guiyang Maitong Vascular Hospital (~200 beds), Zhejiang Qiushi Cardiovascular Hospital (~200 beds) and Changde Hospital, Xiangya School of Medicine, Central South University (~1900 beds), from February 2023 to May 2023. Patients aged ≥18 years, who had 3 months or more oral anticoagulant course planned, were included using convenience sampling. Exclusion criteria were as follows: 1) planned pause in OAC; 2) chronic kidney disease (N18. 9), heart failure (I50. 9) or other conditions that, according to the doctor, might influence adherence to OACs safety measures or otherwise affect answers; 3) incomplete questionnaire and logical errors.

The study was ethically approved by the Medical Ethics Committee of Changde Hospital, Xiangya School of Medicine, Central South University (Approval No: YX-2023-020-01) and informed consent was obtained from the study participants before the distribution of questionnaires.

Questionnaire and Quality Control

The questionnaire was designed with reference to previously published studies accessing KAP towards OACs,[15,19] as well as ICH prevention among OAC users.[9,14] A small pretest (n = 235) was conducted after the initial draft of the questionnaire was designed. The overall Cronbach's α (reliability of a scale) for the questionnaire was 0.908, and the Cronbach's α for the knowledge, attitudes, and practice sections were 0.782, 0.942, and 0.940, respectively, suggesting good reliability (>0.07 for exploratory research).[20]

The final questionnaire was in Chinese and included four dimensions of information collection with a total of 47 items. Of these, 16 items were included in the general/demographic information dimension, 16 in the knowledge dimension, seven in the attitude dimension, and eight in the practice dimension. The knowledge category was scored from 0 to 16 points, with one point for a correct answer and zero points for incorrect or unclear answers; two points for "know", one point for "partially know", and zero points for "do not know". Attitude and practice questions were scored on a 5-point Likert scale, with scores ranging from 7 to 35 points and 8–40 points, respectively. A score of 70% or more of the maximum total score for knowledge, attitude, and practice was considered "adequate knowledge", "positive attitude", and "sufficient practice".

Participants were recruited from the hospital, and data were collected using the online "questionnaire stars" platform or WeChat messenger groups. For participants who preferred an offline version, the questionnaires were distributed in outpatient clinics and wards. Before the start, participants were informed that all responses are analyzed anonymously

and there is no right or wrong answers, to reduce social desirability bias. If any problems were encountered during the response process, the doctors were responsible for giving a prompt explanation to the participants. After data collection was completed, the questionnaires were checked for quality by the members of the study team. Incomplete items, obvious logical errors, or a pattern of choosing exactly the same option to answer were considered invalid.

Statistical Analysis

Stata 17.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. Continuous variables were expressed using means and standard deviations, and comparisons between groups conforming to the normal distribution were performed using ANOVA; for those conforming to the skew distribution, comparisons were performed using the Kruskal–Wallis *H*-test. Categorical variables were expressed as n (%). Structural equation modeling was used to test the hypotheses that (H1) knowledge regarding ICH has an effect on attitudes; (H2) knowledge has an effect on practices; and (H3) attitude has an effect on practices. The two-sided P<0.05 was considered statistically significant.

Results

A total of 797 questionnaires were collected, and 261 questionnaires were excluded due to incompleteness or logical errors, resulting in 536 valid questionnaires (67.3%). Among the participants, 265 (49.4%) were male and 271 (50.6%) were female, covering various age groups. They were receiving Warfarin (43.8%), Rivaroxaban (40.5%), or Dabigatran (15.7%) for indications such as heart valve disease (40.3%), myocardial infarction (14.7%), atrial fibrillation (21.8%), or thrombotic disorders (22.4%). About 27.9% of participants had been diagnosed with ICH before (Table 1). Approximately 10.5% of participants started OAC less than 1 month ago, while 19.9% had been on OAC for more

Table 1 Participants' Demographics and Knowledge, Attitude, and Practice Scores Regarding Intracerebral Hemorrhage (ICH) Prevention

Variables	N (%)	Knowledge, mean ± SD	P	Attitude, mean ± SD	P	Practice, mean ± SD	P
Total	536	9.22±2.95		24.11±6.91		28.01±7.30	
Gender			0.175		0.6247		0.299
Male	265(49.4)	9.36±2.74		23.98±6.76		27.68±7.15	
Female	271(50.6)	9.08±3.14		24.23±7.06		28.33±7.44	
Age, years			<0.001		<0.001		<0.001
>50	219(40.9)	10.06±2.17		22.28±6.26		26.06±6.25	
50–59	220(41.0)	9.35±2.41		22.88±6.45		26.63±7.14	
≥60	97(18.1)	7.02±4.24		31.00±4.78		35.53±4.65	
Marital status			0.114		0.313		0.002
Unmarried	6(1.1)	9.33±2.07		23.00±9.90		24.17±8.42	
Married	482(89.9)	9.28±2.97		23.98±6.96		27.73±7.30	
Divorced	29(5.4)	9.14±2.13		24.45±5.16		30.21±5.89	
Widowed	19(3.5)	7.79±3.39		27.11±6.52		32.84±6.83	
Residence			0.043		<0.001		<0.001
Rural	214(39.9)	8.76±3.37		26.46±6.67		30.20±6.74	
Urban	173(32.3)	9.37±2.83		22.88±6.89		27.52±7.49	
Suburban	149(27.8)	9.70±2.28		22.14±6.28		25.42±6.92	
Education			<0.001		<0.001		<0.001
Primary school	63(11.8)	7.03±4.06		29.00±6.35		32.81±7.12	
Middle school	132(24.6)	8.63±2.86		25.67±6.89		29.25±7.46	
High school/Technical secondary school	187(34.9)	9.97±2.69		23.32±6.64		27.00±6.88	
Junior college/Undergraduate	113(21.1)	9.46±2.22		21.86±6.22		26.35±6.99	
Postgraduate and above	41(7.7)	10.39±1.88		21.37±5.98		25.76±5.94	
Family members with medical Background			0.120		0.203		<0.001
Yes	87(16.2)	9.08±2.66		24.97±6.23		30.38±6.33	
No	449(83.8)	9.25±3		23.94±7.02		27.55±7.39	

(*Continued*)

Table 1 (Continued).

Variables	N (%)	Knowledge, mean ± SD	P	Attitude, mean ± SD	P	Practice, mean ± SD	P
Monthly per capita income			0.005		0.001		0.190
<2000	67(12.5)	8.81±3.15		24.94±7.2		27.79±7.26	
2000–4999	250(46.6)	8.74±3.32		25.06±7.4		28.75±7.93	
5000–9999	172(32.1)	9.94±2.21		22.54±6		27.16±6.63	
10,000–19,999	35(6.5)	9.49±2.42		23.23±5.49		27.31±5.51	
≥20,000	12(2.2)	10.42±1.78		24.58±7.05		27.75±6.92	
Medical insurance			<0.001		<0.001		<0.001
Social	192(35.8)	8.42±3.85		27.04±7.31		30.97±7.51	
Commercial	125(23.3)	9.41±2.19		22.55±5.83		26.77±6.45	
Social and commercial	149(27.8)	10.12±2.16		23.35±5.7		26.87±6.16	
No insurance	70(13.1)	9.16±2.06		20.44±6.93		24.49±7.61	
Reasons for taking OACs			<0.001		<0.001		<0.001
Heart valve disease	216(40.3)	9.72±2.07		22.49±6.75		26.34±6.68	
Myocardial infarction	79(14.7)	9.39±2.12		22.87±6.28		26.15±7.00	
Atrial fibrillation	117(21.8)	7.52±4.42		29.43±5.50		34.66±4.60	
Thrombotic disorders	120(22.4)	9.88±2.34		22.49±6.27		25.50±6.85	
Other	4(0.8)	9.00±2.45		28.75±3.40		35.25±3.59	
Previous ischemic stroke			<0.001		<0.001		<0.001
Yes	296(55.2)	9.99±2.24		22.70±6.02		26.47±6.44	
No	240(44.8)	8.27±3.40		25.84±7.52		29.90±7.84	
Previous ICH			0.099		0.023		0.412
Yes	150(27.9)	9.11±2.30		23.09±6.05		27.62±6.19	
No	386(72.0)	9.26±3.17		24.50±7.18		28.16±7.69	
Current OACs			<0.001		<0.001		<0.001
Warfarin	235(43.9)	9.82±2.34		22.74±6.42		26.40±6.90	
Rivaroxaban	217(40.5)	8.48±3.60		26.36±7.09		30.54±7.26	
Dabigatran	84(15.7)	9.46±2.10		22.12±6.14		25.94±6.58	
Time from treatment start			<0.001		<0.001		<0.001
<1 month	56(10.5)	6.95±4.37		32.18±3.84		35.68±4.87	
1–3 months	94(17.5)	9.30±2.94		24.01±6.53		28.37±6.65	
3–6 months	147(27.4)	9.60±2.21		22.69±6.12		26.69±6.35	
6 months - 1 year	132(24.6)	9.42±2.24		22.48±6.26		26.02±6.88	
More than 1 year	107(19.9)	9.57±3.23		23.92±7.42		27.93±8.07	
Smoking status			<0.001		0.051		0.002
Never smoked	177(33.0)	8.42±3.51		25.05±7.92		29.37±8.4	
Used to smoke, now quit	196(36.6)	9.47±2.65		23.77±6.67		27.3±6.89	
Still smoking	163(30.4)	9.79±2.41		23.49±5.87		27.37±6.24	
Do you drink alcohol at least once a month			<0.001		<0.001		<0.001
Yes	347(64.7)	9.80±2.18		22.35±6.28		26.01±6.63	
No	189(35.3)	8.16±3.77		27.33±6.85		31.67±7.06	
Family member diagnosed with ICH			0.661		0.099		<0.001
Yes	108(20.1)	9.27±2.68		25.30±5.60		30.54±5.68	
No	428(79.9)	9.21±3.02		23.81±7.17		27.37±7.52	

Notes: Comparisons between groups conforming to normal distribution were performed using *T*-test or ANOVA; for those conforming to skew distribution, comparisons were performed using the Mann–Whitney U or Kruskal–Wallis *H*-test. The two-sided P<0.05 was considered statistically significant.
Abbreviations: SD, standard deviation; ICH, intracerebral hemorrhage; OACs, oral anticoagulants.

than one year, with others in between. Participants resided in rural (39.9%) or suburban (27.8%) areas, were married (89.9%), had no family history of stroke (79.9%), used to smoke (36.6%) or were still smoking (30.4%), and reported consuming alcohol at least once a month (64.7%).

The mean knowledge, attitude and practice score were 9.22 ± 2.95, 24.11±6.91 and 28.01 ± 7.30, respectively.

The results showed that compared to participants who received Warfarin, those who received Rivaroxaban had lower knowledge scores but higher attitude and practice scores (all $p < 0.001$); however, in those prescribed with Dabigatran, KAP scores did not significantly differ. Attitude scale scores were slightly lower in participants who had experienced ICH before (23.09

± 6.05 vs 24.50 ± 7.18, p = 0.023), but practice and knowledge scores did not differ. In contrast, participants with a family member who had experienced ICH had higher attitude (25.30 ± 5.60 vs 23.81 ± 7.17, p < 0.001) and practice (30.54 ± 5.68 vs 27.37 ± 7.52, p < 0.001) scores, while knowledge scores did not differ (Table 1).

In the knowledge dimension, the question with the highest correct rate (82.7%) was about stress being a known risk factor for ICH, while the question with the lowest correct rate (30.0%) was about identifying bleeding symptoms warranting an immediate visit to the doctor (Supplement Table 1). In the attitude dimension, the most controversial question was about restricting alcohol consumption, with 25.8% of responders strongly agreeing, 24.1% disagreeing, and 10.6% strongly disagreeing (Supplement Table 2). In the practice dimension, numerous violations of safe OAC treatment procedures were noted: 32.8% of participants did not monitor their stool, 25.2% did not adhere to the prescribed follow-up visit schedule, 24.4% did not regularly keep the dosage diary, and 22.0% were not willing or able to change their lifestyle to avoid ICH risk factors (Supplement Table 3).

Structural equation modeling was used to explore factors that might influence KAP scores (Figure 1A and Table 2). The results showed that while attitude had a direct positive effect on practice (β = 0.694 [0.603–0.804], p = 0.012), knowledge had a direct negative effect on attitude (β = −2.077 [−2.507–1.651], p = 0.013), and a negative effect on practice, both direct (β = −0.450[−0.689–2.03], p = 0.012) and indirect (β = −1.441 [−1.928–1.192], p = 0.004). To further test the effect of knowledge on practice, questions in the knowledge dimension were grouped into three sub-domains (Figure 1B and Table 3): KA (general questions) (β = −0.323, p = 0.002) and KB (risk factors) (β = −0.962, p = 0.024) still had a significant negative impact, while KC (symptoms that warrant a hospital visit) had a positive effect but without statistical significance (β = 0.197, p = 0.375).

Discussion

Patients taking OACs showed insufficient knowledge, negative attitude, and limited proactive practice regarding ICH prevention. Despite this, a notable proportion of participants still did not adhere to safety measures and were not willing or able to change their lifestyle to avoid ICH risk factors. The analysis of the attitude dimension revealed several barriers to adequate risk assessment and help-seeking.

This study is the first to report on KAP towards IHC prevention among OAC users in China, and the observed KAP patterns are consistent with reports from other countries. For instance, a study by Smet et al[14] assessed adherence, knowledge, and perception of OACs in Belgium patients with atrial fibrillation at high risk for thromboembolic events; although adequate treatment adherence was found in three-quarters of patients, the total mean knowledge score was low. Similarly, a study by Moudallel et al[15] reported suboptimal knowledge about and adherence to direct OACs in atrial fibrillation patients, with significant knowledge gaps. A study conducted in Pakistan by Zahid et al[16] also found poor knowledge among OAC users, with more than half of the study population not observing safety measures. In the present study, the knowledge scale score was only 51.2% of the maximum, while attitude and practice scale scores were 68.9% and 70.0% of the maximum, respectively. Although the practice score barely reaches an acceptable level, a significant proportion of the study population demonstrated a lack of willingness or ability to adhere to safety measures and make lifestyle changes to avoid ICH risk factors. These results may be partly explained by the lower education level and rural/suburban residence of participants, which is consistent with other studies where residence, income and education level were found to be predictors of knowledge scores.[19,21] Moreover, this study covered four hospitals in three provinces in the South-Central and South-East part of China with significant rural populations and included a notable part of middle-aged and older adults, reportedly characterized by social loneliness and delays in help-seeking for cardiac diseases.[22] Assistance to vulnerable groups of patients should be prioritized to enhance their access to medical care.

Conversely, one of the most unexpected findings of this study was the negative effect of knowledge on practice, both directly and indirectly via attitude. While these findings may explain the generally poor adherence to safe practices of OACs treatment observed in other studies, they contradict the previously discussed notion that better knowledge always leads to better practice.[14,17] However, a recent study by Ahmed et al[23] on direct OACs with a longer follow-up period found no association between knowledge and adherence over a 6-month period. Due to the design limitations, direct comparison of the results obtained here with previously undertaken studies is not possible. Nevertheless, some similar observations suggest important nuances in the relationship between knowledge and practice among patients on OACs. Firstly, this study included participants who received both direct OACs and Warfarin. Those who received Rivaroxaban had lower knowledge scores compared to those on Warfarin or

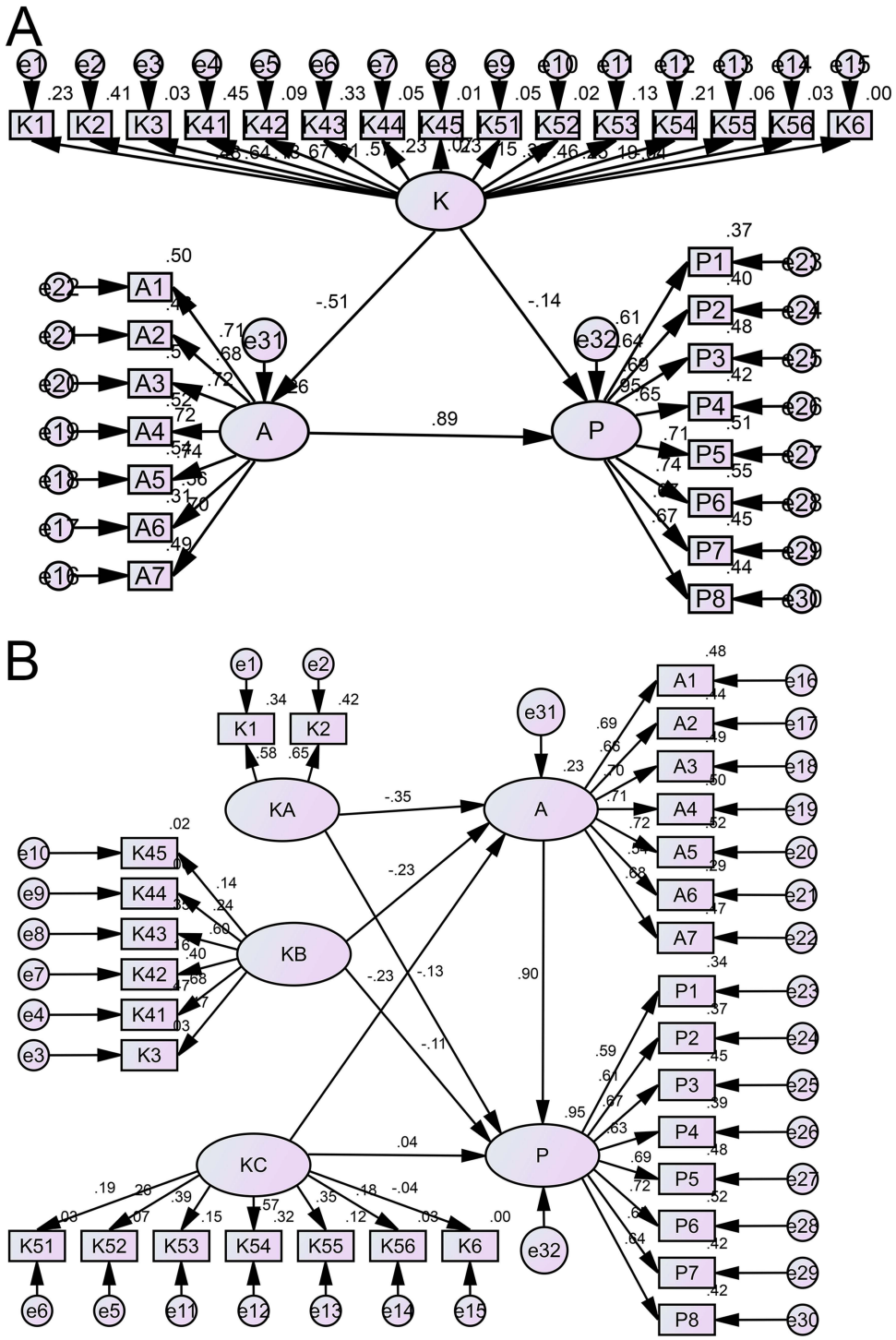

Figure 1 Results of structural equation modelling of factors influencing knowledge, attitudes and practice. (**A**) Initial equation demonstrating direct positive effect of attitude on practice (β = 0.694), direct negative effect of knowledge on attitude (β = −2.077), and negative effect of knowledge on practice, both direct (β = −0.450) and indirect (β = −1.441). (**B**) 3 sub-domains in the knowledge dimension: KA, general questions, (β = −0.323, p=0.002) and KB, risk factors, (β = −0.962, p = 0.024) still had a significant negative impact, while KC, symptoms that warrant hospital visit, had positive effect, but without statistical significance (β = 0.197, p = 0.375).

Dabigatran but exhibited higher attitude and practice scores. This difference might be attributed to the later approval of Rivaroxaban in China and less available information for patients.[24] Secondly, knowledge scale scores were significantly lower in participants aged 60 and older, but practice scale scores were higher. With older age, the risk of ICH is higher, while access to information may become somewhat restricted.[19] Thus, older patients, especially after retirement, might be more attentive to safe practices despite having a lower understanding of underlying mechanisms. Finally, the abundance of coagulation-related data

Table 2 Results of Structural Equation Modelling for the Effects Between Knowledge (K), Attitude (A) and Practice (P)

			β	P
Attitude	<—	Knowledge	−2.077	<0.001
Practice	<—	Attitude	0.694	<0.001
Practice	<—	Knowledge	−0.450	<0.001
K1	<—	Knowledge	1.000	
K2	<—	Knowledge	1.146	<0.001
K3	<—	Knowledge	0.386	<0.001
K41	<—	Knowledge	1.074	<0.001
K42	<—	Knowledge	0.641	<0.001
K43	<—	Knowledge	1.068	<0.001
K44	<—	Knowledge	0.494	<0.001
K45	<—	Knowledge	0.147	0.129
K51	<—	Knowledge	0.470	<0.001
K52	<—	Knowledge	0.315	0.003
K53	<—	Knowledge	0.725	<0.001
K54	<—	Knowledge	0.865	<0.001
K55	<—	Knowledge	0.533	<0.001
K56	<—	Knowledge	0.394	<0.001
K6	<—	Knowledge	−0.130	0.384
A7	<—	Attitude	1.000	
A6	<—	Attitude	0.697	<0.001
A5	<—	Attitude	1.043	<0.001
A4	<—	Attitude	0.992	<0.001
A3	<—	Attitude	0.950	<0.001
A2	<—	Attitude	0.907	<0.001
A1	<—	Attitude	1.052	<0.001
P1	<—	Practice	1.000	
P2	<—	Practice	1.058	<0.001
P3	<—	Practice	1.111	<0.001
P4	<—	Practice	1.029	<0.001
P5	<—	Practice	1.226	<0.001
P6	<—	Practice	1.386	<0.001
P7	<—	Practice	1.143	<0.001
P8	<—	Practice	1.108	<0.001

Table 3 Results of Structural Equation Modelling for 3 Sub-Domains in the Knowledge Dimension: KA (General Questions), KB (Risk Factors), KC (Symptoms That Warrant a Hospital Visit)

			β	P
Attitude (A)	<—	KA	−1.190	<0.001
A	<—	KB	−2.656	0.013
A	<—	KC	−1.701	0.007
Practice (P)	<—	KA	−0.323	0.002
P	<—	A	0.653	<0.001
P	<—	KB	−0.962	0.024
P	<—	KC	0.197	0.375
Knowledge question 1(K1)	<—	KA	1.000	

(*Continued*)

Table 3 (Continued).

			β	P
K2	<—	KA	0.960	<0.001
K3	<—	KB	1.000	
K41	<—	KB	3.109	0.002
K42	<—	KB	2.366	0.003
K43	<—	KB	3.155	0.002
K44	<—	KB	1.426	0.010
K45	<—	KB	0.808	0.040
K53	<—	KC	1.404	<0.001
K54	<—	KC	1.955	<0.001
K55	<—	KC	1.320	<0.001
A1	<—	A	1.000	
A2	<—	A	0.861	<0.001
A3	<—	A	0.903	<0.001
A4	<—	A	0.944	<0.001
A5	<—	A	0.990	<0.001
A6	<—	A	0.660	<0.001
A7	<—	A	0.950	<0.001
P1	<—	P	1.000	
P2	<—	P	1.056	<0.001
P3	<—	P	1.110	<0.001
P4	<—	P	1.028	<0.001
P5	<—	P	1.223	<0.001
P6	<—	P	1.382	<0.001
P7	<—	P	1.142	<0.001
P8	<—	P	1.109	<0.001
K6	<—	KC	−0.232	0.501
K56	<—	KC	0.688	0.017
K51	<—	KC	0.694	0.014
K52	<—	KC	1.000	

might confuse patients of any age, as shown by the replies to trap questions in this study and results published by Runev et al.[18] In addition, older adults in China often rely on their children for informational and other support, and are not active in seeking new knowledge.[22,25] This suggests that the population of chronic OAC patients is unique and requires a more specific approach to in-hospital education than is currently available; culturally sensitive educational interventions should be developed, tailored to different patient demographics.

Other findings that require further discussion include the relationship between practice and attitude, which might be more complex than previously reported. A previous study[23] showed a statistically significant strong positive correlation between adherence to medication and time in therapeutic range – a difference also observed in the present study when comparing participants who started OACs 1–3 months and more than one year before the study. However, upon closer examination of the time range, it was observed that initial knowledge scores were very low, while attitude and practice scores were the highest during the observed period; scores gradually declined until the 6th month and slightly increased afterwards, suggesting a very close relationship between attitude and practice, as confirmed by the structural equation model. Another finding related to attitudes was the persistence of the drinking habit in more than half of the participants; 24.1% disagreed and 10.6% strongly disagreed that restriction of alcohol consumption is necessary for the prevention of ICH, despite knowledge and strong evidence of the related ICH risk.[9,26] Additionally, it was found that practice scores were significantly higher in participants who had a family member with ICH but did not differ in those who had experienced ICH themselves before, partly confirming the previous observation that closer contact with bleeding complications encourages patients to pay more attention to safety measures.[21,27] All of the above suggests that adherence to ICH prevention practice might be more influenced by attitude rather than knowledge, and attitude is

influenced by a variety of external and internal factors. These factors should be taken into account when planning educational interventions targeting OACs patients in the future.

This study had some limitations. The study design and lack of follow-up may have introduced selection bias, as participants who decided to partake in the study might be more health conscious, which may lead to difficulties in drawing predictive conclusions based on the observed differences. Some sub-populations in the study (such as patients on Dabigatran or those with myocardial infarction) might be too small to demonstrate significant differences. Moreover, the sample was chosen through "convenience sampling" rather than random selection, which is in line with the general principles of KAP sampling, but might still not be fully representative of the studied population. Finally, although measures were taken to avoid social expectation bias, the answers given by the patients could not be independently verified; some of the answers might still have been chosen based on what was expected instead of reflecting actual attitudes or practices.

In conclusion, patients taking OACs showed insufficient knowledge, negative attitude, and limited proactive practice regarding ICH in China; practice scores were affected by age, type of anticoagulation medication, and attitude rather than knowledge. The studied population of chronic OACs patients demonstrated unique features that require a more specific approach to in-hospital education, taking into account the more prominent influence of attitude on practice.

Abbreviations

ICH, Intracerebral hemorrhage; OAC, oral anticoagulation; KAP, knowledge, attitude and practice.

Data Sharing Statement

All data generated or analyzed during this study are included in this published article.

Ethics Approval and Consent to Participate

The study was carried out in accordance with the Declaration of Helsinki. The study was ethically approved by the Medical Ethics Committee of Changde Hospital, Xiangya School of Medicine, Central South University (Approval No: YX-2023-020-01.) and informed consent was obtained from the study participants before the distribution of questionnaires.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors declare that they have no competing interests in this work.

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