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Knowledge, attitudes, and practices among patients with impacted wisdom teeth toward teeth extraction

Running Title: KAP toward wisdom teeth extraction

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ABSTRACT

Objectives: This study aimed to assess the knowledge, attitudes, and practices (KAP) among patients with impacted wisdom teeth toward tooth extraction, with the intention of identifying gaps and opportunities for improved dental health education and practices.

Design: A cross-sectional study employing a web-based questionnaire.

Setting: The study was conducted at the Department of Oral and Maxillofacial Surgery, School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University, and Jinan Stomatological Hospital.

Participants: This study garnered responses from 3,467 individuals presenting with impacted wisdom teeth at the study settings between March and May 2023.

Primary and Secondary Outcome Measures: The primary outcomes measured were the levels of knowledge, attitudes, and practices toward wisdom teeth extraction among participants. The knowledge was assessed on a scale of 0-11, attitudes on a scale of 10-50, and practices on a scale of 11-55. Secondary outcomes included the exploration of relationships between knowledge, attitudes, and practices using structural equation modeling.

Results: Participants demonstrated a mean knowledge score of 9.1±1.4, mean attitude score of 38.0±2.7, and mean practice score of 41.7±8.2. The analysis using a structural equation model revealed a direct effect of knowledge on attitudes (path coefficient = 2.042, $p<0.001$) and a direct effect of attitudes on practices (path coefficient = 1.460, $p<0.001$).

Conclusions: The findings suggest that patients with impacted wisdom teeth possess sufficient knowledge and favorable attitudes towards teeth extraction, which positively influences their practices. However, there is still a need for tailored interventions to further enhance the KAP toward wisdom teeth extraction in this population.

Strengths and limitations of this study

- This study, while offering significant insights into the knowledge, attitudes, and practices of patients with impacted wisdom teeth regarding tooth extraction, is characterized by both strengths and limitations related to its methodology. Firstly, the large sample size utilized in the survey enhances the representativeness and generalizability of the findings, ensuring that the results can be applied to a broader population with similar conditions.
- Furthermore, the comprehensive exploration of the relationships between knowledge, attitudes, and practices provides valuable insights that can inform clinical guidance and patient education strategies.
- However, the study's reliance on self-reported data may introduce discrepancies between reported behaviors and actual practices, potentially affecting the accuracy of the findings.
- Additionally, the exclusive use of online surveys for data collection could lead to non-response bias, as certain demographics may be underrepresented among respondents. Despite these limitations, the study's methodological strengths contribute to a deeper understanding of patient perspectives on wisdom teeth extraction, offering a foundation for future research and clinical improvements in this area.

Keywords: Knowledge; Attitude; Practice; Cross-Sectional Study; Wisdom teeth;

Introduction

Impacted wisdom teeth constitute a significant public health issue due to their high prevalence and the associated complications[1]. Epidemiological evidence indicates that a substantial proportion of the adult population will develop at least one impacted wisdom teeth, necessitating consideration for extraction to mitigate potential risks such as infection, crowding, and other dental pathologies[1, 2].

Nevertheless, the extraction procedure for impacted wisdom teeth is fraught with challenges. It is well-documented that these procedures can elicit significant psychological stress in patients, resulting in dental anxiety or phobia[3]. This stress is exacerbated by the complexity and invasiveness inherent in the extraction of impacted teeth, which can amplify patients' apprehensions and uncertainties concerning dental care[4, 5]. Such anxiety and uncertainty negatively impact patients' attitudes towards dental health and treatment, potentially leading to detrimental dental health behaviors, delayed care-seeking, and consequently, poorer dental and overall health outcomes[6, 7].

Knowledge-Attitude-Practice (KAP) model posit that an individual's knowledge significantly influences their attitudes towards health and illness, which, in turn, shapes their health-related behaviors[8, 9]. Despite the recognition of dental anxiety among patients with impacted wisdom teeth, there exists a conspicuous gap in the research literature regarding the application of the KAP model to comprehend and address this issue. Predominant research efforts have been directed towards delineating the prevalence of dental anxiety and its determinants within this demographic[3, 10, 11],

with insufficient focus on elucidating how knowledge and attitudes concerning wisdom teeth impaction and extraction affect health behaviors.

Thus, this study aims to bridge this gap by leveraging the KAP framework to investigate the knowledge, attitudes, and practices toward wisdom teeth extraction among patients with impacted wisdom teeth.

Materials and Methods

Study design and participants

This cross-sectional study was conducted between March and May 2023 at Department of Oral and Maxillofacial Surgery, School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University and Jinan Stomatological Hospital.

The inclusion criteria as follows: 1) patients diagnosed with impacted wisdom teeth at the Department of Oral and Maxillofacial Surgery, School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University, and 2) patients proficient in the Chinese language to ensure effective communication during the data collection process. Conversely, those who reported participation in similar studies were excluded from this study. This study was approved by the Ethics Committee of the School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University (Ethical No. 20230361), The medical ethics committee of Jinan Stomatological Hospital (JNSKQYY-2023-001) and informed consent was obtained from all patients.

Questionnaire introduction and data collection

The questionnaire was designed with reference to relevant guidelines and previous literature[12, 13], and was revised by two chief physicians and one vice-chief physician. A pilot test was conducted (n=34) and Cronbach's α coefficient value was 0.819, indicating a good internal consistency.

The final questionnaire contains four dimensions: demographic characteristics, knowledge, attitudes and practices. The knowledge dimension consists of 13 questions, with 1 point for a correct answer and 0 points for the rest. Questions K5 and K10 were designed as trap questions, presenting exactly opposite meanings. patients who selected "right" or "wrong" for both questions were deemed to have a logical conflict and were excluded from the survey. Consequently, the knowledge scores ranged from 0 to 11 points. The attitudes dimension consists of 13 questions, wherein questions A11-A13 are designated exclusively for descriptive analysis purposes. The remaining questions utilized a 5-point Likert scale, ranging from very positive (5 points) to very negative (1 point), yielding a possible score range of 10-50 points. The practices dimension consists of 11 questions using a 5-point Likert scale as well, ranging between very conforming (5 points) to very non-conforming (1 point), with a possible score range of 11-55 points. Both electronic and printed versions of the questionnaire were utilized in this study. The electronic questionnaire was hosted on Sojump (http://www.sojump.com), an online survey platform. At the onset of it, patients were required to indicate their consent by clicking the option "I agree to participate in this study" before proceeding to respond to the questions. The data collection process ensured anonymity. Additionally, an IP restriction was implemented to prevent duplication of responses,

restricting the survey completion to a single instance from each unique IP address. To accommodate individuals less acquainted with electronic devices, such as elderly patients, printed questionnaires were made available during their clinic visit, and they were requested to complete the printed forms. During the dissemination of it, five trained research assistants first introduced the study face-to-face to patients before distributing the questionnaires. They also assisted patients when needed, checked questionnaire completeness, and asked the patients to complete any missing information.

Statistical analysis

STATA 17.0 (STATA Corporation, College Station, TX, USA) was utilized for statistical analyses. Continuous variables were presented as mean±standard deviation (SD) and were compared using the student's t-test or one-way analysis of variance (ANOVA). Categorical variables were presented as numbers (percentages). In this study, 70% of the total score was used as the cut-off value, that means the threshold for sufficient knowledge, favorable attitudes, and proactive practices were 7.7, 35 and 38.5 points respectively[14]. Pearson correlation was used to analyze the correlation between knowledge, attitudes, and practices. Variables with $p<0.02$ in the single-factor logistic regression analysis are included in the multivariate logistic regression analysis. AMOS 24.0 (IBM, NY, USA) was utilized to construct a structural equation model (SEM) examining the knowledge, attitudes, and practices of patients with impacted wisdom toward wisdom teeth extraction. This SEM tested the main hypotheses as follows: 1) knowledge had direct effects on attitudes, 2) knowledge had direct effects

on practices, and 3) attitudes had direct effects on practices. Model fit was evaluated using CMIN/DF (Chi-square goodness-of-fit test/Degrees of Freedom), RMSEA (Root Mean Square Error of Approximation), IFI (Incremental Fixation Index), TLI (Tucker-Lewis index) and CFI (Comparative Fixation Index). A two-sided p-value <0.05 was considered statistically significant.

Results

A total of 3467 patients participated in this study. Among them, 1092 (31.50%) were aged 30 or below, 2259 (65.16%) were female, 2927 (84.42%) lived in urban areas, and 2391 (68.96%) brushed their teeth twice daily. In addition, 1790 (51.63%) had undergone wisdom teeth extraction. The mean scores of knowledge, attitudes, and practices were 9.1±1.4 (possible range: 0-11), 38.0±2.7 (possible range: 10-50), and 41.7±8.2 (possible range: 11-55), respectively (**Table S1**).

The three knowledge items with the highest correctness rates were "The primary issues associated with wisdom teeth are insufficient space and misalignment." (K2), with a correctness rate of 89.59%, "Wisdom teeth are unlikely to cause damage to neighboring teeth, even if left untreated promptly." (K5), with a correctness rate of 88.78%, and "Delaying the treatment of wisdom teeth may result in harm to neighboring teeth." (K10), with a correctness rate of 88.78%. The three items with the lowest correctness rates were "In cases where the growth of wisdom teeth leads to a severe infection, fever may not necessarily be present." (K4), with a correctness rate of 74.53%, "Various treatment options exist for wisdom teeth, including medications (antibiotics, traditional

Chinese medicine, etc.) and surgical procedures (incision and drainage, wisdom teeth extraction, etc.)." (K9), with a correctness rate of 78.40%, and "Wisdom teeth, also known as third molars, are the last and farthest-back teeth to emerge in the mouth. They typically surface in adults between the ages of 18 and 25 years." (K1), with a correctness rate of 80.93% (**Table 1**).

Table 1. Knowledge

Knowledge	**Correctness Rate N(%)**
K1. Wisdom teeth, also known as third molars, are the last and farthest-back teeth to emerge in the mouth. They typically surface in adults between the ages of 18 and 25 years. **(True)**	2806 (80.93)
K2. The primary issues associated with wisdom teeth are insufficient space and misalignment. **(True)**	3106 (89.59)
K3. The emergence of wisdom teeth can lead to pain, inflammation, facial and jaw congestion, edema, and difficulty in swallowing. **(True)**	2826 (81.51)
K4. In cases where the growth of wisdom teeth leads to a severe infection, fever may not necessarily be present. **(False)**	2584 (74.53)
K5. Wisdom teeth are unlikely to cause damage to neighboring teeth, even if left untreated promptly. **(False)**	3078 (88.78)
K6. The growth of wisdom teeth can create gaps that allow food debris to enter, resulting in a range of symptoms, including inflammation. **(True)**	2906 (83.82)
K7. Consuming spicy, hard, and sticky foods can exert pressure on the teeth, leading to pain and swelling. Additionally, sugars in food and drinks can contribute to plaque buildup on teeth, causing dental caries and other oral problems. Thus, it is advisable to minimize their intake. **(True)**	3043 (87.77)
K8. Not all patients require wisdom teeth extraction, particularly if they are growing normally and not causing any dental problems. **(False)**	2871 (82.81)
K9. Various treatment options exist for wisdom teeth, including medications (antibiotics, traditional Chinese medicine, etc.) and surgical procedures (incision and drainage, wisdom teeth extraction, etc.). **(True)**	2718 (78.40)
K10. Delaying the treatment of wisdom teeth may result in harm to neighboring teeth. **(True)**	3078 (88.78)

K11. Wisdom teeth extraction may cause temporary discomfort and swelling, but it generally does not have any long-term effects on the function and appearance of the mouth. **(True)**	2998 (86.47)
K12. Following the wisdom teeth extraction, patients should adhere to the prescribed regimen, which may include ice compresses, a specific diet, and proper oral care, to alleviate pain. **(True)**	3022 (87.16)
K13. Wisdom teeth extraction always leads to a slimmer face. **(False)**	2819 (81.31)

A significant majority of the patients (93.86%) strongly agreed or agreed that they are willing to proactively engage in discussions with their doctor about their condition and receive professional medical support (A1). Similarly, a high percentage (92.70%) claimed that they believe in actively seeking medical treatment if they experience visible symptoms in their wisdom teeth (A5). Additionally, an overwhelming 90.51% of the patients expressed trust in the treatment plan proposed by an oral surgeon and demonstrated their willingness to heed the professional advice given by the oral surgeon (A7). However, it is worth noting that a considerable portion (58.23%) of the patients admitted to experiencing fear and anxiety when undergoing procedures related to wisdom teeth (A6). Additionally, 58.96% of the patients expressed fear concerning potential hazards associated with wisdom teeth (A4). Furthermore, 25.12% of the patients strongly agreed or agreed that the daily care or wisdom teeth extraction may demand a significant amount of time and energy, leading to a lack of willingness to prioritize it (A8). The decision-making process for undergoing wisdom teeth extraction is influenced by the reimbursement rates provided by medical insurance, as mentioned by 46.47% of the patients (A13). Additionally, 47.6% of the patients preferred medication as an intervention for wisdom teeth rather than opting for surgical procedures (A12). Interestingly, a substantial 80.3% of the patients expressed their

willingness to undergo prophylactic wisdom teeth extraction if recommended by their doctor (A11) (**Table 2**).

Table 2. Attitudes

	Strongly agree N(%)	Agree N(%)	Neutral N(%)	Disagree N(%)	Strongly disagree N(%)
A1. You are willing to proactively discuss your condition with your doctor and seek professional medical support. **(Positive)**	1863 (53.75%)	1391 (40.14%)	99 (2.86%)	81 (2.34%)	33 (0.95%)
A2. You are open to discussing your wisdom teeth condition with friends or family and seeking their advice on whether to retain or extract them. **(Positive)**	1144 (32.97%)	1664 (48.00%)	424 (12.23%)	178 (5.14%)	57 (1.64%)
A3. You are willing to acquire medical knowledge related to the risks and wisdom teeth extraction through concise online videos or books. **(Positive)**	1180 (34.06%)	1878 (54.18%)	216 (6.23%)	114 (3.29%)	79 (2.28%)
A4. You are concerned about potential hazards posed by wisdom teeth in your daily life, such as inflammation and infection. **(Negative)**	644 (18.56%)	1400 (40.39%)	1017 (29.33%)	320 (9.22%)	86 (2.48%)
A5. You firmly believe in seeking medical treatment if you experience visible symptoms related to your wisdom teeth. **(Positive)**	1884 (54.41%)	1330 (38.38%)	124 (3.57%)	117 (3.38%)	12 (0.35%)
A6. Undergoing wisdom teeth extraction would elicit feelings of fear or anxiety about the surgery. **(Negative)**	668 (19.27%)	1351 (38.96%)	880 (25.40%)	419 (12.08%)	149 (4.29%)
A7. You place trust in your oral surgeon's treatment plan and are receptive to their professional advice. **(Positive)**	1414 (40.80%)	1724 (49.72%)	216 (6.23%)	75 (2.17%)	38 (1.10%)
A8. You consider the daily care or extraction of your wisdom teeth to be time-consuming and energy-demanding, hence, you do not prioritize it. **(Negative)**	325 (9.38%)	546 (15.75%)	408 (11.76%)	1600 (46.14%)	588 (17.00%)

A9. You recognize the significance of a good diet and oral hygiene in preventing and managing wisdom teeth issues. **(Positive)**	1382 (39.87%)	1550 (44.69%)	345 (9.95%)	122 (3.52%)	68 (1.96%)
A10. You acknowledge the importance of regular oral check-ups in preventing wisdom teeth-related diseases. **(Positive)**	1407 (40.57%)	1727 (49.77%)	201 (5.79%)	62 (1.79%)	70 (2.02%)
	Yes	No			
A11. If the doctor recommends prophylactic wisdom teeth extraction, you would be willing to undergo the surgery.	2784 (80.30%)	683 (19.70%)			
A12. You prefer medication over surgery as an intervention for wisdom teeth, viewing surgery as a last resort rather than a first-choice approach.	1650 (47.60%)	1817 (52.40%)			
A13. The reimbursement rates of medical insurance for wisdom teeth extraction and related costs significantly influence your decision on whether to undergo the procedure.	1403 (46.47%)	2064 (59.53%)			

Moreover, 83.89% of the patients reported (very confirming or confirming) that they are highly capable of evaluating the risks and benefits associated with wisdom teeth extraction, and they readily accept their dentist's treatment recommendations (P9). Additionally, 79.23% claimed that they utilize dental floss to clean the crevices that a toothbrush cannot effectively reach during oral cleaning (P5). Moreover, 74.70% of the patients asserted their ability to evaluate issues and make incremental adjustments concerning their experiences with wisdom teeth prevention or treatment (P11). However, the proportion of patients who confirmed their intention to inform their family or friends about the potential hazards of wisdom teeth and remind them to seek prompt medical attention or have their wisdom teeth extracted was only 33.89% (P8). Similarly, only 47.76% of the patients reported being consciously vigilant about their oral health by regularly visiting the dental clinic (P3) (**Table 3**).

Table 3. Practices

	Very conforming N(%)	Conforming N(%)	Neutral N(%)	Non-conforming N(%)	Very non-conforming N(%)
P1: You will attend lectures on the topic of wisdom teeth and other oral health problems that can arise throughout your life, or you can acquire knowledge about the risks and wisdom teeth extraction through books and online resources.	931 (26.88%)	1100 (31.79%)	803 (23.17%)	417 (12.04%)	216 (6.23%)
P2: If you are prescribed medication, it is essential to thoroughly read the instructions to comprehend its proper usage and potential adverse effects.	858 (24.77%)	1044 (30.16%)	631 (18.23%)	639 (18.48%)	295 (8.53%)
P3: Regularly, you conscientiously monitor your oral health by visiting the dental clinic.	751 (21.70%)	905 (26.14%)	1041 (30.06%)	567 (16.39%)	203 (5.87%)
P4: When brushing your teeth, use a soft toothbrush and pay careful attention to cleaning the back row of wisdom teeth, neighboring teeth, and gums.	1140 (32.92%)	1388 (40.08%)	677 (19.55%)	1544 (4.46%)	108 (3.12%)
P5: To address areas that a toothbrush cannot effectively reach during oral cleaning, utilize dental floss to clean the crevices.	1379 (39.83%)	1368 (39.49%)	345 (9.96%)	256 (7.40%)	119 (3.44%)
P6: As part of your routine, you regularly rinse your mouth with mouthwash to maintain good oral hygiene.	1141 (32.95%)	1446 (41.77%)	384 (11.08%)	308 (8.90%)	188 (5.44%)
P7: Regarding your diet, you are conscious of reducing the consumption of sugary or spicy foods, and you promptly clean food	944 (27.32%)	1277 (36.90%)	822 (23.75%)	278 (8.03%)	146 (4.23%)

debris through methods like brushing and flossing.					
P8: You will inform your family or friends about the hazards of wisdom teeth and remind them to seek medical attention or promptly have their wisdom teeth removed if necessary.	1062 (30.70%)	113 (3.27%)	895 (25.87%)	274 (7.92%)	123 (3.56%)
P9: You are capable of evaluating the risks and benefits associated with wisdom teeth extraction and accepting your doctor's treatment recommendations.	1551 (44.79%)	1354 (39.10%)	396 (11.45%)	119 (3.44%)	47 (1.36%)
P10: You remain vigilant for symptoms such as swollen gums, teeth pain, and a foul taste in the mouth.	880 (25.43%)	1117 (32.28%)	785 (22.69%)	525 (15.17%)	160 (4.63%)
P11: You have the ability to evaluate issues and make adjustments gradually based on your experiences with wisdom teeth prevention or treatment.	1094 (31.61%)	1496 (43.24%)	633 (18.29%)	167 (4.83%)	77 (2.23%)

The correlation analysis showed that the knowledge score and the attitude score were positively correlated (r = 0.288, p<0.001), and the knowledge score and the practice score were also positively correlated (r = 0.348, p<0.001). Additionally, there was a positive correlation between attitude and practice scores (r = 0.452, p<0.001) **(Table 4).**

Table 4. Correlation analysis

	Knowledge	Attitudes	Practices
Knowledge	1		
Attitudes	0.288 (P<0.001)	1	
Practices	0.348 (P<0.001)	0.452 (P<0.001)	1

The SEM was established to further investigate whether patients with impacted wisdom' knowledge and attitude toward wisdom teeth extraction affect their practice, whether attitude plays an intermediary role between knowledge and practice, and whether knowledge can directly affect their practice according to the KAP theory. It also investigated the effect of other factors including residence and monthly per capita household income on the three dimensions mentioned above (**Table S2**). The fitting index of the structural model (CMIN/DF = 13.905; RMSEA = 0.061; IFI = 0.847; TLI = 0.834; CFI = 0.847) outperformed the respective threshold value, signifying that the data fit the structural model satisfactorily (**Table S3**). The SEM demonstrated that knowledge had direct effects on attitudes, as indicated by a path coefficient of 2.042 (p<0.001) and a significant and attitudes had direct effects on practices, with a path coefficient of 1.460 (p<0.001) (**Figure 1**).

Discussion

Patients with impacted wisdom had sufficient knowledge, favorable attitudes, and proactive practices toward wisdom teeth extraction.

However, this study still identified deficiencies of certain aspects. Additionally, variances in KAP levels were observed across different demographic characteristics within the patients. These findings underscore the importance of considering these factors in the development of subsequent health education programs. The present study found that male and younger patients (<30 years) tend to have higher KAP scores. This finding is different from previous studies which reported higher oral health knowledge and behaviors among female and partipants older than 30 years[15, 16]. Nonetheless, the previous studies were not conducted in a Chinese population, and characteristics of their participants were distinctive different from participants in our study. Further education and tailored interventions should be designed for female and older patients in China. Furthermore, the present study identified that urban residents, those with higher education levels, non-smokers, non-drinkers, those who had not undergone dental treatment other than wisdom teeth removal, and those who were not informed and education about wisdom teeth during their dental treatment had lower KAP scores, and future programs should also consider the knowledge needs of these patients to enhance the dental care quality and the KAP towards wisdom teeth.

The present study found sufficient knowledge of wisdom teeth and that most patients would accept being educated about wisdom teeth during other oral therapies. patients had good knowledge about potential complications associated with wisdom teeth and the importance of treating wisdom teeth in a timely manner. This finding is consistent with previous knowledge and awareness studies conducted on medical students: a large percentage of the study population was aware of wisdom teeth impaction and its consequences[17, 18]. Patients in the present study had less knowledge about infection

related to wisdom teeth and different treatment options. Hanna et al. have found that patients used the internet to seek information related to wisdom teeth, but internet use was not associated with better wisdom teeth knowledge[19]. Therefore, it is important for healthcare professionals to provide patients with accurate information and internet guidance to improve wisdom teeth knowledge. Zincir et al. reported that patients found educational videos related to wisdom teeth surgical removal were excellent for patient education, and educational videos in Chinese should be made available to improve patients' knowledge[20]. Increased awareness of hazards and removal of wisdom teeth among patients with impacted wisdom will help in the management of wisdom teeth[21].

In the present study, most patients had a positive attitude toward seeking professional advice and medical treatments, and they also trusted the treatment plan formulated by their oral surgeon. This result reflected a high level of patient trust in dentists, and the level of trust is higher than previously reported[22, 23]. This discrepancy can be explained by the larger proportion of patients with higher education in the present study[24]. Similar to previous findings, patients in the present study reported a high level of anxiety about the potential hazards of wisdom teeth and extraction surgery[25-27]. Lack of knowledge about the procedure is one of the possible contributors to anxiety related to oral surgery[27]. Effective education toward wisdom teeth extraction is critical in reducing anxiety in patients and improving the quality of care. Moreover, in the present study, medical insurance reimbursement rates were a decisive factor for wisdom teeth extraction, which is consistent with a previous study conducted in the United States[28]. Thus, there is a need to improve insurance coverage of wisdom teeth treatments to improve adherence to dentists' recommendations.

Most patients claimed that they would weigh the risks and benefits of wisdom teeth extraction to make an informed decision, and around 80% would use dental floss regularly. Zhao et al. reported that very few Chinese adults use dental floss, and the patients with impacted wisdom in the present study might have better practice than the general population due to their disease experience and better dental knowledge[29]. Liu et al. reported that the rate of dental care visits and the utilization of oral health resources are low in the Chinese general population[30]. It is important to enhance patients' practice by improving their knowledge and attitude toward wisdom teeth extraction. Furthermore, this study found that patients who had prior wisdom teeth extraction demonstrated better knowledge, attitudes and practices compared to those without previous wisdom teeth extraction experience. Similarly, Brasileiro et al. also identified that patients with a history of teeth extraction and those without it presented different patterns of knowledge about wisdom teeth extraction[27]. Patients who had no experience with wisdom teeth extraction may need more attention to improve their KAP in this area.

The results of correlation analysis and SEM demonstrated that patients with impacted wisdom' knowledge had direct effects on attitudes, and attitudes had direct effects on practices. These implies that patients with impacted wisdom with better knowledge about wisdom teeth would have more favorable attitudes, which indirectly results in better practice toward wisdom teeth[31]. The finding highlighted the importance of education in patients with impacted wisdom to improve their knowledge, as well as their attitude and practice toward wisdom teeth. It also found that residence had direct effects on knowledge and monthly per capita household income had direct effects on attitudes. This finding is consistent with previous studies on dental health and dental care utilization in China[30, 32, 33]. Patients with lower income and those who lived

in rural areas tend to have poorer knowledge and health-seeking behaviors, and more clinical and research attention should be paid to these patients.

This study has some limitations. The self-reported nature of the data collection may result in deviations between reported and actual practices. Meanwhile, the use of online surveys may introduce non-response bias. Nevertheless, this study also has considerable strengths. The large sample size enhances representativeness and generalizability of the results. Furthermore, this study provides an in-depth exploration of the relationship between patients with impacted wisdom' knowledge, attitudes, and practices regarding wisdom teeth extraction. These findings offer valuable insights to inform clinical guidance in this area.

Conclusions

In conclusion, this KAP study demonstrated sufficient knowledge, favorable attitudes, and proactive practices toward wisdom teeth extraction among patients with impacted wisdom. Further tailored interventions should be developed and implemented in this population to improve their KAP of wisdom teeth.

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University (Ethical No. 20230361), The medical ethics committee of Jinan Stomatological Hospital (JNSKQYY-2023-001) and Informed consent was obtained from all patients. 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.

Consent for publication

Not applicable.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

1) conceived and designed the experiments: Jing Sun, Junru Meng, Shu Li, Dongdong Tong

2) performed the experiments: Jing Sun, Xin Wang, Bing Wang, Xiao Luan,Dongdong Tong

3) analyzed and interpreted the data: Jing Sun, Junru Meng, Xin Wang, Shu Li, Dongdong Tong

4) contributed reagents, materials, analysis tools or data: Jing Sun, Junru Meng, Xin Wang, Bing Wang, Xiao Luan,Shu Li, Dongdong Tong

5) wrote the paper:Jing Sun, Junru Meng, Shu Li, Dongdong Tong

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Figure Legends

Figure 1. The KAP structural equation model

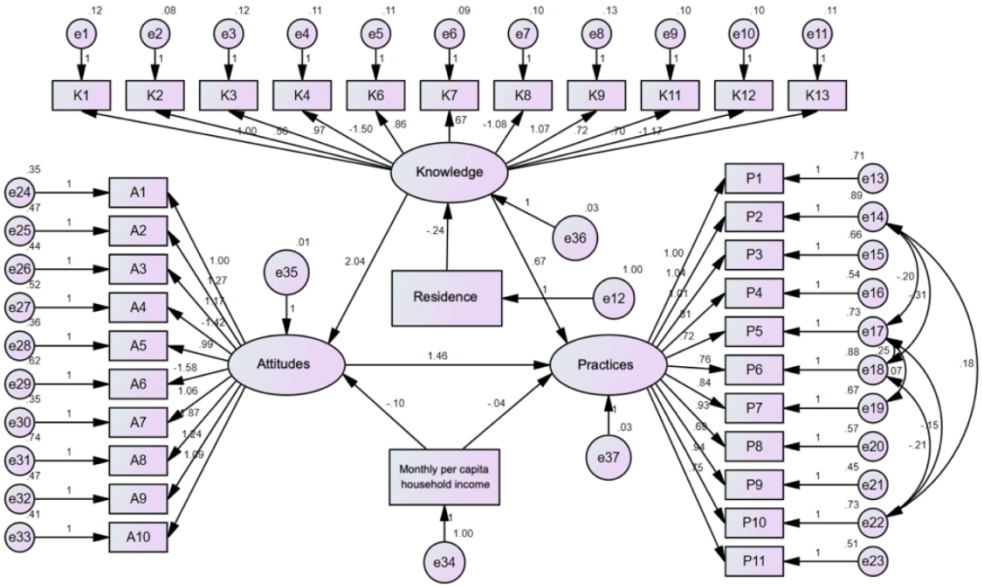

Figure 1. The KAP structural equation model

170x108mm (300 x 300 DPI)

Supplementary Tables

Table S1. Demographic information and KAP scores.

Variables	N (%)	Knowledge Mean ± SD	P	Attitudes Mean ± SD	P	Practices Mean ± SD	P
Total	3467	9.14 ±1.35		38.01 ±2.72		41.65 ±8.24	
Gender			<0.001		<0.001		<0.001
Male	1208 (34.84)	9.47 ±1.02		39.02 ±1.97		48.55 ±5.59	
Female	2259 (65.16)	8.97 ±1.47		37.47 ±2.91		37.97 ±6.96	
Age, years			<0.001		<0.001		<0.001
30 and below	1092 (31.50)	9.57 ±1.03		39.32 ±2.12		48.89 ±5.41	
31-40	889 (25.64)	9.39 ±1.19		38.31 ±2.55		42.46 ±7.30	
41-50	1051 (30.31)	8.81 ±1.53		37.02 ±2.77		36.62 ±6.06	
51 and above	435 (12.55)	8.37 ±1.36		36.50 ±2.60		34.01 ±4.13	
Residence			<0.001		<0.001		<0.001
Rural	540 (15.58)	9.43 ±1.01		39.11 ±1.74		50.34 ±4.43	
Urban	2927 (84.42)	9.09 ±1.40		37.80 ±2.82		40.05 ±7.76	
Education			<0.001		<0.001		<0.001
Middle school and below	131 (3.78)	9.21 ±1.05		38.99 ±1.57		51.73 ±2.87	

High school/Technical secondary school	354 (10.21)	9.44 ±0.93		39.17 ±1.77	50.35 ±4.61	
Junior college/Undergraduate	2382 (68.70)	9.24 ±1.33		38.02 ±2.73	41.46 ±7.76	
Postgraduate and above	600 (17.31)	8.56 ±1.51		37.06 ±2.97	35.08 ±5.34	
Occupation			<0.001			<0.001
State Organ and Enterprise Leaders	239 (6.89)	9.40 ±0.99		39.21 ±1.81	51.03 ±4.51	
Professional and Technical Personnel (e.g., teachers, doctors, engineers, writers, etc.)	976 (28.15)	9.54 ±1.03		39.04 ±2.05	47.84 ±5.90	
General Employees and Support Staff	473 (13.64)	9.40 ±1.15		38.41 ±2.50	42.44 ±7.03	
Commercial and Service Industry Workers	345 (9.95)	9.19 ±1.43		37.72 ±2.75	39.81 ±7.22	
Agriculture, Forestry, Animal Husbandry, Fisheries, and Water Resources Workers	199 (5.74)	8.89 ±1.45		37.64 ±2.58	37.77 ±6.75	

Production and Transport Equipment Operators	174 (5.02)	8.81 ±1.49		36.82 ±2.83	36.56 ±.94	
Military	48 (1.38)	8.90 ±1.74		37.67 ±2.91	37.29 ±6.83	
Student	748 (21.57)	8.71 ±1.48		36.85 ±3.00	35.66 ±5.34	
Others	265 (7.64)	8.61 ±1.62		37.15 ±3.02	35.40 ±6.45	
Medical Insurance						
No medical insurance	306 (8.83)					
Social medical insurance	1283 (37.01)					
Social and commercial medical insurance	1878 (54.17)					
Monthly per capita household income (CNY)			<0.001		<0.001	<0.001
<2,000	218 (6.29)	9.33 ±0.95		39.30 ±1.78	51.41 ±3.98	
2,000-5,000	682 (19.67)	9.58 ±1.01		39.14 ±1.84	49.18 ±5.10	
5,000-10,000	1263 (36.43)	9.35 ±1.25		38.13 ±2.71	41.99 ±7.28	
10,000-20,000	831 (23.97)	8.78 ±1.50		37.28 ±2.86	36.34 ±5.96	
>20,000	473 (13.64)	8.51 ±1.54		36.74 ±2.96	34.75 ±5.03	
Smoking			<0.001		<0.001	<0.001
Yes	503 (14.51)	9.40 ±0.99		39.18 ±1.60	50.80 ±3.47	
No	2964 (85.49)	9.10 ±1.40		37.81 ±2.82	40.10 ±7.79	
Alcohol consumption			<0.001		<0.001	<0.001
Yes	656 (18.92)	9.44 ±1.00		39.26 ±1.78	50.25 ±4.43	

No	2811 (81.08)	9.07 ±1.41		37.72 ±2.82	39.65 ±7.60	
Frequency of teeth brushing (per day)			<0.001			<0.001
1 time	550 (15.86)	9.47 ±0.99		39.19 ±1.78	50.02 ±4.79	
2 times	2391 (68.96)	9.22 ±1.36		38.03 ±2.72	41.32 ±7.78	
3 times	469 (13.53)	8.48 ±1.45		36.71 ±3.00	34.54 ±4.76	
4 times or more	57 (1.64)	8.35 ±1.38		36.46 ±2.47	33.33 ±3.39	
Oral Disease Complications (multiple choices)			/			/
Gum Disease	986 (28.44)					
Dental Caries	1536 (44.30)					
Pulpitis	689 (19.87)					
Oral Cancer	450 (12.98)					
Oral ulcers	700 (20.19)					
Dentition defects	348 (10.04)					
Irregular teeth alignment	1082 (31.21)					
Loose teeth	279 (8.05)					
Other oral diseases	276 (7.96)					

No oral conditions as described above	215 (6.20)					
Undergone wisdom teeth extraction			<0.001			<0.001
Yes	1790 (51.63)	9.51 ±1.08		38.90 ±2.33	46.45 ±6.87	
No	1677 (48.37)	8.75 ±1.49		37.05 ±2.78	36.53 ±6.25	
If have, the age at that time (years old)			<0.001			<0.001
20 and below	350 (10.10)	9.29 ±0.99		39.39 ±1.91	51.24 ±3.55	
21-30	855 (24.66)	9.55 ±1.03		39.19 ±2.18	47.72 ±6.08	
30 and above	585 (16.87)	9.57 ±1.19		38.19 ±2.61	41.73 ±6.68	
If have, the reasons were (multiple choices):			/			/
Recurring painful inflammation	1091 (31.47)					
Get stuck between the teeth or cheek grinding	903 (26.05)					
Dental caries or periodontal disease	774 (22.32)					
Prophylactic extractions or findings on check-ups	912 (26.31)					
Surgical requirements	388 (11.19)					

Other	113 (3.26)					
Undergone oral therapy other than treatment for wisdom teeth related oral diseases			<0.001		<0.001	<0.001
Yes	1780 (51.34)	9.50 ±1.07		38.89 ±2.34		46.55 ±6.80
No	1687 (48.66)	8.76 ±1.50		37.08 ±2.78		36.49 ±6.22
Acceptance of being informed and educated about wisdom teeth during other oral therapies			<0.001		<0.001	<0.001
Yes	2540 (73.26)	9.33 ±1.24		38.41 ±2.58		43.97 ±7.86
No	927 (26.74)	8.63 ±1.49		36.89 ±2.79		35.30 ±5.41

Table S2. Test results of the hypothesis.

Hypothesized paths				path coefficient	P value
Hypothesis 1	Knowledge	<---	Residence	-0.[illegible]	<0.001
Hypothesis 2	Attitudes	<---	Knowledge	[illegible]	<0.001
Hypothesis 3	Attitudes	<---	Monthly per capita household income	-0.[illegible]	<0.001
Hypothesis 4	Practices	<---	Attitudes	[illegible]	<0.001
Hypothesis 5	Practices	<---	Knowledge	0.66[illegible]	0.104
Hypothesis 6	Practices	<---	Monthly per capita household income	-0.04[illegible]	0.052

Table S3. Model fitness indices for the KAP structural equation model

Goodness-of-Fit Indices	Ideal standards	Measurement value
CMIN/DF	1-3 excellent, 3-5 good	2.905
RMSEA	<0.08 good	0.061
IFT	>0.8 good	0.947
TLI	>0.8 good	0.934
CFI	>0.8 good	0.947

CMIN/DF, Chi-square fit statistics/degree of freedom; RMSEA, root mean square error of approximation; IFT, incremental fix index; TLI, Tucker-Lewis index; CFI, comparative fix index.

Questionnaire

Part I Demographic information	
1. Gender	a. Male b. Female
2. Age, years	_____
3. Residence	a. Rural b. Urban
4. Education	a. Middle school and below b. High school/Technical secondary school c. Junior college/Undergraduate d. Postgraduate and above
5. Occupation	a.State Organ and Enterprise Leaders b.Professional and Technical Personnel (e.g., teachers, doctors, engineers, writers, etc.) c.General Employees and Support Staff d.Commercial and Service Industry Workers e.Agriculture, Forestry, Animal Husbandry, Fisheries, and Water Resources Workers f.Production and Transport Equipment Operators g.Military h.Student I.Others
6. Medical Insurance：	a. No medical insurance b. Social medical insurance

	c. Social and commercial medical insurance
7. Monthly per capita household income (CNY)	a. <2,000 b. 2,000-5,000 c. 5,000-10,000 d. 10,000-20,000 e. >20,000
8. Smoking	a. Yes b. No
9. Alcohol consumption	a. Yes b. No
10. Frequency of teeth brushing (per day)	a. 1 time b. 2 times c. 3 times d. 4 times or more
11. Oral Disease Complications	a. Gum Disease b. Dental Caries c. Pulpitis d. Oral Cancer e. Oral ulcers f. Dentition defects g. Irregular teeth alignment h. Loose teeth i. Other oral diseases j. No oral conditions as described above
12. Undergone wisdom teeth extraction	a. Yes

	b. No
12.1 If have, the age at that time (years old)	_____
12.2 If have, the reasons were:	a. Recurring painful inflammation b. Get stuck between the teeth or cheek grinding c. Dental caries or periodontal disease d. Prophylactic extractions or fillings on check-ups e. Surgical requirements f. Other
13. Undergone oral therapy other than treatment for wisdom teeth related oral diseases	a. Yes b. No
14. Acceptance of being informed and educated about wisdom teeth during other oral therapies	a. Yes b. No

Part II Knowledge

K1. Wisdom teeth, also known as third molars, are the last and farthest-back teeth to emerge in the mouth. They typically surface in adults between the ages of 18 and 25 years.	A.Yes	B.No
K2. The primary issues associated with wisdom teeth are insufficient space and misalignment.	A.Yes	B.No
K3. The emergence of wisdom teeth can lead to pain, inflammation, facial and jaw congestion, edema, and difficulty in swallowing.	A.Yes	B.No
K4. In cases where the growth of wisdom teeth leads to a severe infection, fever may not necessarily be present.	A.Yes	B.No
K5. Wisdom teeth are unlikely to cause damage to neighboring teeth, even if left untreated promptly.	A.Yes	B.No
K6. The growth of wisdom teeth can create gaps that allow food debris to enter, resulting in a range of symptoms, including inflammation.	A.Yes	B.No
K7. Consuming spicy, hard, and sticky foods can exert pressure on the teeth, leading to pain and swelling. Additionally, sugars in food and drinks can contribute to plaque buildup on teeth, causing dental caries and other oral problems. Thus, it is advisable to minimize their intake.	A.Yes	B.No
K8. Not all patients require wisdom teeth extraction, particularly if they are growing normally and not causing any dental problems.	A.Yes	B.No
K9. Various treatment options exist for wisdom teeth, including medications (antibiotics, traditional Chinese medicine, etc.) and surgical procedures (incision and drainage, wisdom teeth extraction, etc.).	A.Yes	B.No
K10. Delaying the treatment of wisdom teeth may result in harm to neighboring teeth.	A.Yes	B.No

K11. Wisdom teeth extraction may cause temporary discomfort and swelling, but it generally does not have any long-term effects on the function and appearance of the mouth.	A.Yes	B.No
K12. Following the wisdom teeth extraction, patients should adhere to the prescribed regimen, which may include ice compresses, a specific diet, and proper oral care, to alleviate pain.	A.Yes	B.No
K13. Wisdom teeth extraction always leads to a slimmer face.	A.Yes	B.No

Part III Attitudes					
A1. You are willing to proactively discuss your condition with your doctor and seek professional medical support.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A2. You are open to discussing your wisdom teeth condition with friends or family and seeking their advice on whether to retain or extract them.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A3. You are willing to acquire medical knowledge related to the risks and wisdom teeth extraction through concise online videos or books.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A4. You are concerned about potential hazards posed by wisdom teeth in your daily life, such as inflammation and infection.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A5. You firmly believe in seeking medical treatment if you experience visible symptoms related to your wisdom teeth.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A6. Undergoing wisdom teeth extraction would elicit feelings of fear or anxiety about the surgery.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A7. You place trust in your oral surgeon's treatment plan and are receptive to their professional advice.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A8. You consider the daily care or extraction of your wisdom teeth to be time-consuming and energy-demanding, hence, you do not prioritize it.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A9. You recognize the significance of a good diet and oral hygiene in preventing and managing wisdom teeth issues.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A10. You acknowledge the importance of regular oral check-ups in preventing wisdom teeth-related diseases.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree

A11. If the doctor recommends prophylactic wisdom teeth extraction, you would be willing to undergo the surgery.	a.Yes	b.No
A12. You prefer medication over surgery as an intervention for wisdom teeth, viewing surgery as a last resort rather than a first-choice approach.	a.Yes	b.No

Part IV Practice
P1: You will attend lectures on the topic of wisdom teeth and other oral health problems that can arise throughout your life, or you can acquire knowledge about the risks and wisdom teeth extraction through books and online resources. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P2: If you are prescribed medication, it is essential to thoroughly read the instructions to comprehend its proper usage and potential adverse effects. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P3: Regularly, you conscientiously monitor your oral health by visiting the dental clinic. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming ·
P4: When brushing your teeth, use a soft toothbrush and pay careful attention to cleaning the back row of wisdom teeth, neighboring teeth, and gums. a. Very conforming b. Conforming

c. Neutral d. Non-conforming e. Very non-conforming
P5: To address areas that a toothbrush cannot effectively reach during oral cleaning, utilize dental floss to clean the crevices. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P6: As part of your routine, you regularly rinse your mouth with mouthwash to maintain good oral hygiene. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P7: Regarding your diet, you are conscious of reducing the consumption of sugary or spicy foods, and you promptly clean food debris through methods like brushing and flossing. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P8: You will inform your family or friends about the hazards of wisdom teeth and remind them to seek medical attention or promptly have their wisdom teeth removed if necessary. a. Very conforming b. Conforming

c. Neutral d. Non-conforming e. Very non-conforming
P9: You are capable of evaluating the risks and benefits associated with wisdom teeth extraction before accepting your doctor's treatment recommendations. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P10: You remain vigilant for symptoms such as swollen gums, teeth pain, and a foul taste in the mouth. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P11: You have the ability to evaluate issues and make adjustments gradually based on your experiences with wisdom teeth prevention or treatment. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming

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Knowledge, attitudes, and practices among patients with impacted wisdom teeth toward teeth extraction in Jinan, Shandong Province, China: A Cross-Sectional Study

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Primary Subject Heading:	Dentistry and oral medicine
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Keywords:	Knowledge, Attitude, Awareness

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Knowledge, attitudes, and practices among patients with impacted wisdom teeth toward teeth extraction in Jinan, Shandong Province, China: A Cross-Sectional Study

Running Title: KAP toward wisdom teeth extraction

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ABSTRACT

Objectives: This study aimed to assess the knowledge, attitudes, and practices (KAP) of patients with impacted wisdom teeth toward tooth extraction, with the intention of identifying both gaps and opportunities for improved dental health education and practices.

Design: A cross-sectional study utilizing a web-based questionnaire.

Setting: The study was conducted at the Department of Oral and Maxillofacial Surgery, School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University, and Jinan Stomatological Hospital.

Participants: This study included responses from 3,467 individuals presenting with impacted wisdom teeth at the study settings between March and May 2023.

Primary and Secondary Outcome Measures: The primary outcomes measured were the levels of knowledge, attitudes, and practices toward wisdom teeth extraction among participants. The knowledge was assessed on a scale of 0-11, attitudes on a scale of 10-50, and practices on a scale of 11-55. Secondary outcomes included the exploration of associations between knowledge, attitudes, and practices using structural equation modeling.

Results: Participants demonstrated a mean knowledge score of 9.1±1.4, mean attitude score of 38.0±2.7, and mean practice score of 41.7±8.2. The analysis using a structural equation model revealed a direct effect of knowledge on attitudes (path coefficient = 2.042, $p<0.001$) and a direct effect of attitudes on practices (path coefficient = 1.460, $p<0.001$).

Conclusions: The findings suggest that patients with impacted wisdom teeth possess adequate knowledge and favorable attitudes towards teeth extraction, which positively

influences their practices. However, tailored interventions are still needed to further enhance KAP regarding this procedure in this population.

Strengths and limitations of this study

- Large sample size enhances the representativeness of findings.
- Structural equation modeling strengthens analysis of relationships between KAP factors.
- The online survey method enables convenient, large-scale data collection.
- Reliance on self-reported data may introduce reporting bias.
- Exclusive use of online surveys could result in non-response bias.

Keywords: Knowledge; Attitude; Practice; Cross-Sectional Study; Wisdom teeth;

Introduction

Impacted wisdom teeth constitute a significant public health issue due to their high prevalence and the associated complications[1]. Epidemiological evidence indicates that a substantial proportion of the adult population will develop at least one impacted wisdom teeth, necessitating extraction to mitigate potential risks such as infection, crowding, and other dental pathologies[1, 2].

Nevertheless, the extraction procedure for impacted wisdom teeth poses numerous challenges. It is well-documented that these procedures can elicit significant psychological stress in patients, resulting in dental anxiety or phobia[3]. This stress is exacerbated by the complexity and invasiveness inherent in the extraction of impacted teeth, which can amplify patients' apprehensions and uncertainties concerning dental care[4, 5]. Such anxiety and uncertainty negatively may negatively influence patients' attitudes towards dental health and treatment, potentially leading to suboptimal dental health behaviors, delayed care-seeking, and consequently, poorer dental and overall health outcomes[6, 7].

Knowledge-Attitude-Practice (KAP) model suggests that an individual's knowledge significantly influences their attitudes towards health and illness, which, in turn, shapes their health-related behaviors[8, 9]. Despite the recognition of dental anxiety among patients with impacted wisdom teeth, there exists a notable gap in the research literature regarding the application of the KAP model to better understand and address this issue. Previous research efforts have been directed towards delineating the prevalence of dental anxiety and its determinants within this demographic[3, 10, 11], with insufficient

focus on elucidating how knowledge and attitudes concerning wisdom teeth impaction and extraction affect health behaviors.

Thus, this study aims to address this gap by leveraging the KAP framework to investigate the knowledge, attitudes, and practices toward wisdom teeth extraction among patients with impacted wisdom tooth.

Materials and Methods

Study design and participants

This cross-sectional study was conducted between March and May 2023 at the Department of Oral and Maxillofacial Surgery, School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University and Jinan Stomatological Hospital. The inclusion criteria were as follows: 1) patients diagnosed with impacted wisdom tooth either at the Department of Oral and Maxillofacial Surgery, School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University, and 2) patients proficient in the Chinese to ensure effective communication during the data collection. Conversely, those who reported prior participation in similar studies were excluded from this study. Ethical approval was approved by the Ethics Committee of the School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University (Ethical No. 20230361), The medical ethics committee of Jinan Stomatological Hospital (JNSKQYY-2023-001) and informed consent was obtained from all patients.

Questionnaire introduction and data collection

The questionnaire was designed with reference to relevant guidelines and previous literature[12, 13], and was revised by two chief physicians and one vice-chief physician. A pilot test was conducted (n=34) and Cronbach's α coefficient value was 0.819, indicating a good internal consistency.

The final questionnaire contains four dimensions: demographic characteristics, knowledge, attitudes and practices. The knowledge dimension consists of 13 questions, with 1 point for a correct answer and 0 points for the rest. Given that the necessity of wisdom teeth extraction is a common misconception among patients, often due to a lack of understanding of guideline recommendations, question K8 was designed to address this issue. Questions K5 and K10 were designed as trap questions, presenting exactly opposite meanings[14, 15]. patients who selected "right" or "wrong" for both questions were deemed to have a logical conflict and were excluded from the survey. Consequently, the knowledge scores ranged from 0 to 11 points. The attitudes dimension consists of 13 questions, wherein questions A11-A13 are designated exclusively for descriptive analysis purposes. The remaining questions utilized a 5-point Likert scale, ranging from very positive (5 points) to very negative (1 point), yielding a possible score range of 10-50 points. The practices dimension consists of 11 questions using a 5-point Likert scale as well, ranging between very conforming (5 points) to very non-conforming (1 point), with a possible score range of 11-55 points.

Both electronic and printed versions of the questionnaire were utilized in this study. The electronic questionnaire was hosted on the Sojump platform (http://www.sojump.com), an online survey platform. At the onset of the survey,

patients were required to indicate their consent by clicking the option "I agree to participate in this study" before proceeding to respond to the questions. The data collection process ensured participant anonymity. Additionally, an IP restriction was implemented to prevent duplication of responses, restricting participants to a single submission from each unique IP address. To accommodate individuals who may be less acquainted with electronic devices, such as elderly patients, printed questionnaires were made available during their clinic visit, and they were requested to complete the printed forms. During questionnaire distribution, five trained research assistants first introduced the study face-to-face to patients before distributing the questionnaires. They also provided assistance when necessary, reviewed questionnaire completeness, and asked the patients to complete any missing information.

Statistical analysis

STATA 17.0 (STATA Corporation, College Station, TX, USA) was utilized for statistical analyses. Continuous variables were presented as mean±standard deviation (SD) and were compared using the student's t-test or one-way analysis of variance (ANOVA). Categorical variables were presented as numbers (percentages). In this study, 70% of the total score was used as the cut-off value, that means the threshold for sufficient knowledge, favorable attitudes, and proactive practices were 7.7, 35 and 38.5 points respectively[16]. Pearson correlation was used to analyze the correlation between knowledge, attitudes, and practices. Variables with $p<0.02$ in the single-factor logistic regression analysis are included in the multivariate logistic regression analysis. AMOS 24.0 (IBM, NY, USA) was utilized to construct a structural equation model (SEM)

examining the knowledge, attitudes, and practices of patients with impacted wisdom teeth toward wisdom teeth extraction. This SEM tested the main hypotheses as follows: 1) knowledge had direct effects on attitudes, 2) knowledge had direct effects on practices, and 3) attitudes had direct effects on practices. Model fit was evaluated using CMIN/DF (Chi-square goodness-of-fit test/Degrees of Freedom), RMSEA (Root Mean Square Error of Approximation), IFI (Incremental Fixation Index), TLI (Tucker-Lewis index) and CFI (Comparative Fixation Index). A two-sided p-value <0.05 was considered statistically significant.

Results

A total of 3467 patients participated in this study. Among them, 1092 (31.50%) were aged 30 or below, 2259 (65.16%) were female, 2927 (84.42%) lived in urban areas, and 2391 (68.96%) brushed their teeth twice daily. In addition, 1790 (51.63%) had undergone wisdom teeth extraction. The mean scores for knowledge, attitudes, and practices were 9.1±1.4 (possible range: 0-11), 38.0±2.7 (possible range: 10-50), and 41.7±8.2 (possible range: 11-55), respectively (**Table S1**).

The three knowledge items with the highest correctness rates were "The primary issues associated with wisdom teeth are insufficient space and misalignment." (K2), with a correctness rate of 89.59%, "Wisdom teeth are unlikely to cause damage to neighboring teeth, even if left untreated promptly." (K5), with a correctness rate of 88.78%, and "Delaying the treatment of wisdom teeth may result in harm to neighboring teeth." (K10), with a correctness rate of 88.78%. The three items with the lowest correctness

rates were "In cases where the growth of wisdom teeth leads to a severe infection, fever may not necessarily be present." (K4), with a correctness rate of 74.53%, "Various treatment options exist for wisdom teeth, including medications (antibiotics, traditional Chinese medicine, etc.) and surgical procedures (incision and drainage, wisdom teeth extraction, etc.)." (K9), with a correctness rate of 78.40%, and "Wisdom teeth, also known as third molars, are the last and farthest-back teeth to emerge in the mouth. They typically surface in adults between the ages of 18 and 25 years." (K1), with a correctness rate of 80.93% (**Table 1**).

Table 1. Knowledge

Knowledge	**Correctness Rate N(%)**
K1. Wisdom teeth, also known as third molars, are the last and farthest-back teeth to emerge in the mouth. They typically surface in adults between the ages of 18 and 25 years. **(True)**	2806 (80.93)
K2. The primary issues associated with wisdom teeth are insufficient space and misalignment. **(True)**	3106 (89.59)
K3. The emergence of wisdom teeth can lead to pain, inflammation, facial and jaw congestion, edema, and difficulty in swallowing. **(True)**	2826 (81.51)
K4. In cases where the growth of wisdom teeth leads to a severe infection, fever may not necessarily be present. **(False)**	2584 (74.53)
K5. Wisdom teeth are unlikely to cause damage to neighboring teeth, even if left untreated promptly. **(False)**	3078 (88.78)
K6. The growth of wisdom teeth can create gaps that allow food debris to enter, resulting in a range of symptoms, including inflammation. **(True)**	2906 (83.82)
K7. Consuming spicy, hard, and sticky foods can exert pressure on the teeth, leading to pain and swelling. Additionally, sugars in food and drinks can contribute to plaque buildup on teeth, causing dental caries and other oral problems. Thus, it is advisable to minimize their intake. **(True)**	3043 (87.77)
K8. Not all patients require wisdom teeth extraction, particularly if they are growing normally and not causing any dental problems. **(False)**	2871 (82.81)

K9. Various treatment options exist for wisdom teeth, including medications (antibiotics, traditional Chinese medicine, etc.) and surgical procedures (incision and drainage, wisdom teeth extraction, etc.). **(True)**	2718 (78.40)
K10. Delaying the treatment of wisdom teeth may result in harm to neighboring teeth. **(True)**	3078 (88.78)
K11. Wisdom teeth extraction may cause temporary discomfort and swelling, but it generally does not have any long-term effects on the function and appearance of the mouth. **(True)**	2998 (86.47)
K12. Following the wisdom teeth extraction, patients should adhere to the prescribed regimen, which may include ice compresses, a specific diet, and proper oral care, to alleviate pain. **(True)**	3022 (87.16)
K13. Wisdom teeth extraction always leads to a slimmer face. **(False)**	2819 (81.31)

A significant majority of the patients (93.86%) reported that they are willing to proactively engage in discussions with their doctor about their condition and receive professional medical support (A1). Similarly, a high percentage (92.70%) claimed that they believe in actively seeking medical treatment if they experience any visible symptoms in their wisdom teeth (A5). Additionally, an overwhelming 90.51% of the patients expressed trust in the treatment plan proposed by an oral surgeon and demonstrated willingness to heed the professional advice given by the oral surgeon (A7). However, it is worth noting that a considerable portion (58.23%) of the patients admitted to experiencing fear and anxiety regarding procedures related to wisdom teeth (A6). Additionally, 58.96% of the patients expressed fear concerning potential hazards associated with wisdom teeth (A4). In addition, 25.12% of the patients strongly agreed or agreed that the daily care or wisdom teeth extraction requires a significant amount of time and energy, leading to a lack of willingness to prioritize it (A8). The decision-making process for undergoing wisdom teeth extraction is influenced by the reimbursement rates provided by medical insurance, as mentioned by 46.47% of the

patients (A13). Additionally, 47.6% of the patients preferred medication as an intervention for wisdom teeth rather than opting for surgical procedures (A12). Notably, a substantial 80.3% of the patients expressed their willingness to undergo prophylactic wisdom teeth extraction if recommended by their doctor (A11) (**Table 2**).

Table 2. Attitudes

	Strongly agree N(%)	Agree N(%)	Neutral N(%)	Disagree N(%)	Strongly disagree N(%)
A1. You are willing to proactively discuss your condition with your doctor and seek professional medical support. **(Positive)**	1863 (53.75%)	1391 (40.14%)	99 (2.86%)	81 (2.34%)	33 (0.95%)
A2. You are open to discussing your wisdom teeth condition with friends or family and seeking their advice on whether to retain or extract them. **(Positive)**	1144 (32.97%)	1664 (48.00%)	424 (12.23%)	178 (5.14%)	57 (1.64%)
A3. You are willing to acquire medical knowledge related to the risks and wisdom teeth extraction through concise online videos or books. **(Positive)**	1180 (34.06%)	1878 (54.18%)	216 (6.23%)	114 (3.29%)	79 (2.28%)
A4. You are concerned about potential hazards posed by wisdom teeth in your daily life, such as inflammation and infection. **(Negative)**	644 (18.56%)	1400 (40.39%)	1017 (29.33%)	320 (9.22%)	86 (2.48%)
A5. You firmly believe in seeking medical treatment if you experience visible symptoms related to your wisdom teeth. **(Positive)**	1884 (54.41%)	1330 (38.38%)	124 (3.57%)	117 (3.38%)	12 (0.35%)
A6. Undergoing wisdom teeth extraction would elicit feelings of fear or anxiety about the surgery. **(Negative)**	668 (19.27%)	1351 (38.96%)	880 (25.40%)	419 (12.08%)	149 (4.29%)
A7. You place trust in your oral surgeon's treatment plan and are receptive to their professional advice. **(Positive)**	1414 (40.80%)	1724 (49.72%)	216 (6.23%)	75 (2.17%)	38 (1.10%)
A8. You consider the daily care or extraction of your wisdom teeth to be time-consuming and energy-demanding, hence, you do not prioritize it. **(Negative)**	325 (9.38%)	546 (15.75%)	408 (11.76%)	1600 (46.14%)	588 (17.00%)

A9. You recognize the significance of a good diet and oral hygiene in preventing and managing wisdom teeth issues. **(Positive)**	1382 (39.87%)	1550 (44.69%)	345 (9.95%)	122 (3.52%)	68 (1.96%)
A10. You acknowledge the importance of regular oral check-ups in preventing wisdom teeth-related diseases. **(Positive)**	1407 (40.57%)	1727 (49.77%)	201 (5.79%)	62 (1.79%)	70 (2.02%)
	Yes	No			
A11. If the doctor recommends prophylactic wisdom teeth extraction, you would be willing to undergo the surgery.	2784 (80.30%)	683 (19.70%)			
A12. You prefer medication over surgery as an intervention for wisdom teeth, viewing surgery as a last resort rather than a first-choice approach.	1650 (47.60%)	1817 (52.40%)			
A13. The reimbursement rates of medical insurance for wisdom teeth extraction and related costs significantly influence your decision on whether to undergo the procedure.	1403 (46.47%)	2064 (59.53%)			

Moreover, 83.89% of patients indicated that they are highly capable of evaluating the risks and benefits associated with wisdom teeth extraction, and they readily accept their dentist's treatment recommendations (P9). Additionally, 79.23% reported using dental floss to clean the crevices that a toothbrush cannot effectively reach during oral cleaning (P5). Moreover, 74.70% of patients asserted their ability to evaluate issues and make incremental adjustments concerning their experiences with wisdom teeth prevention or treatment (P11). However, the proportion of patients who confirmed their intention to inform their family or friends about the potential hazards of wisdom teeth and remind them to seek prompt medical attention or have their wisdom teeth extracted was only 33.89% (P8). Similarly, only 47.76% of the patients reported being consciously vigilant about their oral health by regularly attending the dental clinic (P3) (**Table 3**).

Table 3. Practices

	Very conforming N(%)	Conforming N(%)	Neutral N(%)	Non-conforming N(%)	Very non-conforming N(%)
P1: You will attend lectures on the topic of wisdom teeth and other oral health problems that can arise throughout your life, or you can acquire knowledge about the risks and wisdom teeth extraction through books and online resources.	931 (26.88%)	1100 (31.79%)	803 (23.17%)	417 (12.04%)	216 (6.23%)
P2: If you are prescribed medication, it is essential to thoroughly read the instructions to comprehend its proper usage and potential adverse effects.	858 (24.77%)	1044 (30.16%)	631 (18.23%)	639 (18.45%)	295 (8.53%)
P3: Regularly, you conscientiously monitor your oral health by visiting the dental clinic.	751 (21.70%)	905 (26.14%)	1041 (30.06%)	567 (16.39%)	203 (5.87%)
P4: When brushing your teeth, use a soft toothbrush and pay careful attention to cleaning the back row of wisdom teeth, neighboring teeth, and gums.	1140 (32.92%)	1388 (40.08%)	677 (19.55%)	1544 (4.56%)	108 (3.12%)
P5: To address areas that a toothbrush cannot effectively reach during oral cleaning, utilize dental floss to clean the crevices.	1379 (39.83%)	1368 (39.49%)	345 (9.96%)	256 (7.40%)	119 (3.44%)
P6: As part of your routine, you regularly rinse your mouth with mouthwash to maintain good oral hygiene.	1141 (32.95%)	1446 (41.77%)	384 (11.08%)	308 (8.90%)	188 (5.44%)
P7: Regarding your diet, you are conscious of reducing the consumption of sugary or spicy foods, and you promptly clean food	944 (27.32%)	1277 (36.90%)	822 (23.75%)	278 (8.03%)	146 (4.23%)

debris through methods like brushing and flossing.					
P8: You will inform your family or friends about the hazards of wisdom teeth and remind them to seek medical attention or promptly have their wisdom teeth removed if necessary.	1062 (30.70%)	113 (3.27%)	895 (25.87%)	274 (7.92%)	123 (3.56%)
P9: You are capable of evaluating the risks and benefits associated with wisdom teeth extraction and accepting your doctor's treatment recommendations.	1551 (44.79%)	1354 (39.10%)	396 (11.45%)	119 (3.44%)	47 (1.36%)
P10: You remain vigilant for symptoms such as swollen gums, teeth pain, and a foul taste in the mouth.	880 (25.43%)	1117 (32.28%)	785 (22.69%)	525 (15.17%)	160 (4.63%)
P11: You have the ability to evaluate issues and make adjustments gradually based on your experiences with wisdom teeth prevention or treatment.	1094 (31.61%)	1496 (43.24%)	633 (18.29%)	167 (4.83%)	77 (2.23%)

The correlation analysis showed that the knowledge score and the attitude score were positively correlated (r = 0.288, p<0.001), and the knowledge score and the practice score were also positively correlated (r = 0.348, p<0.001). Additionally, there was a positive correlation between attitude and practice scores (r = 0.452, p<0.001) **(Table 4).**

Table 4. Correlation analysis

	Knowledge	Attitudes	Practices
Knowledge	1		
Attitudes	0.288 (P<0.001)	1	
Practices	0.348 (P<0.001)	0.452 (P<0.001)	1

The SEM was established to further investigate whether patients with impacted wisdom teeth knowledge and attitude toward wisdom teeth extraction affect their practice, whether attitude plays an intermediary role between knowledge and practice, and whether knowledge can directly affect their practice according to the KAP theory. It also investigated the effect of other factors including residence and monthly per capita household income on the three dimensions mentioned above (**Table S2**). The fitting index of the structural model (CMIN/DF = 13.905; RMSEA = 0.061; IFI = 0.847; TLI = 0.834; CFI = 0.847) outperformed the respective threshold value, signifying that the data fit the structural model satisfactorily (**Table S3**). The SEM demonstrated that knowledge had direct effects on attitudes, as indicated by a path coefficient of 2.042 (p<0.001) and a significant and attitudes had direct effects on practices, with a path coefficient of 1.460 (p<0.001) (**Figure 1**).

Discussion

Patients with impacted wisdom teeth had sufficient knowledge, favorable attitudes, and proactive practices toward wisdom teeth extraction.

However, this study still identified deficiencies of certain aspects. Additionally, variances in KAP levels were observed across different demographic characteristics within the patients. These findings underscore the importance of considering these factors in the development of subsequent health education programs. The present study found that male and younger patients (<30 years) tend to have higher KAP scores. This finding is different from previous studies which reported higher oral health knowledge and behaviors among female and partipants older than 30 years[17, 18]. Nonetheless, the previous studies were not conducted in a Chinese population, and characteristics of their participants were distinctive different from participants in our study. Further education and tailored interventions should be designed for female and older patients in China. Furthermore, the present study identified that urban residents, those with higher education levels, non-smokers, non-drinkers, those who had not undergone dental treatment other than wisdom teeth removal, and those who were not informed and education about wisdom teeth during their dental treatment had lower KAP scores, and future programs should also consider the knowledge needs of these patients to enhance the dental care quality and the KAP towards wisdom teeth.

The present study found sufficient knowledge of wisdom teeth and that most patients would accept being educated about wisdom teeth during other oral therapies. patients had good knowledge about potential complications associated with wisdom teeth and the importance of treating wisdom teeth in a timely manner. This finding is consistent with previous knowledge and awareness studies conducted on medical students: a large percentage of the study population was aware of wisdom teeth impaction and its consequences[19, 20]. Patients in the present study had less knowledge about infection

related to wisdom teeth and different treatment options. Hanna et al. have found that patients used the internet to seek information related to wisdom teeth, but internet use was not associated with better wisdom teeth knowledge[21]. Therefore, it is important for healthcare professionals to provide patients with accurate information and internet guidance to improve wisdom teeth knowledge. Zincir et al. reported that patients found educational videos related to wisdom teeth surgical removal were excellent for patient education, and educational videos in Chinese should be made available to improve patients' knowledge[22]. Increased awareness of hazards and removal of wisdom teeth among patients with impacted wisdom teeth will help in the management of wisdom teeth[23].

In the present study, most patients had a positive attitude toward seeking professional advice and medical treatments, and they also trusted the treatment plan formulated by their oral surgeon. This result reflected a high level of patient trust in dentists, and the level of trust is higher than previously reported[24, 25]. This discrepancy can be explained by the larger proportion of patients with higher education in the present study[26]. Similar to previous findings, patients in the present study reported a high level of anxiety about the potential hazards of wisdom teeth and extraction surgery[27-29]. Lack of knowledge about the procedure is one of the possible contributors to anxiety related to oral surgery[29]. Effective education toward wisdom teeth extraction is critical in reducing anxiety in patients and improving the quality of care. Moreover, in the present study, medical insurance reimbursement rates were a decisive factor for wisdom teeth extraction, which is consistent with a previous study conducted in the United States[30]. Thus, there is a need to improve insurance coverage of wisdom teeth treatments to improve adherence to dentists' recommendations.

Most patients claimed that they would weigh the risks and benefits of wisdom teeth extraction to make an informed decision, and around 80% would use dental floss regularly. Zhao et al. reported that very few Chinese adults use dental floss, and the patients with impacted wisdom teeth in the present study might have better practice than the general population due to their disease experience and better dental knowledge[31]. Liu et al. reported that the rate of dental care visits and the utilization of oral health resources are low in the Chinese general population[32]. It is important to enhance patients' practice by improving their knowledge and attitude toward wisdom teeth extraction. Furthermore, this study found that patients who had prior wisdom teeth extraction demonstrated better knowledge, attitudes and practices compared to those without previous wisdom teeth extraction experience. Similarly, Brasileiro et al. also identified that patients with a history of teeth extraction and those without it presented different patterns of knowledge about wisdom teeth extraction[29]. Patients who had no experience with wisdom teeth extraction may need more attention to improve their KAP in this area.

The results of correlation analysis and SEM demonstrated that patients with impacted wisdom teeth knowledge had direct effects on attitudes, and attitudes had direct effects on practices. These implies that patients with impacted wisdom teeth with better knowledge about wisdom teeth would have more favorable attitudes, which indirectly results in better practice toward wisdom teeth[33]. The finding highlighted the importance of education in patients with impacted wisdom teeth to improve their knowledge, as well as their attitude and practice toward wisdom teeth. It also found that residence had direct effects on knowledge and monthly per capita household income had direct effects on attitudes. This finding is consistent with previous studies on dental health and dental care utilization in China[32, 34, 35]. Patients with lower income and those who lived in rural

areas tend to have poorer knowledge and health-seeking behaviors, and more clinical and research attention should be paid to these patients. In addition to common complications, patients should also be informed about rare but serious risks associated with wisdom teeth extraction, such as nerve damage. Damage to the inferior alveolar nerve (IAN) or the lingual nerve, which can occur during extraction of deeply impacted lower wisdom teeth, can result in long-term sensory changes, including numbness, tingling, or even pain in the lower lip, chin, or tongue. Although such nerve injuries are uncommon, with incidence rates reported between 0.4% and 8.4% depending on the complexity of the extraction, the potential impact on a patient's quality of life makes it essential for healthcare providers to discuss these risks. Providing patients with clear information about these rare but serious complications can support informed decision-making and reduce postoperative anxiety.

This study has some limitations. The self-reported nature of the data collection may result in deviations between reported and actual practices. Additionally, since over half of the sample has undergone wisdom tooth removal, there might be inherent differences in knowledge and attitudes compared to those who have not experienced the procedure. Future research could consider handling these two groups separately or using a quasi-experimental design to better explore these differences. Moreover, while this study focuses on common outcomes, it may not fully capture rare complications associated with wisdom teeth extraction, such as changes in sensation due to nerve damage. The large sample size enhances representativeness and generalizability of the results. Furthermore, this study provides an in-depth exploration of the relationship between patients with impacted wisdom teeth knowledge, attitudes, and practices regarding wisdom teeth extraction. These findings offer valuable insights to inform clinical guidance in this area.

Conclusions

In conclusion, this KAP study demonstrated sufficient knowledge, favorable attitudes, and proactive practices toward wisdom teeth extraction among patients with impacted wisdom teeth. Further tailored interventions should be developed and implemented in this population to improve their KAP of wisdom teeth.

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the School and Hospital of Stomatology, Cheeloo College of Medicine, Shandong University (Ethical No. 20230361), The medical ethics committee of Jinan Stomatological Hospital (JNSKQYY-2023-001) and Informed consent was obtained from all patients. 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.

Patient and Public Involvement

Patients were not directly involved in the design, conduct, or reporting of this study. However, the study results are planned to be disseminated to participants and relevant patient communities, ensuring accessible formats and timings based on public interest.

Consent for publication

Not applicable.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

1) conceived and designed the experiments: Jing Sun, Junru Meng, Shu Li, Dongdong Tong

2) performed the experiments: Jing Sun, Xin Wang, Bing Wang, Xiao Luan,Dongdong Tong

3) analyzed and interpreted the data: Jing Sun, Junru Meng, Xin Wang, Shu Li, Dongdong Tong

4) contributed reagents, materials, analysis tools or data: Jing Sun, Junru Meng, Xin Wang, Bing Wang, Xiao Luan,Shu Li, Dongdong Tong

5) wrote the paper:Jing Sun, Junru Meng, Shu Li, Dongdong Tong

6) Dongdong Tong is the guarantor

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Figure Legends

Figure 1. The KAP structural equation model

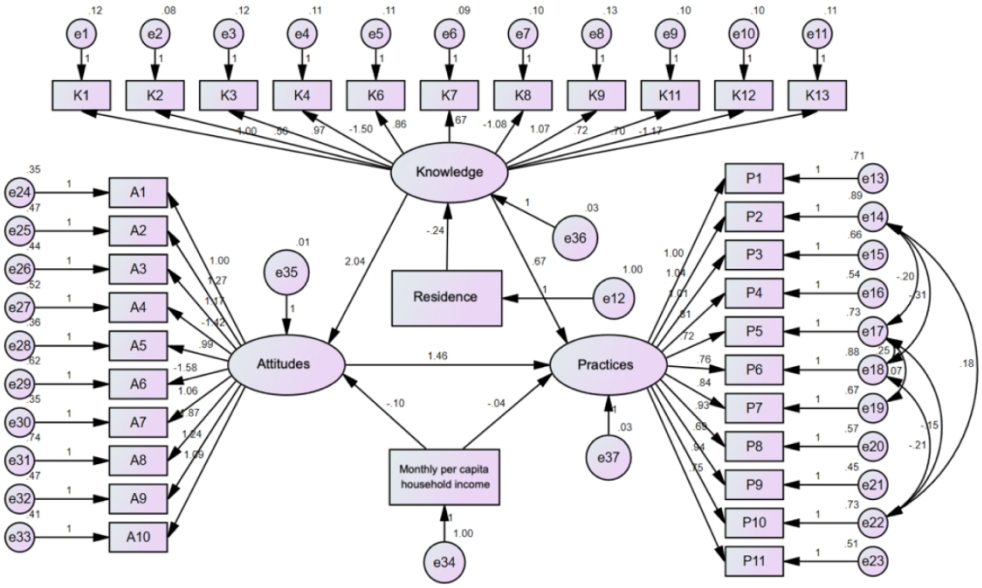

Figure 1. The KAP structural equation model

170x108mm (300 x 300 DPI)

Supplementary Tables

Table S1. Demographic information and KAP scores.

Variables	N (%)	Knowledge Mean ± SD	P	Attitudes Mean ± SD	P	Practices Mean ± SD	P
Total	3467	9.14 ±1.35		38.01 ±2.72		41.65 ±8.24	
Gender			<0.001		<0.001		<0.001
Male	1208 (34.84)	9.47 ±1.02		39.02 ±1.97		48.55 ±5.59	
Female	2259 (65.16)	8.97 ±1.47		37.47 ±2.91		37.97 ±6.96	
Age, years			<0.001		<0.001		<0.001
30 and below	1092 (31.50)	9.57 ±1.03		39.32 ±2.12		48.89 ±5.41	
31-40	889 (25.64)	9.39 ±1.19		38.31 ±2.55		42.46 ±7.30	
41-50	1051 (30.31)	8.81 ±1.53		37.02 ±2.77		36.62 ±6.06	
51 and above	435 (12.55)	8.37 ±1.36		36.50 ±2.60		34.01 ±4.13	
Residence			<0.001		<0.001		<0.001
Rural	540 (15.58)	9.43 ±1.01		39.11 ±1.74		50.34 ±4.43	
Urban	2927 (84.42)	9.09 ±1.40		37.80 ±2.82		40.05 ±7.76	
Education			<0.001		<0.001		<0.001
Middle school and below	131 (3.78)	9.21 ±1.05		38.99 ±1.57		51.73 ±2.87	

High school/Technical secondary school	354 (10.21)	9.44 ±0.93		39.17 ±1.77	50.35 ±4.61	
Junior college/Undergraduate	2382 (68.70)	9.24 ±1.33		38.02 ±2.73	41.46 ±7.76	
Postgraduate and above	600 (17.31)	8.56 ±1.51		37.06 ±2.97	35.08 ±5.34	
Occupation			<0.001			<0.001
State Organ and Enterprise Leaders	239 (6.89)	9.40 ±0.99		39.21 ±1.81	51.03 ±4.51	
Professional and Technical Personnel (e.g., teachers, doctors, engineers, writers, etc.)	976 (28.15)	9.54 ±1.03		39.04 ±2.05	47.84 ±5.90	
General Employees and Support Staff	473 (13.64)	9.40 ±1.15		38.41 ±2.50	42.44 ±7.03	
Commercial and Service Industry Workers	345 (9.95)	9.19 ±1.43		37.72 ±2.75	39.81 ±7.22	
Agriculture, Forestry, Animal Husbandry, Fisheries, and Water Resources Workers	199 (5.74)	8.89 ±1.45		37.64 ±2.58	37.77 ±6.75	

Production and Transport Equipment Operators	174 (5.02)	8.81 ±1.49		36.82 ±2.83	36.56 ±.94	
Military	48 (1.38)	8.90 ±1.74		37.67 ±2.91	37.29 ±6.83	
Student	748 (21.57)	8.71 ±1.48		36.85 ±3.00	35.66 ±5.34	
Others	265 (7.64)	8.61 ±1.62		37.15 ±3.02	35.40 ±6.45	
Medical Insurance						
No medical insurance	306 (8.83)					
Social medical insurance	1283 (37.01)					
Social and commercial medical insurance	1878 (54.17)					
Monthly per capita household income (CNY)			<0.001		<0.001	<0.001
<2,000	218 (6.29)	9.33 ±0.95		39.30 ±1.78	51.41 ±3.98	
2,000-5,000	682 (19.67)	9.58 ±1.01		39.14 ±1.84	49.18 ±5.10	
5,000-10,000	1263 (36.43)	9.35 ±1.25		38.13 ±2.71	41.99 ±7.28	
10,000-20,000	831 (23.97)	8.78 ±1.50		37.28 ±2.86	36.34 ±5.96	
>20,000	473 (13.64)	8.51 ±1.54		36.74 ±2.96	34.75 ±5.03	
Smoking			<0.001		<0.001	<0.001
Yes	503 (14.51)	9.40 ±0.99		39.18 ±1.60	50.80 ±3.47	
No	2964 (85.49)	9.10 ±1.40		37.81 ±2.82	40.10 ±7.79	
Alcohol consumption			<0.001		<0.001	<0.001
Yes	656 (18.92)	9.44 ±1.00		39.26 ±1.78	50.25 ±4.43	

No	2811 (81.08)	9.07 ±1.41		37.72 ±2.82	39.65 ±7.60	
Frequency of teeth brushing (per day)			<0.001			<0.001
1 time	550 (15.86)	9.47 ±0.99		39.19 ±1.78	50.02 ±4.79	
2 times	2391 (68.96)	9.22 ±1.36		38.03 ±2.72	41.32 ±7.78	
3 times	469 (13.53)	8.48 ±1.45		36.71 ±3.00	34.54 ±4.76	
4 times or more	57 (1.64)	8.35 ±1.38		36.46 ±2.47	33.33 ±3.39	
Oral Disease Complications (multiple choices)			/			/
Gum Disease	986 (28.44)					
Dental Caries	1536 (44.30)					
Pulpitis	689 (19.87)					
Oral Cancer	450 (12.98)					
Oral ulcers	700 (20.19)					
Dentition defects	348 (10.04)					
Irregular teeth alignment	1082 (31.21)					
Loose teeth	279 (8.05)					
Other oral diseases	276 (7.96)					

No oral conditions as described above	215 (6.20)					
Undergone wisdom teeth extraction			<0.001			<0.001
Yes	1790 (51.63)	9.51 ±1.08		38.90 ±2.33	46.45 ±6.87	
No	1677 (48.37)	8.75 ±1.49		37.05 ±2.78	36.53 ±6.25	
If have, the age at that time (years old)			<0.001			<0.001
20 and below	350 (10.10)	9.29 ±0.99		39.39 ±1.91	51.24 ±3.55	
21-30	855 (24.66)	9.55 ±1.03		39.19 ±2.18	47.72 ±6.08	
30 and above	585 (16.87)	9.57 ±1.19		38.19 ±2.61	41.73 ±6.68	
If have, the reasons were (multiple choices):			/			/
Recurring painful inflammation	1091 (31.47)					
Get stuck between the teeth or cheek grinding	903 (26.05)					
Dental caries or periodontal disease	774 (22.32)					
Prophylactic extractions or findings on check-ups	912 (26.31)					
Surgical requirements	388 (11.19)					

Other	113 (3.26)					
Undergone oral therapy other than treatment for wisdom teeth related oral diseases			<0.001		<0.001	<0.001
Yes	1780 (51.34)	9.50 ±1.07		38.89 ±2.34		46.55 ±6.80
No	1687 (48.66)	8.76 ±1.50		37.08 ±2.78		36.49 ±6.22
Acceptance of being informed and educated about wisdom teeth during other oral therapies			<0.001		<0.001	<0.001
Yes	2540 (73.26)	9.33 ±1.24		38.41 ±2.58		43.97 ±7.86
No	927 (26.74)	8.63 ±1.49		36.89 ±2.79		35.30 ±5.41

Table S2. Test results of the hypothesis.

	Hypothesized paths			path coefficient	P value
Hypothesis 1	Knowledge	<---	Residence	-0.4	<0.001
Hypothesis 2	Attitudes	<---	Knowledge	2	<0.001
Hypothesis 3	Attitudes	<---	Monthly per capita household income	-0.03	<0.001
Hypothesis 4	Practices	<---	Attitudes	1.43	<0.001
Hypothesis 5	Practices	<---	Knowledge	0.662	0.104
Hypothesis 6	Practices	<---	Monthly per capita household income	-0.04	0.052

Table S3. Model fitness indices for the KAP structural equation model

Goodness-of-Fit Indices	Ideal standards	Measurement value
CMIN/DF	1-3 excellent, 3-5 good	2.905
RMSEA	<0.08 good	0.061
IFT	>0.8 good	0.847
TLI	>0.8 good	0.834
CFI	>0.8 good	0.847

CMIN/DF, Chi-square fit statistics/degree of freedom; RMSEA, root mean square error of approximation; IFT, incremental fix index; TLI, Tucker-Lewis index; CFI, comparative fix index.

Questionnaire

Part I Demographic information	
1. Gender	a. Male b. Female
2. Age, years	_____
3. Residence	a. Rural b. Urban
4. Education	a. Middle school and below b. High school/Technical secondary school c. Junior college/Undergraduate d. Postgraduate and above
5. Occupation	a.State Organ and Enterprise Leaders b.Professional and Technical Personnel (e.g., teachers, doctors, engineers, writers, etc.) c.General Employees and Support Staff d.Commercial and Service Industry Workers e.Agriculture, Forestry, Animal Husbandry, Fisheries, and Water Resources Workers f.Production and Transport Equipment Operators g.Military h.Student I.Others
6. Medical Insurance：	a. No medical insurance b. Social medical insurance

	c. Social and commercial medical insurance
7. Monthly per capita household income (CNY)	a. <2,000 b. 2,000-5,000 c. 5,000-10,000 d. 10,000-20,000 e. >20,000
8. Smoking	a. Yes b. No
9. Alcohol consumption	a. Yes b. No
10. Frequency of teeth brushing (per day)	a. 1 time b. 2 times c. 3 times d. 4 times or more
11. Oral Disease Complications	a. Gum Disease b. Dental Caries c. Pulpitis d. Oral Cancer e. Oral ulcers f. Dentition defects g. Irregular teeth alignment h. Loose teeth i. Other oral diseases j. No oral conditions as described above
12. Undergone wisdom teeth extraction	a. Yes

	b. No
12.1 If have, the age at that time (years old)	_____
12.2 If have, the reasons were:	a. Recurring painful inflammation b. Get stuck between the teeth or cheek grinding c. Dental caries or periodontal disease d. Prophylactic extractions or fillings on check-ups e. Surgical requirements f. Other
13. Undergone oral therapy other than treatment for wisdom teeth related oral diseases	a. Yes b. No
14. Acceptance of being informed and educated about wisdom teeth during other oral therapies	a. Yes b. No

Part II Knowledge		
K1. Wisdom teeth, also known as third molars, are the last and farthest-back teeth to emerge in the mouth. They typically surface in adults between the ages of 18 and 25 years.	A.Yes	B.No
K2. The primary issues associated with wisdom teeth are insufficient space and misalignment.	A.Yes	B.No
K3. The emergence of wisdom teeth can lead to pain, inflammation, facial and jaw congestion, edema, and difficulty in swallowing.	A.Yes	B.No
K4. In cases where the growth of wisdom teeth leads to a severe infection, fever may not necessarily be present.	A.Yes	B.No
K5. Wisdom teeth are unlikely to cause damage to neighboring teeth, even if left untreated promptly.	A.Yes	B.No
K6. The growth of wisdom teeth can create gaps that allow food debris to enter, resulting in a range of symptoms, including inflammation.	A.Yes	B.No
K7. Consuming spicy, hard, and sticky foods can exert pressure on the teeth, leading to pain and swelling. Additionally, sugars in food and drinks can contribute to plaque buildup on teeth, causing dental caries and other oral problems. Thus, it is advisable to minimize their intake.	A.Yes	B.No
K8. Not all patients require wisdom teeth extraction, particularly if they are growing normally and not causing any dental problems.	A.Yes	B.No
K9. Various treatment options exist for wisdom teeth, including medications (antibiotics, traditional Chinese medicine, etc.) and surgical procedures (incision and drainage, wisdom teeth extraction, etc.).	A.Yes	B.No
K10. Delaying the treatment of wisdom teeth may result in harm to neighboring teeth.	A.Yes	B.No

K11. Wisdom teeth extraction may cause temporary discomfort and swelling, but it generally does not have any long-term effects on the function and appearance of the mouth.	A.Yes	B.No
K12. Following the wisdom teeth extraction, patients should adhere to the prescribed regimen, which may include ice compresses, a specific diet, and proper oral care, to alleviate pain.	A.Yes	B.No
K13. Wisdom teeth extraction always leads to a slimmer face.	A.Yes	B.No

Part III Attitudes					
A1. You are willing to proactively discuss your condition with your doctor and seek professional medical support.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A2. You are open to discussing your wisdom teeth condition with friends or family and seeking their advice on whether to retain or extract them.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A3. You are willing to acquire medical knowledge related to the risks and wisdom teeth extraction through concise online videos or books.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A4. You are concerned about potential hazards posed by wisdom teeth in your daily life, such as inflammation and infection.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A5. You firmly believe in seeking medical treatment if you experience visible symptoms related to your wisdom teeth.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A6. Undergoing wisdom teeth extraction would elicit feelings of fear or anxiety about the surgery.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A7. You place trust in your oral surgeon's treatment plan and are receptive to their professional advice.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A8. You consider the daily care or extraction of your wisdom teeth to be time-consuming and energy-demanding, hence, you do not prioritize it.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A9. You recognize the significance of a good diet and oral hygiene in preventing and managing wisdom teeth issues.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree
A10. You acknowledge the importance of regular oral check-ups in preventing wisdom teeth-related diseases.	a.Strongly agree	b.Agree	c. Neutral	d.Disagree	e.Strongly Disagree

A11. If the doctor recommends prophylactic wisdom teeth extraction, you would be willing to undergo the surgery.	a.Yes	b.No
A12. You prefer medication over surgery as an intervention for wisdom teeth, viewing surgery as a last resort rather than a first-choice approach.	a.Yes	b.No

Part IV Practice
P1: You will attend lectures on the topic of wisdom teeth and other oral health problems that can arise throughout your life, or you can acquire knowledge about the risks and wisdom teeth extraction through books and online resources. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P2: If you are prescribed medication, it is essential to thoroughly read the instructions to comprehend its proper usage and potential adverse effects. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P3: Regularly, you conscientiously monitor your oral health by visiting the dental clinic. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming ·
P4: When brushing your teeth, use a soft toothbrush and pay careful attention to cleaning the back row of wisdom teeth, neighboring teeth, and gums. a. Very conforming b. Conforming

c. Neutral
d. Non-conforming
e. Very non-conforming

P5: To address areas that a toothbrush cannot effectively reach during oral cleaning, utilize dental floss to clean the crevices.
a. Very conforming
b. Conforming
c. Neutral
d. Non-conforming
e. Very non-conforming

P6: As part of your routine, you regularly rinse your mouth with mouthwash to maintain good oral hygiene.
a. Very conforming
b. Conforming
c. Neutral
d. Non-conforming
e. Very non-conforming

P7: Regarding your diet, you are conscious of reducing the consumption of sugary or spicy foods, and you promptly clean food debris through methods like brushing and flossing.
a. Very conforming
b. Conforming
c. Neutral
d. Non-conforming
e. Very non-conforming

P8: You will inform your family or friends about the hazards of wisdom teeth and remind them to seek medical attention or promptly have their wisdom teeth removed if necessary.
a. Very conforming
b. Conforming

c. Neutral d. Non-conforming e. Very non-conforming
P9: You are capable of evaluating the risks and benefits associated with wisdom teeth extraction and accepting your doctor's treatment recommendations. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P10: You remain vigilant for symptoms such as swollen gums, teeth pain, and a foul taste in the mouth. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming
P11: You have the ability to evaluate issues and make adjustments gradually based on your experiences with wisdom teeth prevention or treatment. a. Very conforming b. Conforming c. Neutral d. Non-conforming e. Very non-conforming