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Knowledge, attitudes, and practices toward esophageal cancer screening and early diagnosis and treatment among family members of esophageal cancer patients: A cross-sectional study

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This cross-sectional study assessed knowledge, attitudes, and practices (KAP) related to esophageal cancer screening, early detection, and treatment among family members of patients with esophageal cancer. Conducted April–May 2025 at the First Affiliated Hospital of China Medical University, KAP was measured via a self-administered questionnaire. Of 540 distributed questionnaires, 538 valid responses were collected (response rate: 99.63%). Among respondents, 285 (52.97%) were female, 376 (69.89%) resided in urban areas, and 301 (55.95%) were the patient's spouse, child, or parent. Mean scores were: knowledge 19.75 ± 4.84 (range 0–16), attitude 30.38 ± 7.77 (range 12–60), and practice 25.76 ± 10.38 (range 12–60). Structural equation modeling revealed a direct positive effect of knowledge on attitude (β = 1.12, $P < 0.001$) and on practice (β = -1.39, $P < 0.001$); however, attitude did not mediate practice, and the indirect effect of knowledge on practice was not significant. Overall, participants demonstrated moderate knowledge, neutral attitudes, and suboptimal practices. Targeted health education is needed to enhance awareness and proactive screening engagement among caregivers, improving early detection.

Keywords Esophageal neoplasms, Early detection of cancer, Knowledge, attitudes, practice, Family, Questionnaires, Cross-Sectional studies

Esophageal cancer (EC) represents a significant global health challenge, ranking as the seventh most prevalent and sixth most lethal malignancy worldwide[1]. In 2020, China accounted for over 50% of the global EC burden, with approximately 324,422 new cases and 301,135 deaths[2,3]. The geographical distribution of EC in China is markedly uneven, with mortality rates in high-risk areas—such as the Taihang Mountain region and parts of Henan, Hebei, and Shanxi provinces—being two to three times higher than the national average[4]. Early detection is essential; the five-year survival rate for early-stage EC can reach 86%, in contrast to an overall survival rate of only 30.3% in China[5]. Despite the established cost-effectiveness of endoscopic screening in high-risk regions[4] and national guidelines recommending screening for high-risk individuals, including those with a family history of EC[6], the adoption of these practices remains inadequate.

Family members of EC patients constitute a critical target population for screening due to the well-documented familial clustering of the disease. Research indicates that individuals with a family history of EC face a 60% to 80% increased risk compared to those without such a history[7]. This elevated risk arises from both genetic and shared environmental factors. For example, mutations in the RHBDF2 gene, associated with Tylosis with esophageal cancer (Howel-Evans syndrome), and mutations in the BLM gene, linked to Bloom syndrome, significantly increase the risk of squamous cell carcinoma of the esophagus[8,9] Furthermore, epidemiological surveys in high-risk regions of China have demonstrated significant familial aggregation, with multiple affected individuals within certain families across generations[10]. These findings underscore the necessity of screening family members to address the hereditary and environmental risks associated with EC.

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Acknowledging this heightened risk, the 2022 National Guidelines for Diagnosis and Treatment of Esophageal Carcinoma in China explicitly categorize family members of EC patients as a high-risk group for screening. The guidelines recommend that individuals aged 40 years and older with a family history of EC undergo endoscopic screening with esophageal mucosa iodine solution staining[6]. For those without lesions, routine follow-up endoscopy is advised, with specific follow-up intervals recommended based on the grade of intraepithelial neoplasia. For instance, individuals with low-grade intraepithelial neoplasia/dysplasia should undergo follow-up endoscopy every three years, while those with high-grade intraepithelial neoplasia/dysplasia without vascular invasion should consider endoscopic treatment[6]. These guidelines highlight the critical role of screening in high-risk groups, including family members, to enhance early detection and reduce mortality.

Despite these explicit guidelines, there is a paucity of research focusing specifically on the knowledge, attitudes, and practices (KAP) of family members regarding EC screening and early diagnosis in China. Most existing studies have targeted patient populations or generalized high-risk communities, thereby leaving a gap in understanding how family members perceive and engage with screening recommendations. This gap is particularly concerning given the potential benefits of improving screening uptake among family members, which could alleviate the overall burden of EC in high-risk areas and enhance survival rates through early detection. Furthermore, the KAP of a specific population toward a specific topic is highly dependent upon the local socioeconomic status, education system, healthcare access, healthcare policies, and culture. Hence, determining the KAP with a tailored questionnaire is necessary to determine the gaps that will have to be addressed by future interventions. It is why KAP studies usually rely on new tools developed specifically for the needs of the KAP evaluation.

The KAP theory provides a framework for understanding health behaviors, positing that knowledge acquisition leads to the formation of attitudes, which subsequently influence health-related practices[8,9]. However, in the context of EC, the translation of knowledge into positive attitudes and practices is often obstructed by various barriers, including cultural, socioeconomic, and systemic factors. For instance, cultural attitudes toward cancer disclosure in China, where family members may hesitate to discuss cancer diagnoses, can adversely affect screening participation[11]. Additionally, structural obstacles such as limited access to screening facilities, high out-of-pocket costs, and fragmented healthcare financing systems further complicate screening uptake[12].

It was hypothesized that family members of EC patients concerning EC screening and early diagnosis would have knowledge and attitudinal gaps toward EC screening and early diagnosis. Therefore, this study aimed to assess the KAP of family members of EC patients concerning EC screening and early diagnosis in China.

Methods

Study design and participants

A cross-sectional study was conducted between April and May 2025 at the First Affiliated Hospital of China Medical University. Eligible participants included family members of patients diagnosed with esophageal cancer. There were no exclusion criteria. Ethical approval for this study was granted by the Institutional Ethics Committee of the First Affiliated Hospital of China Medical University on March 13, 2025(Approval No. AF-SOP-07-1.2.2-01). Informed consent was obtained from all participants prior to data collection, in accordance with ethical standards for human research.

Procedures

A self-developed questionnaire was utilized to collect data in this study. Its design was informed by established clinical guidelines and relevant literature, including the *Guidelines for the Diagnosis and Treatment of Esophageal Cancer (2022 Edition)*[13] and the *2024 CSCO Guidelines for the Diagnosis and Treatment of Esophageal Cancer*[14]. Content validity was enhanced through expert consultation, with revisions incorporated based on feedback from three specialists in the field. A pilot test involving 46 respondents was conducted, yielding a full response rate. The questionnaire demonstrated satisfactory internal consistency, with an overall Cronbach's α of 0.795. The reliability coefficients for the knowledge, attitude, and practice dimensions were 0.7267, 0.8797, and 0.7821, respectively.

The final questionnaire, administered in Chinese, consisted of 46 items organized into four domains. Fourteen items gathered basic demographic and contextual information, while the remaining items assessed knowledge (8 items), attitude (12 items), and practice (12 items). Scoring was conducted as follows: for the knowledge dimension, correct responses received 2 points, uncertain responses 1 point, and incorrect responses 0 points, yielding a possible range of 0 to 16. For both the attitude and practice sections, a five-point Likert scale was employed. In the attitude section, each item was scored from 1 to 5 according to increasing levels of positivity (a = 1 to e = 5), with total scores ranging from 12 to 60. The practice section followed an inverted scoring scheme (a = 5 to e = 1), also resulting in a total possible range of 12 to 60. Categorization thresholds were established based on total scores, with scores exceeding 75% of the maximum possible in each dimension interpreted as indicators of adequate knowledge, a positive attitude, and proactive practices[15].

Participants were recruited using a convenience sampling approach. Patients visiting our department provided their contact information. The questionnaire was distributed electronically via the Wenjuanxing platform (https://www.wjx.cn/). Respondents accessed the questionnaire by scanning a generated QR code using the WeChat APP (a popular messaging app in China), giving access to the Wenjuanxing platform. Participants had the flexibility to complete the questionnaire at their convenience, whether at home or in the hospital, during the study period. The participants did not receive any special information before completing the survey to avoid influencing them. All necessary information to make an informed consent and to complete the questionnaire was contained in the questionnaire. On the other hand, before the start of the study, all investigators received standardized training on research objectives, sampling procedures, questionnaire interpretation, and uniform instructions to ensure consistency in face-to-face interviews; before data collection, participants were informed

of the research purpose, the voluntariness of participation, their right to withdraw at any time, and the confidentiality of all personal information.

To promote data integrity, only one submission per IP address was permitted, and all items were mandatory. The research team conducted quality control checks, reviewing submissions for completeness, logical consistency, and response validity. Responses completed in under 240 s, displaying patterns inconsistent with common sense, or containing uniform responses across an entire KAP section were excluded as invalid.

Sample size calculation

Sample size estimation was conducted prior to data collection based on the requirements for a cross-sectional survey design. Using the formula for estimating a proportion in a finite population, $\alpha = 0.05$, $n = \left(\frac{z_{1-\alpha/2}}{\delta}\right)^2 \times p \times (1-p)$, a minimum sample size of 384 was calculated, assuming a two-sided confidence level of 95% ($Z = 1.96$), an anticipated prevalence of sufficient knowledge or positive attitude at 50% ($p = 0.5$), and a margin of error of 5% ($d = 0.05$). Considering potential invalid responses and incomplete questionnaires, a 20% increase was applied, resulting in a target sample size of approximately 460 participants.

Statistical analysis

Data analysis was conducted using SPSS 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as means and standard deviations (SD), while categorical variables were presented as frequencies and percentages (n, %). Comparisons of continuous variables across groups were performed using one-way analysis of variance (ANOVA), assuming normal distribution and homogeneity of variance. The chi-square test or Fisher's exact test was applied, as appropriate, to assess differences in categorical variables, including comparisons of knowledge and attitude levels before and after specific interventions or across sociodemographic groups. Correlation analyses employed Spearman correlation coefficients, depending on the distribution of the skewed data. Structural equation modeling (SEM) was utilized to investigate the interrelationships among the constructs of knowledge (K), attitudes (A), and practices (P). The SEM was based on the following working hypotheses: (1) knowledge directly influences attitude, (2) attitude directly influences practice, and (3) knowledge influences practice both directly and indirectly. These pathways are theoretically grounded in the KAP model, which suggests that knowledge shapes attitudes and subsequently influences behaviors[16]. Model fit was evaluated using several standard indices, including the root mean square error of approximation (RMSEA), incremental fit index (IFI), Tucker–Lewis index (TLI), and comparative fit index (CFI). All statistical analyses were two-sided, and a P-value of less than 0.05 was considered indicative of statistical significance.

Results

Demographic characteristics of the participants

Initially, a total of 540 questionnaires were collected for this study. The following samples were excluded: Two cases where item 13 "Do you have any of the following underlying diseases?" selected both "g. none of the above" and other options. Remaining valid questionnaires 538, with an effective rate of 99.63%. Among the participants, 285 (52.97) were female, with a mean age of 41.17 ± 11.16 years, 357 (66.36) had an associate degree/bachelor's degree or above, 376 (69.89) lived in urban areas, and 301 (55.95) were spouse/child/parent of the patient. The mean knowledge, attitude, and practice scores were 19.75 ± 4.84 (possible range: 0–16), 30.38 ± 7.77 (possible range: 12–60), and 25.76 ± 10.38 (possible range: 12–60), respectively. Analysis of demographic characteristics found that participants' knowledge, attitude, and practice scores varied across education, residence, employment status, smoking, alcohol, and type of medical insurance. Meanwhile, participants' knowledge and practice scores varied across ethnicity ($P < 0.001$) (Table 1).

Distribution of Knowledge, attitude, and practice dimension

The distribution of knowledge dimensions showed that the three questions with the highest number of participants choosing the 'Uncertain' option were 'Patients with gastroesophageal reflux should undergo screening at intervals of ≥ 2 years.' (**K7**) with 26.77%, 'If abnormalities are found during screening, endoscopic treatment should be prioritized.' (**K11**) with 26.02%, and 'If you feel a foreign body sensation when swallowing, you should seek medical attention immediately.' (**K3**) with 25.84% (Supplementary Table 1). Responses to the attitude dimension showed that 9.11% strongly disagreed and 13.38% disagreed to pay part of the screening cost out of pocket (**A5**), 8.55% strongly disagreed and 10.78% disagreed that treatment for early detection is much less painful than for late-stage disease (**A3**), and 7.62% strongly disagreed and 12.45% disagreed that screening guidelines issued by medical institutions are trustworthy (**A6**) (Supplementary Table 2). Responses to the practice dimension showed that 38.66% never monitored the temperature of food/drinks at home (**P2**), 37.92% did not record the appearance of swallowing difficulties in their family members (**P3**), 40.15% never explained the importance of screening to their relatives (**P6**), and 42.57% had never had a gastroscopy (**P9**) (Supplementary Table 3).

Spearman correlation and structural equation model analysis

Spearman correlation analysis indicated significant correlations between knowledge and attitude ($r = 0.3192$, $P < 0.001$), as well as practice ($r = -0.4748$, $P < 0.001$). Meanwhile, there was also a correlation between attitude and practice ($r = -0.2700$, $P < 0.001$) (Table 2). The fit of the SEM model yielded good indices demonstrating good model fit (RMSEA value: 0.025, SRMR value: 0.033, TLI value: 0.982, and CFI value: 0.983) (Supplementary Table 4), and the effect estimates between the various paths have been presented (Supplementary Table 5). The results of mediation analysis showed that the direct effect of knowledge on both attitude ($\beta = 1.12$, $P < 0.001$) and practice ($\beta = -1.39$, $P < 0.001$), while neither the direct effect of attitude on practice nor the indirect effect of knowledge on practice was statistically significant (Table 3; Fig. 1).

N = 538	*N* (%)	Knowledge score		Attitude score		Practice score	
		Mean ± SD	*P*	Mean ± SD	*P*	Mean ± SD	*P*
Total score		19.75 ± 4.84		30.38 ± 7.77		25.76 ± 10.38	
Gender			0.660		0.944		0.446
Male	253(47.03)	19.73 ± 4.95		30.56 ± 7.29		25.39 ± 10.2	
Female	285(52.97)	19.76 ± 4.73		30.20 ± 8.17		26.08 ± 10.5	
Age (years old) [20 ~ 72]	41.17 ± 11.16						
BMI [16.14208 30.47722]	21.00 ± 2.46						
Education			< 0.001		0.002		0.002
High school/Technical secondary school or below	181(33.64)	18.10 ± 5.46		29.02 ± 8.04		28.11 ± 11.5	
Associate degree/Bachelor's degree or above	357(66.36)	20.58 ± 4.25		31.05 ± 7.53		24.57 ± 9.53	
Residence			< 0.001		0.002		< 0.001
Urban	376(69.89)	20.81 ± 3.74		31.07 ± 7.63		24.53 ± 9.52	
Rural	50(9.29)	15.52 ± 6.15		28.2 ± 7.61		30.74 ± 11.9	
Suburban	112(20.82)	18.05 ± 5.84		28.98 ± 7.96		27.66 ± 11.4	
Ethnicity			< 0.001		0.565		0.001
Han	492(91.45)	20.08 ± 4.50		30.44 ± 7.79		25.27 ± 10.1	
Ethnic minority	46(8.55)	16.17 ± 6.60		29.65 ± 7.52		30.95 ± 11.3	
Employment status			< 0.001		< 0.001		< 0.001
Employed	431(80.11)	20.43 ± 4.29		30.89 ± 7.62		24.66 ± 9.55	
Other	107(19.89)	16.98 ± 5.84		28.28 ± 8.01		30.20 ± 12.2	
Relationship to the patient			0.793		0.450		0.518
Spouse/child/parent	301(55.95)	19.64 ± 5.04		30.11 ± 7.83		25.22 ± 9.93	
Sibling/other relatives	237(44.05)	19.89 ± 4.55		30.70 ± 7.68		26.44 ± 10.8	
Smoking			< 0.001		0.040		< 0.001
Never	92(17.1)	17.29 ± 5.46		28.72 ± 8.29		29.38 ± 9.86	
Used to	291(54.09)	20.72 ± 4.15		31.06 ± 7.39		24.42 ± 9.83	
Currently smoke	155(28.81)	19.38 ± 5.09		30.05 ± 8.00		26.12 ± 11.1	
Alcohol			< 0.001		0.006		< 0.001
Never	100(18.59)	17.33 ± 4.90		29.04 ± 8.23		29.95 ± 10.2	
Used to	158(29.37)	19.17 ± 5.14		29.40 ± 7.87		25.94 ± 10.4	
Currently drink	280(52.04)	20.93 ± 4.22		31.4 ± 7.40		24.16 ± 10.0	
Main sources of health knowledge (multiple choice)							
Hospital promotion	280(52.04)						
Community lectures	248(46.1)						
Online platform	258(47.96)						
Experiences shared by relatives	272(50.56)						
Television and radio	258(47.96)						
Printed materials	4(0.74)						
Never exposed to information	280(52.04)						
Chronic conditions (multiple choice)							
Hypertension	105(19.52)						
Diabetes	141(26.21)						
Rheumatoid arthritis	111(20.63)						
Stroke	81(15.06)						
Chronic obstructive pulmonary disease	126(23.42)						
Coronary heart disease	113(21)						
None of the above	253(47.03)						
Not sure	12(2.23)						
Type of medical insurance			< 0.001		< 0.001		< 0.001
Basic medical insurance for urban employees	345(64.13)	20.98 ± 4.04		31.30 ± 7.75		23.85 ± 9.46	
Basic medical insurance for urban and rural residents	117(21.75)	18.57 ± 5.04		28.68 ± 8.13		27.14 ± 10.1	
No insurances	76(14.13)	15.94 ± 5.40		28.75 ± 6.49		32.30 ± 11.7	

Table 1. Baseline characteristics.

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.3192 (P<0.001)	1	
Practice	−0.4748 (P<0.001)	−0.2700 (P<0.001)	1

Table 2. Spearman correlation analysis.

Model paths	Total effects		Direct Effect		Indirect effect	
	β (95% CI)	*P*	β (95% CI)	*P*	β (95% CI)	*P*
Asum <-						
Ksum	1.12(0.90,1.33)	< 0.001	1.12(0.90,1.33)	< 0.001		
Psum <-						
Asum	−0.05(−0.12,0.01)	0.097	−0.05(−0.12,0.01)	0.097		
Ksum	−1.45(−1.63, −1.28)	< 0.001	−1.39(−1.58, −1.20)	< 0.001	−0.06(−0.13,0.01)	0.099

Table 3. SEM results of KAP scores.

Discussion

Family members of patients with esophageal cancer demonstrated moderate knowledge, a predominantly neutral attitude, and suboptimal practices regarding screening and early detection. These findings highlight the urgent need for targeted educational interventions and supportive strategies to enhance understanding and engagement among family members, potentially improving their proactive involvement in screening and early diagnosis efforts. This study represents one of the initial investigations into KAP concerning esophageal cancer screening among family members in China, addressing a critical gap due to their increased risk associated with familial clustering[6,7].

The results reveal a complex array of challenges related to how family members perceive and engage with screening and early detection. Although knowledge levels were moderate, attitudes did not reflect a decisively affirmative orientation, and actual screening behaviors were frequently inadequate. This discrepancy is not unique; prior research on cancer-related KAP in the general population has identified similar gaps between awareness and action[12,17]. In contexts where screening is preventive rather than symptom-driven, knowledge alone often fails to translate into proactive behaviors. For example, a recent meta-analysis on esophageal cancer screening in China reported compliance rates of 50.11% in high-risk areas, 52.40% in rural regions, and only 23.67% in urban areas[10], illustrating the gap between knowledge and action, even in urban settings with higher KAP scores. This aligns with our findings that urban respondents exhibited more favorable KAP profiles; however, practical barriers such as cost and access likely impeded actual screening participation.

Knowledge was positively correlated with attitude but negatively associated with practice. Path analysis indicated that while knowledge positively influenced attitudes, it had a direct negative correlation with reported practices. Notably, the indirect path from knowledge to practice through attitude was not supported by the data. These findings suggest that increased knowledge may paradoxically coexist with heightened awareness of barriers or risks that inhibit engagement in practice. Existing studies have identified similar mechanisms, particularly in contexts where perceived procedural discomfort or financial barriers reduce behavioral uptake[18,19]. In China, where esophageal cancer screening programs have been established for decades, challenges such as limited understanding of cancer's natural history and insufficient sustainability of current practices further complicate uptake[20]. Addressing these challenges necessitates the development of tailored screening technologies and pathways informed by high-quality epidemiological studies[20].

Educational attainment significantly influenced all three dimensions, with participants possessing higher degrees demonstrating better outcomes. This pattern has been observed in various contexts, where education enhances not only access to information but also individuals' ability to critically evaluate and act on health-related content[21,22]. Place of residence emerged as another crucial determinant. Urban respondents exhibited more favorable KAP profiles, while rural participants consistently reported lower scores. These disparities reflect broader structural issues, including uneven healthcare resource distribution, varying health communication infrastructures, and persistent gaps in community-level engagement[23,24]. However, despite higher knowledge in urban areas, screening compliance rates were lower in urban China (23.67%) compared to high-risk areas (50.11%) and rural regions (52.40%)[10], indicating that other barriers, such as cost or access, may be more pronounced in urban settings.

Several additional variables, including employment status, type of health insurance, and lifestyle behaviors, were also linked to KAP outcomes. Unemployed respondents and those lacking insurance exhibited notable disadvantages, demonstrating lower knowledge and less consistent health behaviors. These associations suggest that KAP patterns are not merely reflective of individual awareness but are embedded within broader socioeconomic conditions that may limit individuals' perceived or actual capacity to engage in prevention. A closer examination of the knowledge, attitude, and practice items reveals further limitations in public understanding. In the knowledge section, uncertainty was prevalent regarding key clinical recommendations, such as screening intervals for at-risk populations and management protocols following abnormal findings.

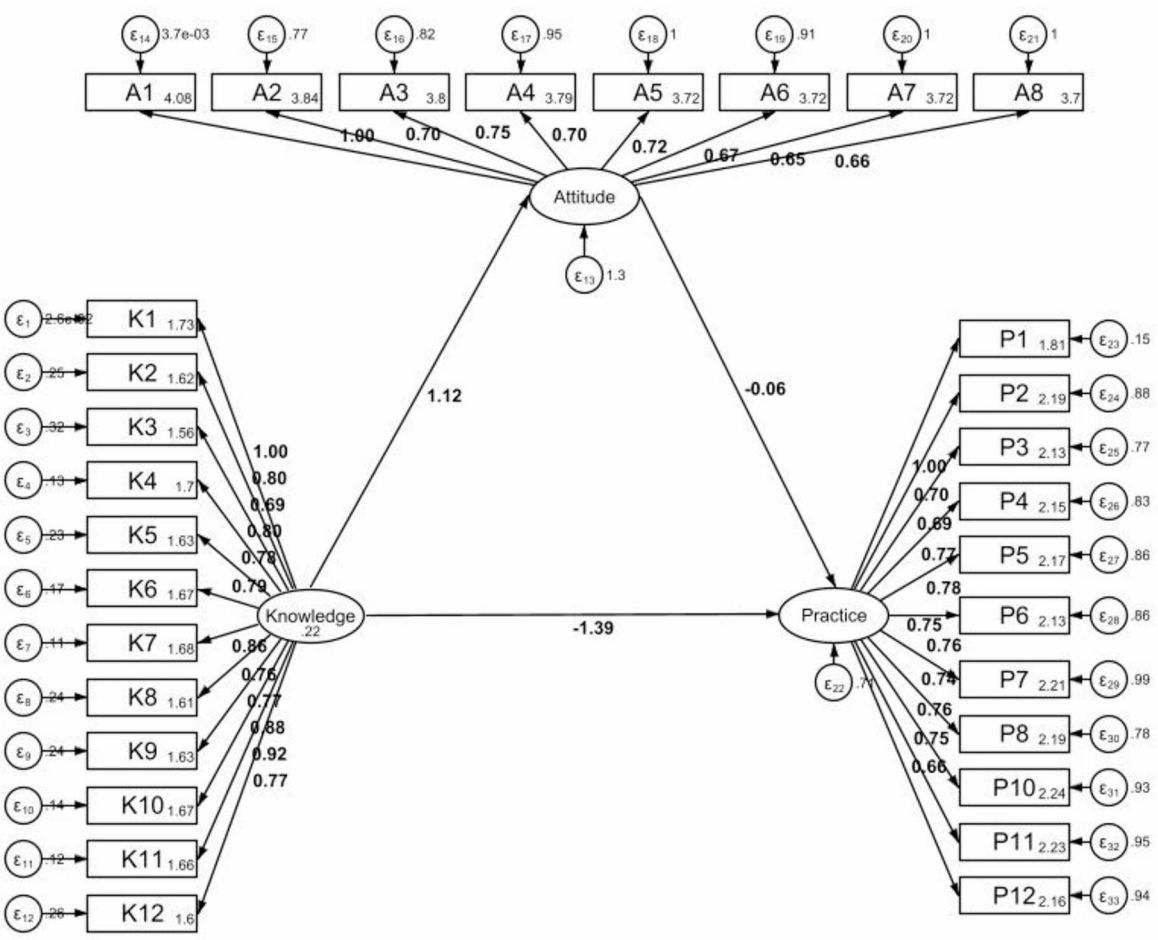

Fig. 1. SEM model.

The issue may not stem from a complete absence of awareness but rather from a lack of detailed, actionable comprehension. A similar lack of clarity was evident in the attitude responses, where many participants expressed doubts about the credibility of institutional guidelines and hesitancy to pay out-of-pocket for early detection procedures. These concerns are common in settings with fragmented healthcare financing structures and uneven trust in the system[20].

Behavioral practices exhibited the most consistent deficits. Many respondents reported never having undergone screening themselves, seldom encouraging family members to do so, and rarely engaging in structured symptom monitoring. These trends are particularly striking when preventive practices rely on voluntary, often inconvenient actions in the absence of overt symptoms. Prior studies on cancer screening uptake in asymptomatic individuals have documented similarly low engagement, especially when procedures are perceived as invasive or entail financial implications[24,25].

The broader sociocultural and institutional context helps elucidate some of these findings. In many East Asian healthcare systems, families often serve as vital intermediaries in medical decision-making[24,26]. Yet, this responsibility is not always accompanied by the necessary support or resources. Limited health literacy, low perceived efficacy of prevention, and underdeveloped community education infrastructures likely contribute to the observed inertia. Notably, a significant number of respondents reported never having been exposed to relevant information outside the hospital environment, raising questions about the reach and effectiveness of current health promotion strategies. Furthermore, cultural attitudes toward cancer disclosure may influence family members' engagement with screening. In China, there is often reluctance among family members to inform patients about their cancer diagnosis, with only 18% desiring disclosure, influenced by factors such as gender, profession, and educational level[27]. This cultural nuance underscores the importance of culturally sensitive educational interventions.

Addressing these issues requires interventions at multiple levels. Structurally, increasing access to screening facilities and reducing out-of-pocket costs could alleviate some of the practical constraints faced by lower-income groups. This might involve expanding mobile screening programs in rural regions, integrating screening into routine health services, or providing subsidies for high-risk families. These findings align with national guidelines for esophageal cancer screening in China, which emphasize targeted screening for high-risk populations, including family members of esophageal cancer patients[28]. Concurrently, the role of frontline health workers and general practitioners in reinforcing evidence-based screening recommendations should

be strengthened through targeted training, focusing on how to communicate risk in a comprehensible and motivating manner[24,29].

Educational outreach must extend beyond simple awareness campaigns. There is a need for more sophisticated public education strategies that address procedural knowledge, perceived barriers, and confidence in health systems. This might include interactive workshops at community health centers, narrative-based health communication via social media, or decision aids that assist families in evaluating the benefits and risks of screening[29,30]. Additionally, given the rapid advancement of digital health technologies in China, future studies could explore the use of mobile applications or online platforms to deliver tailored educational content and reminders for screening, potentially overcoming some of the barriers identified in this study.

This study has several limitations that warrant acknowledgment. First, as a single-center cross-sectional study conducted in one tertiary hospital, the findings may not be generalizable to broader populations or different healthcare settings. Second, reliance on self-reported data may have introduced response biases, including social desirability and recall bias. Third, while the questionnaire demonstrated acceptable internal consistency, the inherent limitations of the KAP framework—such as its inability to capture contextual and structural factors influencing behavior—may constrain the depth of interpretation. Future research should aim to address these limitations by conducting longitudinal and multi-center studies to better understand KAP dynamics over time and in response to interventions. Additionally, exploring the effectiveness of digital health technologies and culturally sensitive educational strategies could provide valuable insights for improving screening uptake. Investigating KAP among different ethnic groups within China could also reveal additional disparities and inform tailored interventions.

In conclusion, family members of patients with esophageal cancer exhibited moderate knowledge, a generally neutral attitude, and suboptimal practices concerning esophageal cancer screening and early detection. These findings underscore the need for targeted health education interventions that not only enhance knowledge but also actively promote behavioral change to improve early detection practices within this high-risk group.

Data availability

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

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Author contributions

Yang Liu and Hao Yu designed the research. Kun Qiu and Dongzhi Yu participated in collecting data. Hao Yu and Shun Xu participated in the acquisition, analysis, and interpretation of data and drafted the manuscript.All authors read and approved the final manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Ethics declarations

The study was approved by the Ethics Committee of the First Affiliated Hospital of China Medical University on March 13, 2025 (Approval No. AF-SOP-07-1.2-01). Informed consent was obtained from all participants prior to data collection, in accordance with ethical standards for human research. I confirm that all methods were performed in accordance with the relevant guidelines. All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Additional information

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