



## Research Article

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# Third molar-related knowledge, attitudes, behaviors, and medical history of 904 Chinese adults: a cross-sectional survey

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**Abstract:** This study investigated the perceptions and medical history of third molars (M3s) and assessed the prevalence of visible M3s (V-M3s) among 904 Chinese adults. The enrolled participants were interviewed to complete a structural questionnaire focused on sociodemographic information and their understanding of, attitudes toward, behaviors regarding, and medical history with respect to M3s. In addition, the number of V-M3s in the cohort was determined by oral examination. Logistic regression analysis was performed to explore the association between individuals' sociodemographic characteristics and their perception of M3s or the presence of V-M3s. The Chi-square test was used to compare the actions taken against symptomatic M3s and the corresponding outcomes among different groups divided according to respondents' sociodemographic factors. In total, 904 completed questionnaires were gathered and analyzed. Nearly half (43.9%) of the respondents knew nothing about M3s, and only 12.7% provided correct answers to all the questions asked. Male sex, older age, occupation involving physical labor, and no previous dental experience were active factors in unawareness of M3s. Male sex was also significantly associated with the presence of at least one V-M3 and negative behavior about symptomatic M3s. In terms of medical history, 192 participants reported having had at least one M3 extracted (438 in total), and 72.6% of the M3s were removed due to the presence of related symptoms or pathologies. In conclusion, the population investigated had a shortage of knowledge about M3s and adopted negative attitudes and actions about M3-related problems.

**Key words:** Third molar; Knowledge; Attitude; Practice; Medical history; Prevalence

## 1 Introduction

Third molars (M3s) are the last to erupt and most likely to be impacted (Chu et al., 2003; Loureiro et al., 2020). Impacted M3s are associated with a variety of problems, several of which have triggered heated discussion, including pain, swelling, food impaction, caries, external root resorption, periodontal damage to adjacent teeth, mandible fractures, cysts, and tumors (van der Linden et al., 1995; Polat et al., 2008; Li ZB et al., 2017b; Liu et al., 2018; Li DN et al., 2019;

Peñarrocha-Diago et al., 2021). Although some M3s seem to be asymptomatic or erupt in a functional position, they become regions of bacterial accumulation, and the anatomical location makes it impossible to remove the biofilm completely. Therefore, maintaining periodontal health in the M3 region becomes very difficult (Phillips et al., 2007; Yang et al., 2022). There is no dispute regarding the extraction of M3s that are associated with pathologies or symptoms, but removal of trouble-free M3s remains controversial. Some authors have indicated that the prophylactic removal of M3s can prevent relevant pathological changes and further complications from occurring in older adults (Bouloux et al., 2015; Ventä et al., 2015; Kim et al., 2017; Shoshani-Dror et al., 2018; Li et al., 2019; Hounsoume et al., 2020), but others have argued that there is still a lack of evidence to support or refute the extraction of asymptomatic M3s (Friedman, 2007;

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Nunn et al., 2013; Steed, 2014; Ghaemina et al., 2020), and that instead of extraction, watchful monitoring is more appropriate (Kandasamy et al., 2009). Although a consensus regarding treatment of M3s free of pathologies or symptoms has not been reached, it is acknowledged that extra attention is needed from clinicians and patients (Sun et al., 2022). For subjects with retained M3s, regular and professional surveillance is necessary (Yang et al., 2023). Therefore, people's perception and behavior have a great impact on the consequences of M3 retention. We have reason to believe that M3s are harmful to the periodontal health of their adjacent second molars (Li et al., 2017a, 2017b; Sun et al., 2020, 2022; Yang et al., 2022, 2023) and potentially to the overall oral condition of subjects who do not have enough awareness of them. There have been many studies concerning the negative effects of M3s, but data about people's knowledge of, attitude toward, and behavior related to M3s are scarce. Obtaining relevant information will contribute to dentists' ability to assess the risks of M3s to a certain degree, and allow them to make personalized recommendations aimed at this population.

In this cross-sectional investigation, we surveyed participants' understanding of M3s, the M3-associated problems that have occurred, and the solutions adopted. We also assessed the prevalence of visible M3s (V-M3s).

## 2 Methods

### 2.1 Patient screening selection

The cross-sectional survey was conducted in the Department of Periodontology, Stomatological Hospital, the Fourth Military Medical University, Xi'an, China, from July, 2015 to June, 2016. Individuals aged >18 years who were visiting the hospital for routine dental care and were willing and able to participate in the survey were recruited, while patients who were visiting the hospital for treatment due to M3-related symptoms (e.g., pain, swelling, and food impaction in the M3 regions) were excluded.

A previous study involving 6793 subjects reported that the prevalence of V-M3s was 31% (Garaas et al., 2011). Based on this prevalence, with an error margin of 5% and a confidence interval (CI) of 95%, we estimated the sample size of this study to be 329.

### 2.2 Questionnaire

Every participant was interviewed to complete a structured questionnaire that had been pretested before the formal survey. In the presurvey, we distributed questionnaires to 30 patients eligible for inclusion and interviewed them face to face. Based on feedback from the respondents, the questions and options that might cause confusion were modified. During the investigation, the trained interviewer (Honglei QU) answered questions raised by the participants when necessary.

The investigation was comprised of three main parts: sociodemographic information; knowledge of, attitudes toward, and behaviors regarding M3s; and medical history of M3s. The sociodemographic information consisted of gender, age (18 to 35 years, or >35 years), educational level (senior in high school or below, or college graduate or above), occupation (farmer/laborer, company employee, or government employee/employer), and dental care history (whether they had ever visited a dentist). Questions were asked about basic knowledge of M3s, including the following: (1) Do you know what an M3/wisdom tooth is? (2) At what age do M3s usually erupt? (3) If you have an M3, do you think it should be given special attention? (4) Will the retention of M3s increase the risk of oral disease? The outcomes were categorized as follows: no M3s knowledge (none of the questions was answered correctly); some M3s knowledge (at least the first question was answered correctly); and better M3s knowledge (all questions were answered correctly). Questions on attitudes toward and behaviors regarding M3s were focused on countermeasures and their corresponding efficacy for patients whose M3s had ever been symptomatic or been affected by a pathology. To collect the medical history of M3s, participants were asked to recall if they had any M3s removed, the reason and institution at which the M3s were removed, and whether any complications occurred during or after the surgery.

### 2.3 Clinical examination

We performed an oral examination on each participant to determine the number of V-M3s. All clinical examinations were conducted by one experienced periodontist (Honglei QU) after the patient was enrolled. The status of M3s was visually categorized as either absent (without a V-M3) or retained (with a V-M3). A V-M3 represents an M3 which has erupted

into the oral cavity and can be either seen or detected with a probe.

## 2.4 Statistical analyses

Collected data entered EpiData 3.0 (EpiData Association, Denmark) and were subsequently analyzed using SPSS software 20 (IBM, Chicago, USA). Logistic regression analysis was conducted to assess the association between the sociodemographic characteristics of subjects and the degree of their knowledge of M3s or the presence of V-M3s. Bivariate associations were determined using odds ratios (ORs) and 95% CIs. Differences in the measures taken by participants against symptomatic M3s and corresponding outcomes between different groups were determined by Chi-square tests. The main predictor variables were participants' sociodemographic factors, including gender, age, education level, occupation, and history of dental visits. The primary outcome variables were M3-related knowledge, behaviors and medical history, and the presence of V-M3s. The significance level was set at  $P < 0.05$ .

## 3 Results

### 3.1 Sociodemographic information and knowledge of M3s

A total of 950 individuals meeting the inclusion criteria were invited to participate in this survey. Twenty-one individuals refused the invitation and 904 individuals (56.1% male, (37.4±13.4) years) completed the questionnaire (questionnaires with incomplete information were excluded). Table 1 showed the demographic information of the recruited subjects. As mentioned above, we divided people's understanding of M3s into three levels: no knowledge, some knowledge, and better knowledge. We found that only 12.7% of respondents had a better understanding of M3s, and 43.9% had no idea what an M3 was.

We built an ordinal logistic regression model to assess the association between patients' sociodemographic characteristics and the degree of their knowledge of M3s (Table 2). The results showed that compared with male respondents, female respondents were 1.58 times more likely to have at least one more level of awareness of M3s. Other factors associated with having a better degree of understanding of M3s

were age 18–35 years, higher education, and company employment. Additionally, a history of dental visits led to a more than two-fold greater probability (95% CI:

**Table 1 Sociodemographic characteristics of investigated population and their basic knowledge about third molars (M3s) ( $n=904$ )**

Variable	Number (percentage) of respondents
Gender	
Male	507 (56.1%)
Female	397 (43.9%)
Age category (years)	
18 to 35	441 (48.8%)
>35	463 (51.2%)
Level of education	
Senior in high school or below	393 (43.5%)
College graduate or above	511 (56.5%)
Occupation	
Farmer/laborer	200 (22.1%)
Company employee	575 (63.6%)
Government employee/employer	129 (14.3%)
Dental experience	
Yes	692 (76.5%)
No	212 (23.5%)
Basic knowledge	
No	397 (43.9%)
Some	392 (43.4%)
Better	115 (12.7%)

**Table 2 Association between sociodemographic characteristics of study population and degree of their understanding about basic knowledge on M3s analyzed using ordinal logistic regression model ( $n=904$ )**

Variable	OR, $P$ value	95% CI
Gender		
Male	1	
Female	1.58, 0.001	1.21–2.07
Age category (years)		
>35	1	
18 to 35	2.13, <0.001	1.59–2.87
Level of education		
Senior high school or below	1	
College graduate or above	2.03, <0.001	1.49–2.78
Occupation		
Farmer/laborer	1	
Company employee	2.16, <0.001	1.47–3.16
Government employee/employer	1.39, 0.181	0.86–2.24
Dental experience		
No	1	
Yes	2.03, <0.001	1.47–2.82

M3s: third molars; OR: odds ratio; CI: confidence interval.

1.47 to 2.82) of understanding more about the characteristics and hazards of M3s. When asked about the source of their knowledge, 38.6% reported that they had obtained information on M3s from dentists, and 23.7% indicated that relatives and friends had delivered the information to them. A total of 22.5% reported the internet, newspaper, television, or radio as a source of knowledge, while 15.2% received information from education in school (not shown).

### 3.2 Prevalence of V-M3s

Among the 904 respondents, those with 0, 1, 2, 3, and 4 V-M3s accounted for 47.2%, 10.1%, 12.8%, 10.3%, and 19.6%, respectively; 52.8% of participants had at least one V-M3 (not shown). The results of binary logistic regression analysis illustrated that men were more likely to have V-M3s than women, with an OR of 1.48 (95% CI: 1.12 to 1.94; Table 3). Although no significant associations were observed between other sociodemographic factors and the presence of V-M3s, the respondents with higher education level, occupation of employee or government staff, and history of dental visits had smaller ORs compared to those with lower educational level, occupation of farmer/laborer, and no history of dental visits.

**Table 3 Association between sociodemographic characteristics of study population and presence of V-M3s analyzed using binary logistic regression model (n=904)**

Variable	OR, P value	95% CI
Gender		
Female	1	
Male	1.48, 0.005	1.12–1.94
Age category (years)		
18 to 35	1	
>35	1.11, 0.497	0.82–1.50
Level of education		
Senior high school or below	1	
College graduate or above	0.80, 0.169	0.58–1.10
Occupation		
Farmer/laborer	1	
Company employee	0.82, 0.404	0.51–1.31
Government employee/employer	0.89, 0.558	0.60–1.32
Dental experience		
No	1	
Yes	0.79, 0.162	0.57–1.10

V-M3s: visible third molars; OR: odds ratio; CI: confidence interval.

### 3.3 Attitudes toward and behaviors regarding M3s

We also analyzed the impact of participants' sociodemographic characteristics on their attitudes

toward and behaviors regarding M3s (Table 4). A total of 119 respondents reported that their retained M3s had ever exhibited symptoms or pathologies. When M3s caused discomfort, women were more inclined to take active measures than men. Most women chose to visit a professional dentist or use mouthwashes and antibiotics at home, while more than half of men chose not to take any action instead of asking for help. In contrast to this significant effect of gender, other sociodemographic factors did not appear to be notably associated with people's attitudes toward symptomatic M3s. However, in terms of proportion, respondents with younger age, lower education level, and a government staff occupation were more likely to take positive measures than to do nothing compared to those with older age, higher education level, and other occupations.

**Table 4 Coping strategies for symptomatic third molars (M3s) stratified by subjects' sociodemographic characteristics (n=119)**

Variable	Number (percentage) of respondents		
	Visit a dentist	Handle at home	Take no action
Gender <sup>a</sup>			
Male	16 (24.6%)	13 (20.0%)	36 (55.4%)
Female	25 (46.3%)	10 (18.5%)	19 (35.2%)
Age category (years)			
18 to 35	30 (36.6%)	16 (19.5%)	36 (43.9%)
>35	11 (29.7%)	7 (18.9%)	19 (51.4%)
Level of education			
Senior high school or below	13 (36.1%)	9 (25.0%)	14 (38.9%)
College graduate or above	28 (33.7%)	14 (16.9%)	41 (49.4%)
Occupation			
Farmer/laborer	8 (42.1%)	24 (28.9%)	9 (52.9%)
Company employee	24 (28.9%)	17 (20.5%)	42 (50.6%)
Government employee/employer	9 (52.9%)	4 (23.5%)	4 (23.5%)

<sup>a</sup> P<0.05.

Table 5 illustrated the relative efficacy of different strategies. The outcomes obtained for symptomatic M3s were significantly correlated with patient behaviors. More respondents who chose to visit a dentist reported that their troubles were resolved thoroughly or that the treatments obviously helped. Only 7 (17.1%) respondents indicated that there was no difference before or after visiting a dentist. Patients who used mouthwashes

and antibiotics at home responded similarly to those who visited a dentist, but the proportion of patients in whom symptoms were not completely resolved was higher. More than half of the respondents who did not take any action reported that their problems lasted or occurred repeatedly.

**Table 5 Corresponding outcomes of each coping strategy for symptomatic third molars (M3s) ( $n=119$ )**

Coping strategy <sup>***</sup>	Consequence	Number (percentage) of respondents
Go to a dentist	Completely cured	20 (48.8%)
	Obviously improved	14 (34.1%)
	No improvement	7 (17.1%)
	Total	41 (100.0%)
Handle at home	Completely cured	7 (30.4%)
	Obviously improved	12 (52.2%)
	No improvement	4 (17.4%)
	Total	23 (100.0%)
Take no action	Completely cured	20 (36.4%)
	Obviously improved	5 (9.1%)
	No improvement	30 (54.5%)
	Total	55 (100.0%)

<sup>\*\*\*</sup>  $P<0.001$ .

### 3.4 Medical history of M3s

A total of 438 M3s of 192 respondents had been removed before they were recruited to participate in the study, and most respondents reported that the M3s had been extracted because of relevant symptoms or pathologies (Table 6). M3s in the maxilla and mandible were extracted for the same primary reasons. Among the symptomatic and pathological reasons, pain related to M3s was the most common, followed by swelling (in the M3 region) and caries (in M3s or adjacent second molars). Less than 7% of the 438 M3s were removed due to tongue or cheek biting, pus discharge, or food impaction, and no one removed for tumors or cysts was reported. Dentists' suggestions led to the prophylactic extraction of M3s free of symptoms or pathologies, accounting for 24.6% in total. Only 14 (3.2%) M3s were removed for prosthetic or orthodontic needs.

## 4 Discussion

Many recent studies have indicated that M3s are associated with a wide range of oral diseases, even

**Table 6 Distribution of symptoms resulting in extraction of third molars (M3s) ( $n=438$ )**

Reason	Number (percentage) of M3s		
	Maxilla	Mandible	Total
Pain	75 (36.4%)	84 (36.2%)	159 (36.3%)
Swelling	34 (16.5%)	46 (19.8%)	80 (18.3%)
Tongue or cheek biting	2 (1.0%)	4 (1.7%)	6 (1.4%)
Pus discharge	1 (0.5%)	2 (0.9%)	3 (0.7%)
Caries	23 (11.2%)	26 (11.2%)	49 (11.2%)
Food impaction	9 (4.4%)	10 (4.3%)	19 (4.3%)
Tumor or cyst	0	0	0
Prophylactic extraction	57 (27.7%)	51 (22.0%)	108 (24.6%)
Prosthetic or orthodontic needs	5 (2.4%)	9 (3.9%)	14 (3.2%)
Total	206 (100.0%)	232 (100.0%)	438 (100.0%)

nonimpacted M3s (Li et al., 2017a; Sun et al., 2022). Due to the negative effects on oral health, dentists have consistently advised patients to pay close attention to M3s in case of irreversible damage (Marciani, 2012; Irja, 2014; Jin et al., 2021; Tian et al., 2021). However, according to our survey, the investigated population lacked basic knowledge about M3s (Table 1). A total of 43.9% of respondents knew nothing about M3s, even though some of them had at least one V-M3.

Similar to previous research, we found that people's concern and awareness of oral problems are related to socioeconomic factors, including gender, age, educational level, and occupation (Wu et al., 2013; Muthra et al., 2019; Saadaldina et al., 2020) (Table 2). It should be noted that people who had previous dental experience clearly understood M3s better, which has been found by Lawal and Oke (2020). The authors also indicated that people who have visited a dentist have better oral knowledge. There are two possible explanations of this phenomenon: on the one hand, these patients paid more attention to oral issues, and on the other hand, they may have been educated by dentists about M3s during their visits. Given the prevalence of M3s is also significantly related to their potential negative effects, we carried out a clinical examination to investigate the prevalence of V-M3s in the subjects, and then analyzed the association between patients' sociodemographic characteristics and the presence of at least one V-M3. Interestingly, people with a better understanding of M3s seemed

less likely to have at least one V-M3 (Table 3). We suspect that these people had their M3s removed earlier when they realized that they had them. However, we still lack direct evidence to prove this association.

A total of 119 out of the 904 respondents reported that they chose to retain their M3s, although there were M3-related symptoms or pathologies, and nearly half of them did not take any measures in response to these problems (Table 4). Women are more likely to take positive measures against M3s with problems than men, which may be related to their better understanding of M3s. Similar to those who handled their symptoms at home, 17.1% of the participants who went to dentists reported no relief of their discomfort, but the proportion of remaining patients who reported a complete cure was higher (Table 5). In this survey, we did not investigate the advice given by dentists or whether the participants fully complied. We speculated that in some cases, they did not follow the doctor's advice to treat or extract their M3s, and thus the efficacy was less than ideal.

The reasons why respondents had their M3s removed in the past also reflected the attitudes of doctors and patients toward M3s to some extent. Therefore, we investigated the medical history of the respondents' M3s. For the M3s that had been removed, the largest number was due to pain (Table 6), which is in agreement with a previous report by Kim et al. (2017); but the proportion of preventive extractions was much lower than they reported. These results may partly reflect the attitudes of Chinese patients and dentists toward M3s. Chinese patients seem more inclined to deal with problematic M3s than to have them removed preventatively. In fact, we also investigated the institutions where people chose to have their M3s extracted and the corresponding probability of complications, and found no correlation between them (not shown). More than 90% of the removed M3s were extracted at stomatological hospitals or in the stomatological departments of public hospitals. This may be related to the fact that the location of the investigation is a public hospital. The intraoperative and postoperative complications investigated included lasting pain, swelling, trismus, alveolar osteitis, postoperative infection, hemorrhage, oroantral communication, damage to adjacent teeth, delayed healing, and fracture (Bouloux et al., 2007; Daware et al., 2021). The incidence of complications related to M3 extraction

was similar at different medical institutions, with an average of 13%, which is consistent with the previously reported incidence of 4.6% to 30.9% (Bui et al., 2003; Bouloux et al., 2007; Sayed et al., 2019).

We are aware of the strengths and limitations of the current study. To the best of our knowledge, this is the first investigation to reveal people's understanding of, attitudes toward, behaviors regarding, and medical history of M3s. We believe that the results of this study have important implications for the comprehensive assessment of the potential harms of M3s and for making clinical decisions regarding M3s. In this study, we collected questionnaires by conducting interviews. For the first question, "Do you know what an M3/wisdom tooth is?" If the patients answered "Yes," we would ask them to explain or point out what an M3 was to ensure the accuracy of their answer. For patients who had removed more than one M3 or experienced discomfort with M3s, the investigator could assist in completing the questionnaire to minimize omissions, confusion, and errors. Although most of the questions in this survey were retrospective, this approach likely reflects respondents' true attitudes toward M3s and the related actions they would take best, because these behaviors have occurred.

As a part of our previous study (Qu et al., 2017), this survey was conducted five years ago. As far as we know, China has not made major changes related to public policies, including medical insurance and education during this period. However, people's concern and understanding of oral problems may increase with economic development and the pursuit of a high quality of life. Therefore, we plan to further explore whether this situation has changed. In addition, we did not investigate the reasons why patients with symptomatic M3s chose not to see a dentist. Patients' insurance type and income level affect their medical activity (Saadaldina et al., 2020), and dental anxiety may also have an impact on their behavior (Halvari et al., 2010).

This investigation was conducted in one of the most prestigious stomatology hospitals in China. Due to the nonprofit nature of this public hospital, patients had a wide range of ages and occupations. The patients were included for routine dental care while excluding M3-related complaints, to reduce bias in the results. However, the subjects of this hospital-based study could not completely represent the entire

population. Since they paid more attention to their oral health than those who did not visit the hospital at all, the general lack of knowledge about M3s may be underestimated in this sample. In terms of future research, we look forward to studies based on multiple centers or involving more representative populations.

More than half of the respondents had at least one V-M3 (impacted or nonimpacted); however, some of them did not know they had M3s. We have reason to believe that the lack of sufficient knowledge of and special attention to M3s aggravates their negative effects. We call for a variety of ways to popularize the public's knowledge of M3s, including through communities, dentists, media, and education. According to our survey results, there is room for improvement in many channels. Some people do not know that they have wisdom teeth, although they have seen a dentist. This shows that the work of dentists is also inadequate. Dentists should at least provide relevant information to patients with M3s to strengthen care and prevent disease in molar areas, even if they are not maxillofacial surgery specialists. A doctor's scientific explanation and guidance can enhance patients' compliance with regular visits to the dentist and attention to oral health care. However, due to limited medical resources, official media promotion and community/school-based education may be more effective. The accuracy, popularity, and understandability of the information delivered must be ensured.

## 5 Conclusions

M3-related knowledge, attitudes, and behaviors of the surveyed population were poor. Action should be taken by health departments, dentists, schools, communities, and official media platforms to disseminate information about M3s in order to reduce the risks and prevent diseases associated with them.

### Data availability statement

All statistical data supporting the findings of this study are available within the paper, and the detailed questionnaire is available from the corresponding author upon reasonable request.

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### Author contributions

Honglei QU: conceptualization, data collection, and original draft preparation. Yang YANG: data curation, statistical analysis, and manuscript writing. Yi TIAN, Zhibang LI, and Lijuan SUN: experimental design and statistical analysis. Faming CHEN and Beimin TIAN: supervision, financial support, and manuscript writing and revision. All authors have read and approved the final manuscript, and therefore, have full access to all data in the study and are responsible for the integrity and security of the data.

### Compliance with ethics guidelines

Honglei QU, Yang YANG, Yi TIAN, Zhibang LI, Lijuan SUN, Faming CHEN, and Beimin TIAN declare that they have no conflicts of interest.

The research protocol strictly complies with the guidelines of the Helsinki Declaration and was approved by the Ethics Committee, School of Stomatology, the Fourth Military Medical University (No. IRB-REV-2017034). All respondents provided written informed consent.

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