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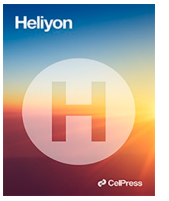

Research article

Knowledge, attitudes, and practice toward glioma of patients with neurological symptoms or diseases in henan, China

Haozhi Ma [a,b,1], Di Nie [a,b,1], Bo Wang [b], Yang Bai [c], Qunjian Cui [b,*]

[a] Xinxiang Medical University, Henan, 453003, China
[b] The First Affiliated Hospital of Nanyang Medical College, Nanyang, 473003, China
[c] The First Affiliated Hospital of Zhengzhou University, Zhengzhou, 450052, China

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ABSTRACT

Objective: To explore the knowledge, attitude, and practice (KAP) toward glioma of patients with neurological symptoms or diseases.
Methods: This web-based cross-sectional study was conducted at two medical centers in Henan Province between January 2023 and April 2023 and enrolled patients with neurological symptoms or diseases. The demographic characteristics of the participants and their KAP toward glioma were collected using a self-administered questionnaire. A structural equation modeling (SEM) was used to examine the relationship among KAP dimensions.
Results: The study included 442 valid questionnaires. The mean knowledge, attitude, and practice scores were 7.65 ± 1.62 (possible range: 0–9), 37.98 ± 3.17 (possible range: 9–45), and 40.16 ± 4.17 (possible range: 10–50), indicating good knowledge, favorable attitude, and active practice. The SEM analysis showed that knowledge directly affected attitudes ($\beta = 0.89$, 95%CI: 0.73–1.06, $P < 0.001$) but not practice ($\beta = -0.08$, 95%CI: −0.32–0.14, $P = 0.487$), while attitudes directly affected practice ($\beta = 0.35$, 95%CI: 0.21–0.48, $P < 0.001$).
Conclusion: Patients with neurological symptoms/diseases who had heard of gliomas had good knowledge, favorable attitudes, and active practice toward glioma. Specific knowledge items that would warrant improvements were identified in the specific population of patients with neurological symptoms/diseases who had heard of glioma. Future studies should also examine the general population.

1. Introduction

Glioma is a type of tumor originating from the glial cells of the brain or the spine [1]. Gliomas represent about 30% of all brain and central nervous system tumors and 80% of all malignant brain tumors [2]. The incidence of glioma is about 6 per 100,000 people-year in the United States of America [1]. In China, the age-standardized prevalence of primary brain tumors is 22.52 per 100,000 individuals, and gliomas account for 31.1% of the primary brain tumors [3]. Headaches and seizures are the most common initial presenting symptoms, and advanced cases can also present weakness and altered mental status [1]. Treatment includes surgery, chemotherapy, and radiotherapy [4]. Different types of glioma have different prognoses [4], highlighting the need for early detection

* Corresponding author. The First Affiliated Hospital of Nanyang Medical College, China.
E-mail address: 3396358710@qq.com (Q. Cui).
[1] These authors contributed equally to this work.

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Table 1
Demographic characteristics and KAP towards glioma.

Characteristics	n (%)	Knowledge score		Attitude score		Practice score	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Total	442 (100.00)	7.65 ± 1.62		37.98 ± 3.17		40.16 ± 4.17	
Age	51.46 ± 10.57						
Gender			0.038		0.432		<0.001
Male	251 (56.79)	7.79 ± 1.57		38.09 ± 3.11		38.31 ± 4.04	
Female	191 (43.21)	7.47 ± 1.68		37.85 ± 3.25		42.59 ± 2.89	
Residence			<0.001		0.711		0.059
Urban	341 (77.15)	7.79 ± 1.57		38.09 ± 3.11		38.31 ± 4.04	
Non-Urban	101 (22.85)	7.47 ± 1.68		37.85 ± 3.25		42.59 ± 2.89	
Ethnicity			0.406		0.342		0.841
Han Chinese	441 (99.77)	7.65 ± 1.62		37.98 ± 3.17		40.16 ± 4.17	
Minority	1 (0.23)	9.00		41		41	
Education			<0.001		<0.001		<0.001
Middle school/high school/technical secondary school	83 (18.78)	6.27 ± 1.44		36.78 ± 3.44		41.89 ± 3.60	
Junior college/undergraduate	313 (70.81)	7.82 ± 1.54		38.07 ± 3.11		40.13 ± 4.13	
Postgraduate and above	46 (10.41)	8.98 ± 0.15		39.57 ± 2.14		37.24 ± 3.78	
Family members working in the medical system			<0.001		<0.001		0.455
Yes	265 (59.95)	8.10 ± 1.49		38.71 ± 3.09		40.04 ± 4.28	
No	177 (40.05)	7.10 ± 1.59		36.90 ± 2.98		40.34 ± 3.99	
Monthly income			<0.001		<0.001		0.002
<5000	2 (0.45)	5.00 ± 1.41		27.50 ± 2.12		29.00 ± 7.07	
5000-10,000	4 (0.90)	5.75 ± 0.96		38.50 ± 3.70		40.25 ± 2.63	
10,000–20,000	256 (57.92)	7.41 ± 1.64		37.58 ± 3.15		40.34 ± 3.95	
>20,000	180 (40.72)	8.06 ± 1.50		38.67 ± 2.91		40.03 ± 4.33	
Medical insurance							
Social medical insurance (e.g., basic medical insurance for urban workers, new agricultural cooperative medical insurance, etc.)	435 (98.42)	–		–		–	
Commercial Insurance	179 (40.50)	–		–		–	
No insurance	1 (0.23)	–		–		–	
Family history of glioma			<0.001		<0.001		<0.001
Yes	267 (60.41)	7.29 ± 1.60		37.49 ± 3.14		40.81 ± 3.76	
No/unclear	175 (39.59)	8.19 ± 1.51		38.74 ± 3.08		39.18 ± 4.56	
History of cerebral disease			0.074		0.056		<0.001
Yes	81 (18.33)	7.36 ± 1.80		38.59 ± 3.45		41.64 ± 4.19	
No	361 (81.67)	7.71 ± 1.58		37.85 ± 3.09		39.83 ± 4.10	
Reason for consultation			0.090		0.003		<0.001
Cerebral vascular disease	114 (25.79)	7.32 ± 1.76		37.33 ± 3.51		40.39 ± 4.00	
Brain inflammation	15 (3.39)	7.60 ± 1.72		38.87 ± 3.44		38.47 ± 4.49	
Brain trauma	104 (23.53)	7.83 ± 1.57		37.51 ± 2.79		38.65 ± 4.72	
Neurological disorders	209 (47.29)	7.74 ± 1.55		38.51 ± 3.05		40.91 ± 3.72	

and diagnosis to improve prognosis [5,6] and because most low-grade gliomas will ultimately lead to patient death by progressing to glioblastoma [7], emphasizing the importance of screening in the presence of neurological symptoms.

Knowledge, attitude, and practice (KAP) survey is a methodology that provides qualitative and quantitative data on the gaps, misconceptions, and misunderstandings that can represent obstacles to specific activities and identify the potential barriers to be changed [8,9]. KAP studies are particularly useful in identifying the points to be improved in a given population and in designing educational interventions.

Previous studies revealed that the KAP toward cancer in general was very variable among different populations [10–14], including cancer screening [14–16]. KAP studies were performed in patients with glioma [17,18] and healthcare providers [19], but no data are available regarding the KAP toward glioma of patients consulting for neurological symptoms in general. Indeed, the most common symptoms of glioma (headache or seizures) are shared by countless conditions [20–22], but knowing that such symptoms might indicate a more serious disease is important and should encourage the patients to consult a healthcare provider promptly. The first step in screening for a specific disease is the patient seeking help and agreeing with the examinations.

Therefore, in the absence of data regarding the KAP toward glioma among individuals with neurological symptoms, this study aimed to explore the KAP regarding glioma among patients with neurological symptoms or diseases.

2. Results

2.1. Characteristics of the participants

A total of 1144 people participated in this study, but 692 had never heard of glioma (their demographic characteristics were collected, but not their KAP). Among the remaining 452 questionnaires, seven questionnaires had inconsistent responses to the K3 and K11 items, and there were three duplicate questionnaires. Therefore, the study included 442 valid questionnaires.

The participants were 51.46 ± 10.57 years of age. Most participants were male (56.79%), living in urban areas (77.15%), Han Chinese (99.77%), with junior college/undergraduate education (70.81%), working or with family members working in the healthcare system (59.95%), earning 10,000–20,000/month (57.92%), with medical insurance (99.77%), with a family history of glioma (60.41%), without previous diagnosis of cerebral diseases (81.67%), and consulting for neurological disorders (47.29%) (Table 1). Compared with the patients who had heard of glioma, those who had never heard of glioma were older ($P < 0.001$), had a higher proportion of females ($P < 0.001$), had a higher education ($P < 0.001$), had a lower proportion of family members working in healthcare ($P < 0.001$), had a lower income ($P < 0.001$), had no history of cerebral disease ($P < 0.001$), and mostly consulter for cerebrovascular disease ($P < 0.001$) (Supplementary Table S1).

2.2. Knowledge, attitude, and practice

The mean knowledge score was 7.65 ± 1.62 (possible range: 0–9, 85.00% of the total score), indicating good knowledge. The highest knowledge scores were observed in males ($P = 0.038$), urban residents ($P < 0.001$), higher education ($P < 0.001$), working or family members working in the medical system ($P < 0.001$), higher income ($P < 0.001$), and family history of glioma ($P < 0.001$) (Table 1). All knowledge items scored >60%. The items that fell in the moderate knowledge range were K7 (68.33%; "Symptoms such as dizziness, headache and vomiting caused by glioma are usually irregular"), K5 (72.85%; "Early manifestations of glioma include dizziness, headache, vomiting, cognitive impairment, etc."), K4 (75.57%; "High doses of ionizing radiation (such as brain radiotherapy) and genetic factors increase the risk of glioma"), K3 (76.02%; "All cases of gliomas are malignant"), and K6 (78.05%; "Epilepsy is one of the early symptoms of glioma") (Supplementary Table S2). The mean source of information was family and friends ($n = 298$), Internet ($n = 250$), physicians ($n = 222$), and traditional media ($n = 197$) (Supplementary Fig. S1).

The mean attitude score was 37.98 ± 3.17 (possible range: 9–45, 84.40% of the total score), indicating favorable attitudes. Higher attitude scores were observed with higher education ($P < 0.001$), higher income ($P < 0.001$), no/unclear family history of glioma ($P < 0.001$), and consulting for brain inflammation ($P = 0.003$) (Table 1). Lower attitudes were observed for A2 ("I am worried that I might be suffering from glioma") (Supplementary Table S3).

The mean practice score was 40.16 ± 4.17 (possible range: 10–50, 80.32% of the total score), indicating active practice. Higher practice scores were observed in women ($P < 0.001$), lower education ($P < 0.001$), higher income ($P = 0.002$), with a family history of glioma ($P < 0.001$), with a history of cerebral disease ($P < 0.001$), and consulting for neurological disorders ($P < 0.001$) (Table 1). Poorer practice scores were observed in P8 ("Do you often drink alcohol in your daily life?"), P9 ("Do you often smoke in your daily life?), and P10 ("Do you often feel tense or stressed in your daily life?") (Supplementary Table S4).

Table 2
Correlation analysis.

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.458 ($P < 0.001$)	1	
Practice	−0.033 ($P = 0.488$)	0.194 ($P < 0.001$)	1

2.3. Correlations

Pearson's correlation analysis showed that the knowledge scores positively correlated to the attitude scores ($r = 0.458$, $P < 0.001$) but not to the practice scores ($P = 0.488$). The attitude scores positively correlated to the practice scores ($r = 0.194$, $P < 0.001$) (Table 2).

2.4. Structural equation modeling

The structural equation modeling (SEM) analysis showed that knowledge directly affected attitudes ($\beta = 0.89$, 95%CI: 0.73–1.06, $P < 0.001$) but not practice ($\beta = -0.08$, 95%CI: −0.32–0.14, $P = 0.487$), while attitudes directly affected practice ($\beta = 0.35$, 95%CI: 0.21–0.48, $P < 0.001$) (Fig. 1 and Table 3**)**. The SEM had a good fit (Supplementary Table S5**)**.

2.5. Multivariable analysis

The multivariable analysis showed that the attitude score (OR = 1.16, 95%CI: 1.05–1.29, $P = 0.003$), age (OR = 1.13, 95%CI: 1.09–1.17, $P < 0.001$), female sex (OR = 27.1, 95%CI: 13.8–53.1, $P < 0.001$), no family history of glioma (OR = 0.51, 95%CI: 0.26–0.97, $P = 0.041$), and no history of cerebral diseases (OR = 0.31, 95%CI: 0.14–0.69, $P = 0.004$) were independently associated with the practice scores (Supplementary Table S6).

2.6. Confirmatory factor analysis

The confirmatory factor analysis (CFA) (Supplementary Fig. S2 and Supplementary Table S7) and the Kaiser-Meyer-Olkin (KMO) test (KMO = 0.814, $P < 0.001$) indicated good construct validity.

3. Discussion

KAP studies were performed in patients with glioma [17,18] and healthcare providers [19]. Indeed, most patients with malignant glioma appear to be ignorant of their life expectancy [17]. The patients with glioma and their caregivers also have limited knowledge and attitudes toward the disease [18]. In Europe, healthcare providers also appear to have a variable KAP toward glioma. Since healthcare providers are a primary source of reliable medical knowledge, limited KAP in healthcare providers can translate into limited KAP in the population. Still, no data were available regarding the KAP toward glioma of patients consulting for neurological symptoms in general. This study contributes to the literature on glioma by suggesting that the patients with neurological symptoms or diseases who had heard of gliomas had good knowledge, favorable attitudes, and active practice toward glioma. Still, some KAP areas could be improved and included in future educational material on glioma. The results might help design educational activities to improve the knowledge toward glioma in the general population.

The present study showed that participants had a high KAP toward glioma. Of note, all included participants were attending brain clinics for known neurological diseases or for neurological symptoms and had at least heard of glioma. Therefore, it is highly likely that they had at least researched their symptoms on the Internet, books, or social media [23,24] and/or discussed them with their social network or healthcare providers. Higher anxiety toward cancer has been reported to increase the rates of colon and breast cancer screening [25,26]. Nevertheless, the KAP toward screening for various cancers is generally poor, but the presence of symptoms generally appears as an incentive [14–16]. The presence of neurological symptoms, especially non-specific ones like headaches and

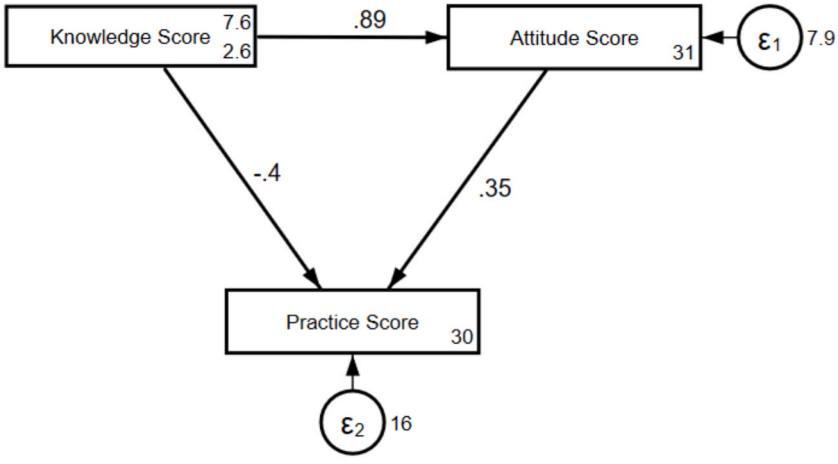

Fig. 1. The structural equation model.

Table 3
Structural equation model results.

	Beta (95% CI)	P-value
Attitude		
Knowledge	0.89 (0.73, 1.06)	<0.001
Practice		
Attitude	0.35 (0.21, 0.48)	<0.001
Knowledge	−0.08 (−0.32, 0.15)	0.487

seizures, can be worrisome since they cannot be directly linked to a specific disease before investigations. Although seizures are more worrisome [21], headaches are quite common and highly unspecific [20,22]. Still, in the present study, a small proportion of patients reported "agree or strongly agree" to "I am worried that I might be suffering from glioma", suggesting that most patients were not worried about the glioma. Nevertheless, there is a bias to this study since more than half of the surveyed patients declared that they never heard of glioma and were not included in this study, reflecting that most patients have insufficient knowledge of this topic.

The participants had a relatively high socioeconomic status (high income, high education, and living in urban areas). In the present study, most patients had a college or undergraduate education, were living in urban areas, had a high income, and had medical insurance, indicating a high socioeconomic status, which is usually directly correlated with health literacy [27–29] and could contribute to the high knowledge observed in this study. Furthermore, most patients were themselves or had a direct family member working in healthcare, which is, of course, associated with health literacy. By definition, healthcare workers will have a higher health literacy than the general population [30] and can influence the health literacy of their family members or provide advice in the presence of symptoms. Most participants who had never heard of glioma had no family members working in healthcare. A large proportion of the participants had a family history of glioma, which will also lead to a higher health literacy regarding that disease [31]. Compared with the patients who had heard of glioma, those who did not showed a higher education level, but fewer had family members working in healthcare, they had a lower income, and fewer had cerebral diseases.

The KAP theory implies that knowledge is the basis for practice and that attitude is the force driving practice [8,9]. The present study also showed that knowledge directly affected attitudes and indirectly affected practice through the attitudes. Therefore, improving knowledge could improve attitudes and practice. Considering that most (55.0%) of the patients had never heard of glioma (and were not included in this study), education about glioma should be enforced, which should translate into better attitudes and practice.

This study had limitations. Many patients scanned the QR code to participate in the study, but only a relatively small proportion had heard of glioma, and only their questionnaires were considered valid and included for analysis. The questionnaire was designed by local investigators based on local practice, guidelines, and policies, limiting the exportability of the questionnaire and the generalizability of the conclusions. Furthermore, although our questionnaire was meticulously designed based on relevant literature and clinical guidelines, it's important to acknowledge that the subjective nature of patients' beliefs and perspectives may introduce inherent inaccuracies, potentially limiting its direct alignment with clinical practice. As for all KAP studies, there is a possibility of the social desirability bias, in which the participants answer what they should do instead of what they are doing [32,33]. The participants had a relatively high socioeconomic status, possibly biasing the results. Finally, a SEM analysis is only a statistical surrogate for causality and is based on predefined hypotheses; therefore, such results must be taken with caution [34,35].

In conclusion, patients with neurological symptoms/diseases and who had heard of gliomas had good knowledge, favorable attitudes, and active practice toward glioma. Specific knowledge items that would warrant improvements were identified in the specific population of patients with neurological symptoms/diseases who had heard of glioma. Despite the high KAP level, some KAP areas could still be improved and should be included in future educational material on glioma. Future studies should also examine the general population.

4. Materials and methods

4.1. Study design and participants

This web-based cross-sectional study was conducted in two medical centers in Henan Province between January 2023 and April 2023. The participants were patients with neurological symptoms or diseases who attended the Department of Brain (Neurology and Neurosurgery) of the First Affiliated Hospital of Nanyang Medical College and the First Affiliated Hospital of Zhengzhou University. The inclusion criteria were 1) patients consulting for neurological symptoms or diseases, 2) voluntary participation for this study, and 3) conscious. The exclusion criteria were 1) medical staff engaged in cerebral disease or 2) questionnaires with incomplete or conflicting responses. This study was approved by the Neurosurgery Medical Ethics Committee of the First Affiliated Hospital of Nanyang Medical College (2023-xxgnk038). Written informed consent was obtained from all participants before they completed the survey.

5. Questionnaire

The questionnaire was designed by the investigators based on the literature [18,36] and the Chinese Guidelines for the Diagnosis and Treatment of Central Nervous System Gliomas. A pilot study was conducted among 29 patients to test the reliability of the

questionnaire and showed a Cronbach' α of 0.822, indicating good internal consistency.

The final questionnaire contained four dimensions: demographic characteristics (including age, gender, residence, ethnicity, education, family members working in the medical system, monthly income, insurance, familial history of glioma, history of cerebral diseases, and reasons for consultation) and the knowledge, attitude, and practice dimensions. The knowledge dimension consisted of 12 items. The first item (K1) asked whether the participant was aware of the concept of glioma; the questionnaire was stopped for those who had never heard of glioma. K11 was used to assess the validity of the questionnaire (a trick question that was contrary to K3; two "yes" or two "no" answers led to questionnaire invalidity). K12 was used to investigate how the participant had learned the relevant knowledge. The remaining nine items were scored 1 point for a correct response and 0 points for a wrong or unclear response. The attitude dimension consisted of nine questions using a 5-point Likert scale, with items A4-A7 being reverse-scored from strongly agree (1 point) to strongly disagree (5 points) and the remaining questions being forward-scored from strongly agree (5 points) to strongly disagree (1 point). The practice dimension contained 10 questions using a five-point Likert scale, with items P1–P5 being forward-scored and P6–P10 being reverse-scored. The score for the knowledge, attitude, and practice dimension was categorized as insufficient, unfavorable, and poor (<60%), moderate (60%–79.9%), and good, favorable, and active (≥80%) [37].

The questionnaires were distributed by posting WeChat QR codes in the departments and sending WeChat QR codes. The investigators participated in the survey process and helped illustrate the questions that were unknown or unclear to the patients.

5.1. Statistical analysis

Stata 17.0 (Stata Corporation, College Station, TX, USA) was used for statistical analysis. All continuous variables conformed to the normal distribution, were presented as means ± standard deviations (SDs), and were compared using Student's t-test or one-way ANOVA. The categorical variables were presented as n (%). The correlations between dimensions were evaluated using Pearson's correlation analysis. A SEM was used to examine the relationship among KAP [34,35]. It was hypothesized that knowledge affected attitudes and practice and that attitudes affected practice. A multivariable logistic regression analysis of the factors independently associated with practice was performed, using the factors with $P < 0.05$ in the univariable analyses. A CFA was performed, and the KMO was calculated to determine whether the questionnaire adhered to the KAP theory. Two-sided $P < 0.05$ was considered statistically significant.

6. Ethics approval and consent to participate

This study was approved by the Neurosurgery Medical Ethics Committee of the First Affiliated Hospital of Nanyang Medical College (2023-xxgnk038). Written informed consent was obtained from all participants before they completed the survey.

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Data availability statement

The data can be obtained from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Haozhi Ma: Writing – original draft, Formal analysis, Data curation, Conceptualization. **Di Nie:** Formal analysis, Data curation. **Bo Wang:** Data curation. **Yang Bai:** Formal analysis, Data curation. **Qunjian Cui:** Writing – original draft, Investigation.

Declaration of competing interest

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

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e28546.

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