



BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [info.bmjopen@bmj.com](mailto:info.bmjopen@bmj.com)

# BMJ Open

## Knowledge, attitude and practice toward myopia among parents of primary school students: A cross-sectional study

Journal:	BMJ Open
Manuscript ID	bmjopen-2024-093565
Article Type:	Original research
Date Submitted by the Author:	10-Sep-2024
Complete List of Authors:	Tian, Yujing; Affiliated Children’s Hospital of Jiangnan University, Department of Ophthalmology Yu, Yingqing; Affiliated Children’s Hospital of Jiangnan University, Department of Ophthalmology
Keywords:	Knowledge, Attitude, Parents, Myopia

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Supérieur (ABES).

**Knowledge, attitude and practice toward myopia among parents of primary school students: A cross-sectional study**

**Running title:** Parents' KAP on myopia

Yujing Tian<sup>¶\*</sup>, Yingqing Yu<sup>¶</sup>

Department of Ophthalmology, Affiliated Children's Hospital of Jiangnan University, 214023, Wuxi, Jiangsu, China

<sup>¶</sup>These authors contributed equally to this work.

**\*Corresponding author**

Yujing Tian

Department of Ophthalmology, Affiliated Children's Hospital of Jiangnan University, 214023, Wuxi, Jiangsu, China

E-mail: 601892303@qq.com

Tel: +86-13511646922

**Abstract**

**Background** Myopia is a common visual condition that requires proper management and prevention strategies, especially among children.

**Objective** To investigate the knowledge, attitude, and practice (KAP) toward myopia among parents of primary school students.

**Design** Cross-sectional study using a self-administered questionnaire.

**Participants/Setting** A total of 552 parents of primary school students participated in the study conducted between October and November 2022.

**Intervention** No intervention was applied; the study was observational, collecting data through questionnaires.

**Main Outcome Measures** Knowledge, attitude, and practice scores regarding myopia among parents.

**Statistical Analyses Performed** Statistical analysis was conducted to identify associations between demographic factors and KAP scores.

**Results** Mean scores for knowledge, attitude, and practice were  $8.38\pm2.29$ ,  $25.01\pm2.79$ , and  $26.37\pm3.96$ , respectively. Higher education, income, personal and child myopia, and having two children correlated with better knowledge. Female gender, higher income, personal myopia, and age 33-44 years were associated with positive attitudes. Better attitudes and having a child in the fourth grade linked with proactive practices.

**Conclusions** Parents showed positive attitudes and proactive practices but had inadequate knowledge about myopia. Targeted health education programs for parents with lower education and income levels are recommended to improve knowledge and foster positive attitudes toward myopia management.

**Keywords:** Knowledge, Attitude and Practice; Myopia; Refractive Errors; Parents; Primary School; Students

Enseignement Supérieur (ABES) .  
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

### Strengths and limitations of this study

- Large sample size provided robust data on myopia KAP among parents.
- Identified specific demographics needing targeted health education, enhancing intervention effectiveness.
- Cross-sectional design limits causal inference between KAP and demographic factors.
- Self-administered questionnaire may introduce bias due to self-reporting inaccuracies.

**Background**

Myopia, also known as short-sightedness or near-sightedness, is a common condition that typically starts in childhood when excessive elongation of the eye results in light from distant objects focused in front of the retina, resulting in blurred distance vision (1, 2). While myopia is one of the most prevalent eye diseases globally, the highest prevalence of myopia in school children has been reported in urban areas of Asia, including China (1). The prevalence of myopia among Chinese primary school students (aged 7-12) is 30.7% (3). Furthermore, the onset of myopia has shifted to a younger age, and the number of children diagnosed with high myopia has drastically increased in the past decades (3, 4). Myopia can lead to decreased productivity and reduced vision-related quality of life in children, and severe forms of myopia are associated with an increased risk of other ophthalmic problems, leading to visual impairment and blinding complications (1, 4, 5). Myopia in school-age children is a global public health problem, and strategies to prevent myopia and limit its progression are urgently needed.

A recent review on the epidemiology of myopia in school children worldwide found that the risk factors for myopia in this population include low outdoor time, continuous near work, dim light exposure, low sleep hours, and a reading distance of less than 25 cm (6). Additionally, the development of myopia increased during the coronavirus disease 2019 (COVID-19) pandemic in school children due to home confinement and decreased outdoor activities (3, 7). There is a growing body of evidence demonstrating that myopia risk can be managed by interventions such as increased time spent outdoors and other optical and pharmacological treatments (8-10). Parents are essential in managing myopia in school children. They influence their children's lifestyle choices, behavior modifications, and environmental exposure, which can prevent myopia. They can work with teachers and school administrators to ensure the classroom environment is conducive to good eye health. Parental involvement is crucial for successfully

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignement Supérieur (ABES).

managing myopia in children (11). Parents are also the main source of myopia information in school-age children (12). Therefore, awareness and practice of parents toward myopia have a strong impact on the prevention and treatment of myopia in school children.

A knowledge, attitude and knowledge (KAP) survey is a quantitative method that is widely used for health-related topics based on the principle that knowledge has an impact on behavior and practice of disease management (13). However, KAP of myopia among parents of primary school students has not been studied in China, the country with the highest risk for myopia. A better understanding of their KAP toward myopia can help develop strategies for improving myopia in school students.

Therefore, this study aimed to assess the KAP toward myopia among parents of primary school children and to investigate the factors associated with levels of KAP, which are valuable information in identifying parents who require further education on myopia.

## Methods

### Patient and public involvement

No patient involved

### Study design and participants

This cross-sectional study was conducted between October 2022 and November 2022 at Wuxi City, China, involving parents of students attending a primary school in the Liangxi District. Parents who declined to participate or did not have a clear understanding of the research procedures were excluded from the study. The study was ethically approved by the Wuxi Children's Hospital (approval number: WXCH2022-09-040) and informed consent was obtained from all participants. The report of this study was in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines(14).

### Procedures



The self-developed questionnaire was designed based on the *Application Standard for Detection and Prevention and Control of Myopia in Children and Adolescents Guidelines* by the Ophthalmology Professional Committee of China Association of Medical Equipment, the *Guidelines on Myopia Prevention and Treatment* by the National Health and Wellness Committee, and the *White Paper on Myopia Management* (15-17). The questionnaire underwent modifications based on feedback from three experts, including two ophthalmologists and one pedagogue, following its initial design. The results of the confirmatory factor analysis (Figure 1) showed that the CFI was 0.829 (>0.800 is good), the IFI was 0.830 (>0.800 is good), the TLI was 0.813 (>0.800 is good), and the CMIN/DF was 2.517 (>1; 1-3 is excellent, 3-5 is good)), indicating that the questionnaire has good reliability.

The questionnaire included four dimensions: 1) demographic information; 2) the knowledge dimension consists of 12 questions, participants received 1 point for each correct answer and 0 points for wrong or unclear answers, resulting in a possible score range of 0 to 12 points; 3) the attitude dimension included 9 questions using a five-point Likert scale ranging from “Very Positive (5 points)” to “Very Negative (1 point)”, and the scoring was reversed for the negative questions, and three questions (Question 6-8) were not included in the total score. Therefore, the possible score range for the attitude dimension was 6 to 30 points; 4) the practice dimension included 13 questions. Questions 1-3 were scored with 1 point for answering yes and 0 points for answering no. Questions 4-7 were descriptive only and were not scored. Questions 8-13 used a five-point Likert scale ranging from “Very Positive (5 points)” to “Very Negative (1 point)”, with the scoring reversed for the negative questions. The total score for the practice dimension ranged from 6 to 33 points. Higher scores are indicative of more adequate knowledge, more positive attitude, and more proactive practice.

The research team obtained permission from the headmaster of a primary school in the Liangxi district of Wuxi City to conduct a survey. Two trained research assistants explained the

questionnaire to teachers and provided them with training on conducting the survey. The teachers assisted in administering the questionnaire. An electronic version of the questionnaire was generated using the Wen Juan Xing (WJX) platform (<https://www.wjx.cn>), and a quick response code was created for participants to scan and access the survey via WeChat. To ensure accurate results, each IP address was only able to submit one response. The research team reviewed all completed questionnaires to check for completeness, internal consistency, and reasonableness. The Cronbach's  $\alpha$  score for the valid questionnaires was 0.729, indicating acceptable internal consistency.

### Statistical analyses

The sample size was calculated using the formula for cross-sectional studies:  $\alpha=0.05$ , where  $Z$  ( $1-\alpha/2$ ) = 1.96 when  $\alpha=0.05$ . The prevalence of myopia in Chinese children and adolescents is 37.3%, and  $\delta$  is an admissible error (which was 5% here) (3). The theoretical sample size was 449 which includes an extra 20% to allow for subjects drop-out during the study.

The statistical analyses software was SPSS 26.0 (IBM Corp., Armonk, N.Y., USA). Continuous data were expressed as mean  $\pm$  standard deviation (SD) and compared by t-test or ANOVA. The categorical data were presented as n (%). Pearson correlation was used to analyze the correlation between knowledge, attitude and practice scores. Univariate and multivariate logistic regression analyses were performed to analyze the risk factors of knowledge, attitude and practice levels. The cut-off value was set at 70% of the score distribution. A two-sided  $P<0.05$  was considered to be statistically significant.

## Results

### Participant demographics

Out of the 1,244 parents in the primary school, 643 questionnaires were returned after obtaining informed consent. However, 91 questionnaires were excluded due to incomplete responses. In

total, 552 valid questionnaires were collected. The results revealed that the majority of participants were female (79.5%), employed (78.1%), and had completed junior college or bachelor's degrees (77.7%). Additionally, 50.9% of participants fell in the 35-44 year-old age range, while 55.3% reported having only one child. Monthly household income per person was reported as 5,000-10,000 yuan for 33.2% of participants. The data also showed that myopia was prevalent among the study population, with 64% of parents and 38% of students reporting the condition, as shown in **Table 1**.

Enseignement Supérieur (ABES).  
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

**Table 1.** Baseline characteristics and KAP scores.

	N=552 (%)	Knowledge score		Attitude score		Practice score	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
<b>Total</b>		8.38±2.288		25.01±2.792		26.37±3.955	
<b>Gender</b>			0.646		0.007		0.116
Male	113(20.47)	8.29±2.166		24.38±2.720		25.85±4.084	
Female	439(79.53)	8.40±2.320		25.18±2.790		26.51±3.915	
<b>Age</b>			0.774		0.0496		0.822
<b>Less than 35 years old</b>	120(21.74)	8.28±2.046		25.55±2.517		26.18±4.107	
<b>35-44 years old</b>	281(50.91)	8.44±2.393		24.81±2.860		26.41±4.014	
<b>45 years old and above</b>	151(27.36)	8.34±2.280		24.97±2.834		26.46±3.736	
<b>Child's grade</b>			0.175		0.43		0.009
1	79(14.31)	8.63±1.995		25.41±2.550		27.29±3.371	
2	66(11.96)	8.41±2.000		25.45±2.142		27.64±3.418	
3	100(18.12)	8.26±2.410		25.00±3.005		26.13±3.946	
4	155(28.08)	8.54±2.118		24.87±2.718		25.85±4.232	
5	75(13.59)	8.55±2.479		24.85±3.199		26.03±3.763	
6	77(13.95)	7.78±2.698		24.69±2.953		26.04±4.275	
<b>Number of children</b>			0.002		0.041		0.858
0	305(55.25)	8.67±2.063		25.28±2.618		26.43±4.025	
1	206(37.32)	8.10±2.418		24.65±2.998		26.34±3.810	
≥2	41(7.43)	7.61±2.854		24.85±2.825		26.07±4.221	
<b>Education</b>			<0.001		0.087		0.003
High School / Technical secondary school and below	90(16.30)	7.00±2.727		24.38±2.951		25.08±4.217	
Junior college/Bachelor's degree	429(77.72)	8.64±2.092		25.14±2.733		26.57±3.909	
Master's degree and above	33(5.98)	8.82±2.113		25.12±2.955		27.33±3.058	
<b>Work Status</b>			0.004		0.422		0.805
Employed	431(78.08)	8.54±2.156		25.04±2.764		26.31±3.902	
Unemployed	37(6.70)	7.32±2.678		25.43±3.132		26.46±4.233	
Self-employed	55(9.96)	8.25±2.633		24.49±2.847		26.47±4.298	
Full-time homemaker	29(5.25)	7.62±2.555		25.00±2.659		27.03±3.850	
<b>Monthly Household Income Per Person, yuan</b>			0.01		0.048		0.034
<5000	76(13.77)	7.64±2.544		24.22±2.974		25.66±3.768	
5000-10000	183(33.15)	8.48±2.156		24.99±2.664		25.98±4.221	
10000-20000	170(30.80)	8.68±2.169		25.25±2.809		26.62±3.963	
>20000	123(22.28)	8.28±2.394		25.21±2.782		27.06±3.533	

<b>Are the parents nearsighted?</b>			<0.001	0.002	0.486
Yes	353(63.95)	8.70±2.144	25.30±2.613	26.28±3.798	
No	199(36.05)	7.82±2.428	24.50±3.023	26.53±4.225	
<b>Is the child nearsighted?</b>			0.002	0.608	0.111
Yes	210(38.04)	8.77±2.140	25.09±2.662	26.03±4.085	
No	342(61.96)	8.14±2.346	24.96±2.871	26.58±3.864	

SD, standard deviation.

For peer review only

Enseignement Supérieur (ABES) .  
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

### Knowledge, attitude, and practice toward myopia

The average knowledge score among participants was  $8.38 \pm 2.29$  (possible range: 0-12). Parents with only one child ( $P=0.002$ ), a master's degree or higher ( $P<0.001$ ), and employment ( $P=0.004$ ) had higher knowledge scores. In terms of attitude, participants had an average score of  $25.01 \pm 2.79$  (possible range: 6-30). Females ( $P=0.007$ ), those under 35 years old ( $P=0.0496$ ), parents with only one child ( $P=0.041$ ), a monthly household income per person of 10,000-20,000 yuan ( $P=0.048$ ), and those who were nearsighted ( $P=0.002$ ) tended to have higher attitude scores. Regarding practice, participants had an average score of  $26.37 \pm 3.96$  (possible range: 6-33). Parents with children in second grade ( $P=0.009$ ), a master's degree or higher ( $P=0.003$ ), and a monthly income of  $>20,000$  yuan ( $P=0.034$ ) had higher practice scores (**Table 1**).

Regarding the knowledge dimension, participants performed best on questions related to the brightness of electronic devices (with a correct rate of 95.8%) and indoor lighting when reading (92.4%). However, they struggled with questions related to the causes of myopia (with a correct rate of only 27.2%) and outdoor exercise (with a correct rate of 20.3%). In terms of attitude, participants generally exhibited a positive attitude, with the exception of the question about wearing glasses. Only 35.1% of respondents agreed (either "Extremely Positive" or "Positive") with the negative statement "I believe that glasses should only be worn when necessary to correct vision." Finally, with regard to the practice dimension, most participants reported positive practice, except for outdoor activities and reading while lying down (**Table 2**).

**Table 2.** Knowledge, attitudes and practices.

Knowledge	N		Correct (%)	Wrong/Unclear (%)	
1. Myopia is the result of overdevelopment of the eyeball, which is essentially a shortening of the eye axis.	552		402(72.83)		
2. The complications of high myopia are mainly fundus lesions, such as: retinal detachment, retinoblastoma, macular haemorrhage, macular fissure, etc.	225		172(76.44)		
3. Low-concentration atropine drops are effective in slowing the development of myopia.	225		285(126.67)		
4. Mydriasis are a routine form of eye examination and treatment.	225		183(81.33)		
5. To give your eyes adequate rest, get up and move around every 20 minutes when working and studying, and stand in front of a window and look 20 foot (6 meters) away for at least 20 seconds.	225		45(20.00)		
6. During home Internet classes, you should ensure that the room is well lit and adjust the brightness of your child's electronic devices appropriately, not too bright or too dark.	225		23(10.22)		
7. Outdoor exercise is also crucial to myopia prevention and control, but it is not matter whether the child is under daylight or not, he/she should be allowed to do more outdoor activities.	225		440(195.56)		
8. Children should not read at home in too much or too little light. Make sure that indoor lighting and eye protection lamps are on at the same time.	225		42(18.67)		
9. Wearing frame glasses is one of the best ways to control myopia, moreover, there have other options such as Keratoscope, as well as reducing close reading & learning and increasing outdoor activities.	225		49(21.78)		
10. If you need to do screen reading for a long time, you should wear anti-blue light glasses to block the harmful blue light to the eyes as much as possible.	225		90(40.00)		
11. When the eyes become tired and dry, you can blink more often to relieve, and if necessary, use artificial tears to relieve the symptoms of dry eyes.	225		81(35.99)		
12. A simple computerized optometry can accurately obtain the diopters of child with myopia.	225		186(82.67)		
Attitude	N (%)			Extremely Negative/Disagree	
	Extremely Positive/Agree	Positive/Agree	Neutral		
A1. I believe that glasses should only be worn when necessary to correct vision. (N)	62(11.23)	132(23.91)	91(16.49)	10(38.04)	57(10.33)
A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)	11(1.99)	15(2.72)	17(3.08)	79(50.54)	230(41.67)
A3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)	3(0.54)	2(0.36)	11(1.99)	76(31.88)	360(65.22)
A4. I fully support promoting the importance of vision protection for primary and secondary school students. (P)	430(77.90)	104(18.84)	16(2.90)	0(0.00)	2(0.36)
A5. If a "vision protection" parent-child activity is offered by the school or	335(60.69)	167(30.25)	46(8.33)	0(0.54)	1(0.18)



community, I would be interested in participating. (P)

A6. I am concerned that my child's myopia may impact their future life and studies.

330(59.78) 165(29.89) 38(6.88) 5(2.72) 4(0.72)

A7. I am worried that my child's myopia may affect their appearance.

273(49.46) 165(29.89) 74(13.41) 5(6.34) 5(0.91)

A8. I am concerned that my child's myopia may lead to low self-esteem.

112(20.29) 75(13.59) 217(39.33) 26(22.83) 22(3.99)

A9. If I am nearsighted, I think that glasses should only be worn when necessary, but not necessarily all day. (N)

20(3.62) 71(12.86) 64(11.59) 62(47.46) 135(24.46)

Practice	N (%)				
	Yes	No			
P1. Encourage your child to participate in outdoor activities for at least 2 hours a day.	208(37.68)	344(62.32)	-	-	-
P2. Supervise your child to perform eye exercises regularly.	334(60.51)	218(39.49)	-	-	-
P3. Attend scientific lectures or activities on children's and adolescents' vision health.	316(57.25)	236(42.75)	-	-	-
	Always	Often	Sometimes	Rarely	Never
P4. Take your child for optical coherence tomography once a year.	118(21.38)	216(39.13)	129(23.77)	89(16.12)	-
P5. Ensure a balanced diet that includes eggs, meat, fish, or animal liver.	11(1.99)	200(36.23)	167(30.55)	174(31.52)	-
P6. Provide dairy or soy products for your child.	6(1.09)	128(23.19)	158(28.82)	260(47.10)	-
P7. Offer plenty of fresh vegetables and fruits.	3(0.54)	58(10.51)	151(27.56)	340(61.59)	-
	Extremely Positive	Positive	Neutral	Negative	Extremely Negative
P8. Supervise your child's reading and writing posture.	181(32.79)	254(46.01)	101(18.50)	14(2.54)	2(0.36)
P9. Discourage your child from using electronic devices such as television, cell phone, or tablet computer in the dark.	364(65.94)	142(25.72)	29(5.25)	12(2.17)	5(0.91)
P10. Do not allow your child to lie down while reading books or using electronic devices.	149(26.99)	90(16.30)	58(10.51)	48(8.70)	207(37.50)
P11. Discourage your child from reading books or looking at electronic products during mobile transportation (bus, car).	360(65.22)	136(24.64)	42(7.61)	7(1.27)	7(1.27)
P12. Discourage your child from rubbing their eyes.	286(51.81)	176(31.88)	68(12.33)	14(2.54)	8(1.45)
P13. Encourage your child to take breaks and relax their eyes during class breaks.	275(49.82)	172(31.16)	77(13.99)	24(4.35)	4(0.72)

“P” indicates a positive statement, while “N” indicates a negative statement. It's important to note that the scores for questions marked with N have

been adjusted based on different assignment bases, and therefore are not a direct result of selection.



Correlation analyses

Pearson correlation analyses showed a significant positive correlation was found between knowledge-attitude ( $r=0.334$ ,  $P<0.001$ ), knowledge-practice ( $r=0.237$ ,  $P<0.001$ ), and attitude-practice ( $r=0.322$ ,  $P<0.001$ ) (Table 3).

Table 3. Pearson correlation analyses.

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.334( $P<0.001$ )	1	
Practice	0.237( $P<0.001$ )	0.322( $P<0.001$ )	1

Risk factors associated with knowledge, attitude, and practice toward myopia

Multivariate logistic regression showed that having a junior college or bachelor’s degree (odd ratio [OR]=3.072, 95% confidence interval [CI]: 1.566-6.025,  $P=0.001$ ), having a master’s degree or above (OR=6.259, 95%CI=2.327-16.835,  $P<0.001$ ), having monthly household income per person of 10,000-20,000 yuan (OR=1.999, 95% CI: 1.029-3.883,  $P=0.041$ ), being nearsighted (OR=1.547, 95% CI: 1.028-2.330,  $P=0.037$ ), having a nearsighted child (OR=1.923, 95% CI: 1.314-2.813,  $P=0.001$ ), and having two children (OR=0.650, 95% CI: 0.434-0.974,  $P=0.037$ ) were independent associated with adequate knowledge. Knowledge (OR=1.239, 95% CI: 1.131-1.357,  $P<0.001$ ), being female (OR=2.080, 95% CI: 1.307-3.310,  $P=0.002$ ), having monthly household income per person of 10,000-20,000 yuan (OR=1.842, 95% CI: 1.010-3.359,  $P=0.046$ ), having monthly household income per person over 20,000 yuan (OR=2.296, 95% CI: 1.211-4.351,  $P=0.011$ ), being nearsighted (OR=1.549, 95% CI: 1.056-2.273,  $P=0.025$ ), and being aged 33-44 years old (OR=0.533, 95% CI: 0.334-0.851,  $P=0.008$ ) were independent associated with positive attitude. Attitude (OR=1.163, 95% CI: 1.076-1.258,  $P<0.001$ ), and

Enseignement Supérieur (ABES) .  
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

1  
2  
3 having a child in the fourth grade (OR=0.478, 95% CI: 0.265-0.859, P=0.014) were  
4  
5 independently associated with proactive attitude (**Table 4**).  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 4.** Univariate and multivariate logistic regression analyses.

Knowledge	Univariate logistic regression		Multivariate logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
<b>Gender</b>				
Male	ref			
Female	1.110(0.717-1.717)	0.640		
<b>Age</b>				
Less than 35 years old	ref			
35-44 years old	1.307(0.830-2.058)	0.248		
45 years old and above	1.133(0.680-1.888)	0.631		
<b>Child's grade</b>				
1	ref			
2	0.985(0.500-1.942)	0.966		
3	0.928(0.502-1.717)	0.813		
4	1.031(0.588-1.807)	0.915		
5	1.283(0.672-2.451)	0.450		
6	0.526(0.262-1.058)	0.071		
<b>Number of siblings</b>				
0	ref		ref	
1	0.614(0.421-0.895)	0.011	0.650(0.434-0.974)	0.037
≥2	0.535(0.259-1.108)	0.092	0.655(0.301-1.423)	0.655
<b>Education</b>				
High School / Technical secondary school and below	ref		ref	
Junior college/Bachelor's degree	3.739(2.013-6.943)	<0.001	3.072(1.566-6.025)	0.001
Master's degree and above	6.293(2.557-15.491)	<0.001	6.259(2.327-16.835)	<0.001
<b>Work Status</b>				
Employed	ref		ref	
Unemployed	0.387(0.166-0.902)	0.028	0.720(0.290-1.785)	0.478
Self-employed	0.876(0.486-1.579)	0.661	1.295(0.677-2.477)	0.434
Full-time homemaker	0.633(0.274-1.461)	0.284	0.876(0.359-2.141)	0.772
<b>Monthly household income per person</b>				
<5000	ref		ref	
5000-10000	2.166(1.156-4.059)	0.016	1.859(0.960-3.596)	0.066
10000-20000	2.689(1.432-5.050)	0.002	1.999(1.029-3.883)	0.041
>20000	1.944(0.999-3.783)	0.050	1.452(0.716-2.947)	0.301
<b>Are the parents nearsighted?</b>				
Yes	2.023(1.380-2.965)	<0.001	1.547(1.028-2.330)	0.037
No	ref		ref	
<b>Is the child nearsighted?</b>				
Yes	1.784(1.249-2.550)	0.01	1.923(1.314-2.813)	0.001
No	ref		ref	
<b>Attitude</b>				
<b>Knowledge score</b>	1.265(1.161-1.379)	<0.001	1.239(1.131-1.357)	<0.001

<b>Gender</b>					
Male	ref		ref		
Female	2.083(1.357-3.198)	0.001	2.080(1.307-3.310)		0.002
<b>Age</b>					
Less than 35 years old	ref		ref		
35-44 years old	0.629(0.408-0.970)	0.036	0.533(0.334-0.851)		0.008
45 years old and above	0.581(0.358-0.943)	0.028	0.632(0.372-1.074)		0.090
<b>Child's grade</b>					
1	ref				
2	1.170(0.608-2.253)	0.639			
3	1.145(0.634-2.067)	0.654			
4	0.988(0.574-1.698)	0.964			
5	0.949(0.505-1.786)	0.872			
6	0.589(0.311-1.115)	0.104			
<b>Number of siblings</b>					
0	ref				
1	0.751(0.527-1.070)	0.113			
≥2	0.772(0.402-1.485)	0.439			
<b>Education</b>					
High School / Technical secondary school and below	ref		ref		
Junior college/Bachelor's degree	1.870(1.170-2.988)	0.009	1.172(0.691-1.989)		0.556
Master's degree and above	2.073(0.924-4.651)	0.077	1.231(0.495-3.065)		0.655
<b>Work Status</b>					
Employed	ref				
Unemployed	1.031(0.527-2.019)	0.928			
Self-employed	0.756(0.430-1.331)	0.333			
Full-time homemaker	0.794(0.373-1.690)	0.549			
<b>Monthly household income per person</b>					
<5000	ref		ref		
5000-10000	1.540(0.886-2.676)	0.126	1.230(0.685-2.207)		0.488
10000-20000	2.141(1.225-3.741)	0.008	1.842(1.010-3.359)		0.046
>20000	2.478(1.373-4.472)	0.003	2.296(1.211-4.351)		0.011
<b>Are the parents nearsighted?</b>					
Yes	1.875(1.317-2.668)	<0.001	1.549(1.056-2.273)		0.025
No	ref		ref		
<b>Is the child nearsighted?</b>					
Yes	1.024(0.726-1.443)	0.894			
No	ref				
<b>Practice</b>					
<b>Knowledge score</b>	1.128(1.033-1.231)	0.007	1.062(0.962-1.172)		0.233
<b>Attitude score</b>	1.187(1.103-1.277)	<0.001	1.163(1.076-1.258)		<0.001
<b>Gender</b>					
Male	ref				
Female	1.147(0.730-1.803)	0.552			
<b>Age</b>					
Less than 35 years old	ref				
35-44 years old	0.942(0.598-1.485)	0.798			
45 years old and above	0.822(0.490-1.379)	0.459			

<b>Child's grade</b>					
1	ref		ref		
2	1.172(0.608-2.262)	0.636	1.205(0.616-2.359)		0.586
3	0.541(0.291-1.005)	0.052	0.576(0.305-1.086)		0.088
4	0.445(0.251-0.790)	0.006	0.478(0.265-0.859)		0.014
5	0.481(0.244-0.949)	0.035	0.512(0.253-1.033)		0.062
6	0.496(0.254-0.971)	0.041	0.576(0.288-1.150)		0.118
<b>Number of siblings</b>					
0	ref				
1	0.945(0.647-1.380)	0.770			
≥2	0.577(0.265-1.254)	0.165			
<b>Education</b>					
High School / Technical secondary school and below	ref		ref		
Junior college/Bachelor's degree	1.714(1.002-2.929)	0.049	1.284(0.723-2.281)		0.393
Master's degree and above	2.275(0.966-5.360)	0.060	1.751(0.713-4.297)		0.222
<b>Work Status</b>					
Employed	ref				
Unemployed	1.214(0.600-2.457)	0.590			
Self-employed	1.090(0.599-1.985)	0.778			
Full-time homemaker	1.179(0.534-2.605)	0.683			
<b>Monthly household income per person</b>					
<5000	ref				
5000-10000	0.598(0.317-1.131)	0.114			
10000-20000	0.694(0.425-1.133)	0.144			
>20000	0.979(0.603-1.590)	0.933			
<b>Are the parents nearsighted?</b>					
Yes	0.955(0.658-1.387)	0.808			
No	ref				
<b>Is the child nearsighted?</b>					
Yes	0.716(0.491-1.045)	0.083			
No	ref				

Abbreviation: OR: odd ratio; CI: confidence interval; ref: reference.

## Discussion

This study found that parents of primary school students had inadequate knowledge, positive attitude, and proactive practice regarding myopia, which might provide valuable insights for future intervention studies to enhance myopia education and promoting better eye health for children.

McCrann et al. reported that 76% of parents of school children recognized the potential health risk of digital technology on the eye (11). One study conducted in rural China by Li et al highlighted that some parents have no clear idea of what myopia was and only a small number knew the anatomical definition of the condition (18), another study comparing myopia control perceptions between parents in the United Kingdom and Hong Kong also found low awareness of the effects of myopia, especially in the United Kingdom (19), which were consistent with the finding in the present study . In the present study, the knowledge among parents was suboptimal, they correctly understood the impact of electronic devices and indoor lighting, but they have poorer knowledge of the cause of myopia and the impact of outdoor exercises. The vast majority agreed that wearing glasses is one of the best ways to control myopia, however, in Li's study, parents had the misconception that glasses-wearing should be delayed in children, and it might be harmful to the eyes(18). This discrepancy can be explained by that the study was conducted in an urban region and parents might have had higher awareness.

He et al.'s study on parents of primary school students also revealed that family income and parents' education level significantly affected their myopia knowledge (20). Furthermore, parents with myopia might have more related knowledge through their experience and they might have more opportunities to seek information from professionals. Therefore, educational interventions need to focus on parents with no myopia history and those whose children have no myopia, as well as parents with lower income and education levels.

One similar survey study conducted in Ireland found parental attitudes to myopia were nonchalant (11). Only 14% of parents of school children expressed that they would be concerned if their children were diagnosed with myopia, and 46% considered myopia presents a health risk to their children (11). The lack of parental concern in the previous study might be due to the low myopia prevalence in Ireland: only 10% of the children had myopia, compared to around 40% in the present study. McCrann et al. also found that myopic parents considered myopia as more of an inconvenience and were more likely to consider limiting screen time (11). Parents' attitudes toward children's visual care were associated with a lower risk of myopia in children, and it is of great importance to enhance their attitude toward myopia (21).

Jiang et al.'s study on parents' intention toward preschool children's myopia-prevention behaviors also found that parental attitude was associated with their myopia-preventive behaviors (22). Parental beneficial behaviors (e.g., spending less time on near work and electronic device use) are positively associated with children's myopia (23). The practice score was adequate in this study. Furthermore, a higher attitude score was significantly associated with better practice scores. This finding reaffirmed the relationship between knowledge, attitude and practice, and that adequate knowledge can lead to a positive attitude to inform better practice (24, 25). This study also found significant correlations between knowledge-attitude, knowledge-practice, and attitude-practice. In the practice dimension, most parents answered positively, except on the items of outdoor activities and reading while lying down.

However, there were several limitations in this study. First, this study was conducted in a single school in China and the results might not be generalized other cities. Second, due to the self-reporting nature of the study, the results might deviate from the actual practice. Furthermore, most participants provided positive answers in the attitude and practice dimensions, and the results might be affected by the social desirability bias. Third, 44% of the parents in the selected school returned a valid survey, and there might be non-response bias.

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.  
Enseignement Supérieur (ABES)

## Conclusions

In conclusion, parents of primary school students had inadequate knowledge, positive attitude, and proactive practice toward myopia. Education programs focusing on the causes and risk factors of myopia, prevention measures, and early detection and treatment should be designed and implemented in this population. To improve knowledge and foster positive attitudes toward myopia, there is a need for health education programs that target parents with lower education and income levels. Efforts should be made to promote positive attitudes toward myopia by highlighting the benefits of outdoor activities and limiting screening time. In addition, healthcare professionals should encourage parents to take proactive measures such as scheduling regular eye check-ups and creating a myopia-friendly environment at home.



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**List of abbreviations**

KAP, knowledge, attitude, and practice

STROBE, Strengthening the Reporting of Observational Studies in Epidemiology

SD, standard deviation

**Declarations**

**Ethics approval and consent to participate**

The study was ethically approved by Wuxi Children's Hospital (approval number: WXCH2022-09-040) and informed consent was obtained from all participants. All methods were performed in accordance with the relevant guidelines and regulations

**Availability of data and materials**

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

**Competing interests**

The authors declare that they have no competing interests

**Funding**

This study was supported by the Guiding Project of Wuxi Science and Technology Bureau (NZ2021014). The funders had no role in study design, data collection and analyses, decision to publish, or preparation of the manuscript.

**Authors' contributions**

Yujing Tian and Yingqing Yu carried out the studies, participated in collecting data, and drafted the manuscript. Yujing Tian and Yingqing Yu performed the statistical analyses and participated in its design. Yujing Tian and Yingqing participated in acquisition, analyses, or interpretation of data and draft the manuscript. All authors read and approved the final manuscript.

**Acknowledgements**

Not applicable

## References

1. Morgan IG, Ohno-Matsui K, Saw SM. Myopia. *Lancet* (London, England). 2012;379(9827):1739-48.
2. Baird PN, Saw SM, Lanca C, Guggenheim JA, Smith Iii EL, Zhou X, et al. Myopia. *Nature reviews Disease primers*. 2020;6(1):99.
3. Dong L, Kang YK, Li Y, Wei WB, Jonas JB. PREVALENCE AND TIME TRENDS OF MYOPIA IN CHILDREN AND ADOLESCENTS IN CHINA: A Systemic Review and Meta-Analysis. *Retina* (Philadelphia, Pa). 2020;40(3):399-411.
4. Jones D, Luensmann D. The prevalence and impact of high myopia. *Eye & contact lens*. 2012;38(3):188-96.
5. Sankaridurg P, Tahhan N, Kandel H, Naduvilath T, Zou H, Frick KD, et al. IMI Impact of Myopia. *Investigative ophthalmology & visual science*. 2021;62(5):2.
6. Grzybowski A, Kanclerz P, Tsubota K, Lanca C, Saw SM. A review on the epidemiology of myopia in school children worldwide. *BMC ophthalmology*. 2020;20(1):27.
7. Wang J, Li Y, Musch DC, Wei N, Qi X, Ding G, et al. Progression of Myopia in School-Aged Children After COVID-19 Home Confinement. *JAMA ophthalmology*. 2021;139(3):293-300.
8. He M, Xiang F, Zeng Y, Mai J, Chen Q, Zhang J, et al. Effect of Time Spent Outdoors at School on the Development of Myopia Among Children in China: A Randomized Clinical Trial. *Jama*. 2015;314(11):1142-8.
9. Wu PC, Tsai CL, Wu HL, Yang YH, Kuo HK. Outdoor activity during class recess reduces myopia onset and progression in school children. *Ophthalmology*. 2013;120(5):1080-5.
10. Smith MJ, Walline JJ. Controlling myopia progression in children and adolescents.

Adolescent health, medicine and therapeutics. 2015;6:133-40.

11. McCrann S, Flitcroft I, Lalor K, Butler J, Bush A, Loughman J. Parental attitudes to myopia: a key agent of change for myopia control? *Ophthalmic & physiological optics : the journal of the British College of Ophthalmic Opticians (Optometrists)*. 2018;38(3):298-308.
12. Almujailli AA, Almatrafi AA, Aldael AA, Almojali HA, Almujailli AI, Pathan A. Knowledge, attitude, and practice about myopia in school students in Marat city of Saudi Arabia. *Journal of family medicine and primary care*. 2020;9(7):3277-80.
13. Ahmed T, Hussain S, Zia UU, Rinchen S, Yasir A, Ahmed S, et al. Knowledge, attitude and practice (KAP) survey of canine rabies in Khyber Pakhtunkhwa and Punjab Province of Pakistan. *BMC public health*. 2020;20(1):1293.
14. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ (Clinical research ed)*. 2007;335(7624):806-8.
15. China TNHawCotPsRo. Guidelines on myopia prevention and treatment. 2018;6(5).
16. Equipment OPCoCAoM. Application standard for detection and prevention and control of myopia in children and adolescents. *Chin J Ophthalmol Med*. 2018;8(6):276-88.
17. Jiang J. White paper on myopia management. *Chinese Journal of Optometry Ophthalmology and Visual Science*. 2019;21(3):161-5.
18. Li L, Lam J, Lu Y, Ye Y, Lam DS, Gao Y, et al. Attitudes of students, parents, and teachers toward glasses use in rural China. *Archives of ophthalmology (Chicago, Ill : 1960)*. 2010;128(6):759-65.
19. Dias L, Brennan N, Sulley A. A comparison of myopia control perceptions between parents in UK and Hong Kong. *Contact Lens and Anterior Ey*. 2018;41:S33.
20. He AQ, Liu SA, He SY, Yao H, Chen P, Li Y, et al. Investigation of children's habits

of smartphone usage and parental awareness of myopia control in underdeveloped areas of China. *International journal of ophthalmology*. 2022;15(10):1691-8.

21. Zhou S, Yang L, Lu B, Wang H, Xu T, Du D, et al. Association between parents' attitudes and behaviors toward children's visual care and myopia risk in school-aged children. *Medicine*. 2017;96(52):e9270.

22. Jiang N, Chen J, Cao H, Liu Y, Zhang Y, Wang Q, et al. Parents' intentions toward preschool children's myopia preventive behaviors: Combining the health belief model and the theory of planned behavior. *Frontiers in public health*. 2022;10:1036929.

23. Liu YL, Jhang JP, Hsiao CK, Tsai TH, Wang IJ. Influence of parental behavior on myopigenic behaviors and risk of myopia: analysis of nationwide survey data in children aged 3 to 18 years. *BMC public health*. 2022;22(1):1637.

24. ul Haq N, Hassali MA, Shafie AA, Saleem F, Farooqui M, Haseeb A, et al. A cross-sectional assessment of knowledge, attitude and practice among Hepatitis-B patients in Quetta, Pakistan. *BMC public health*. 2013;13:448.

25. Evans G, Durant J. The relationship between knowledge and attitudes in the public understanding of science in Britain. *Public Understanding of Science*. 1995;4(1):57-74.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Figure Legends**

Figure 1 Confirmatory factor analysis for KAP.

For peer review only

Enseignement Supérieur (ABES) .  
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only

For peer review only

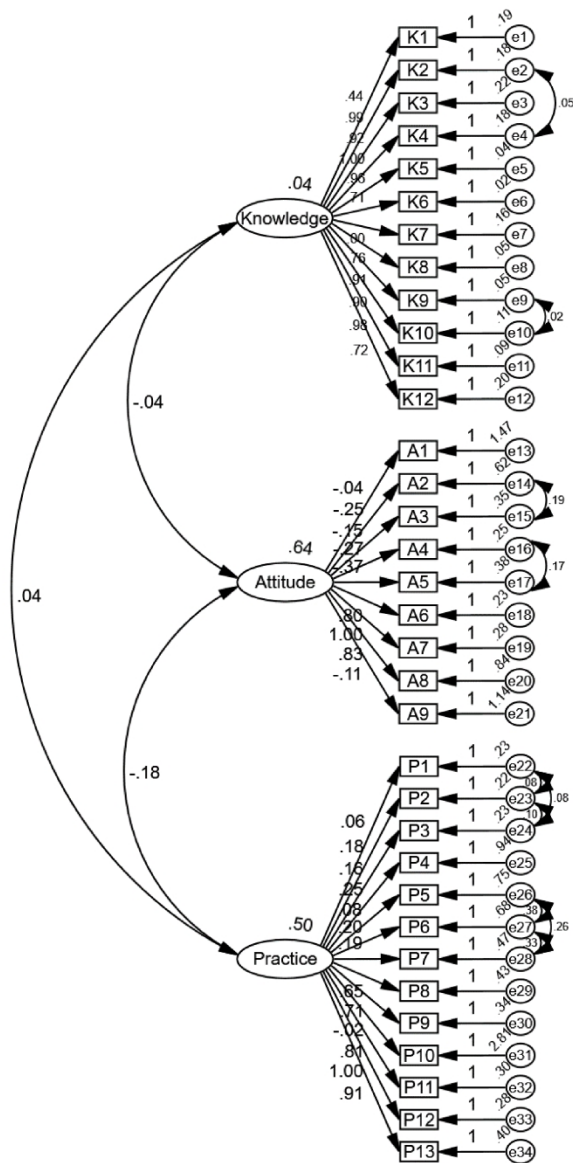


Figure 1 Confirmatory factor analysis for KAP

170x287mm (300 x 300 DPI)



# BMJ Open

**Knowledge, attitude, and practice toward myopia among  
parents of primary school students: A cross-sectional study**

Journal:	BMJ Open
Manuscript ID	bmjopen-2024-093565.R1
Article Type:	Original research
Date Submitted by the Author:	04-Jan-2025
Complete List of Authors:	Tian, Yujing; Children's Hospital Affiliated to Jiangnan University, Department of Ophthalmology Yu, Yingqing; Affiliated Children's Hospital of Jiangnan University, Department of Ophthalmology
<b>Primary Subject Heading</b>:	Ophthalmology
Secondary Subject Heading:	Ophthalmology
Keywords:	Knowledge, Attitude, Parents, Myopia

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignement Supérieur (ABES).

**Knowledge, attitude, and practice toward myopia among parents of primary school students: A cross-sectional study**

**Running title:** Parents' KAP on myopia

Yujing Tian<sup>¶\*</sup>, Yingqing Yu<sup>¶</sup>

Department of Ophthalmology, Affiliated Children's Hospital of Jiangnan University, 214023, Wuxi, Jiangsu, China

<sup>¶</sup>These authors contributed equally to this work.

**\*Corresponding author**

Yujing Tian

Department of Ophthalmology, Affiliated Children's Hospital of Jiangnan University, 214023, Wuxi, Jiangsu, China

E-mail: 601892303@qq.com

Tel: +86-15061871190

**Abstract**

**Background** Myopia is a common visual condition that requires proper management and prevention strategies, especially among children.

**Objective** To investigate the knowledge, attitude, and practice (KAP) toward myopia among parents of primary school students.

**Design** Cross-sectional study using a self-administered questionnaire.

**Participants/Setting** A total of 552 parents of primary school students participated in the study, which was conducted at a primary school in Wuxi City, China between October and November 2022.

**Intervention** No intervention was applied; the study was observational, collecting data through questionnaires.

**Main Outcome Measures** Knowledge, attitude, and practice scores regarding myopia among parents.

**Statistical Analyses Performed** Statistical analysis was conducted to identify associations between demographic factors and KAP scores.

**Results** Mean scores for knowledge, attitude, and practice were 8.38±2.29 (theoretical minimum-maximum: 0-12), 25.01±2.79 (theoretical minimum-maximum: 6-30), and 26.37±3.96 (theoretical minimum-maximum: 6-33), respectively. Higher education, income, personal and child myopia, and having two children correlated with better knowledge. Parental female gender, higher income, myopia, and age 33-44 years were associated with positive attitudes. Better attitudes and having a child in the fourth grade are linked with proactive practices.

**Conclusions** Parents showed positive attitudes and proactive practices but had inadequate knowledge about myopia. Targeted health education programs for parents with lower education and income levels are recommended to improve knowledge and maintain positive attitudes

toward myopia management.

**Keywords:** Knowledge, Attitude and Practice; Myopia; Refractive Errors; Parents; Primary School; Students

### **Strengths and limitations of this study**

- Identified specific demographics needing targeted health education, enhancing intervention effectiveness.
- Cross-sectional design limits causal inference between KAP and demographic factors.
- Self-administered questionnaires may introduce bias due to self-reporting inaccuracies.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Background**

Myopia is a common condition that typically starts in childhood, resulting in light from distant objects focusing in front of the retina and blurred distance vision [1, 2]. While myopia is one of the most prevalent eye diseases globally, the highest prevalence of myopia in school children has been reported in urban areas of Asia, including China [1]. The prevalence of myopia among Chinese primary school students (aged 7-12) is 30.7%-52.7% [3-6]. Furthermore, the onset of myopia has shifted to a younger age, and the number of children diagnosed with high myopia has drastically increased in the past decades [3, 7]. Myopia can lead to decreased productivity and reduced vision-related quality of life in children, and severe forms of myopia are associated with an increased risk of other ophthalmic problems, leading to visual impairment and blinding complications [1, 7, 8]. Myopia in school-age children is a global public health problem, and strategies to prevent myopia and limit its progression are urgently needed.

A recent review on the epidemiology of myopia in school children worldwide found that the risk factors for myopia in this population include low outdoor time, continuous near work, dim light exposure, insufficient sleep, and a reading distance of less than 25 cm [9]. On the other hand, Biswas et al. [10] identified excessive near work as the sole solid risk factor for myopia, while other factors like visual environment, circadian rhythm, sleep, nutrition, smoking, socioeconomic status, and education remain debatable. Additionally, the development of myopia increased during the coronavirus disease 2019 (COVID-19) pandemic in school children due to home confinement and decreased outdoor activities [3, 11]. There is a growing body of evidence demonstrating that myopia risk can be managed by interventions such as increased time spent outdoors and other optical and pharmacological treatments [12-14]. Parents are essential in managing myopia in school children [15]. They influence their children's lifestyle choices, behavior modifications, and environmental exposure, which can prevent myopia. They can work with teachers and school administrators to ensure the classroom

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignement Supérieur (ABES).

environment is conducive to good eye health. Parental involvement is crucial for successfully managing myopia in children [16]. Parents are also the main source of information about myopia in school-age children [17]. Still, a study in China showed that most parents misunderstood the influence of the environment and sports and extracurricular activities on myopia [18]. Although a previous study showed that Indian optometrists had gaps in knowledge regarding childhood myopia [19], preventing the effective transfer of accurate knowledge, the possible knowledge gap in parents remains poorly understood. It is particularly important to study since the awareness and practice of parents toward myopia have a strong impact on the prevention and treatment of myopia in school children.

A knowledge, attitude, and practice (KAP) survey is a quantitative method that is widely used for health-related topics based on the principle that knowledge has an impact on behavior and practice of disease management [20]. Despite China having the highest risk for myopia, the KAP of parents of primary school students regarding myopia remain understudied in China. Only one study has reported that parents or guardians of children demonstrated adequate knowledge, positive attitudes, and proactive practices in preventing and managing childhood myopia. However, this study did not specifically target parents of primary school students [21]. Gaining a better understanding of their KAP can inform strategies to improve myopia prevention and management among school students. A better understanding of their KAP toward myopia can help develop strategies for improving myopia in school students. Therefore, this study aimed to assess the KAP toward myopia among parents of primary school children and to investigate the factors associated with levels of KAP, which are valuable information in identifying parents who require further education on myopia.

## Methods

### Patient and public involvement

1  
2  
3 The parents of primary school students were included in this study as participants, but they were  
4  
5 not involved in the study design.  
6

7  
8 **Study design and participants**  
9

10 This cross-sectional study was conducted between October 2022 and November 2022 in Wuxi  
11  
12 City, China, involving parents of students attending a primary school in the Liangxi District.  
13  
14 The school is located in a city center, and the socioeconomic status is intermediate in the study  
15  
16 area. It was selected because it was one of the myopia prevention and control experimental units  
17  
18 of Wuxi Children's Hospital. Parents who declined to participate or did not have a clear  
19  
20 understanding (self-reported) of the research procedures were excluded from the study. The  
21  
22 study was ethically approved by the Wuxi Children's Hospital (approval number: WXCH2022-  
23  
24 09-040), and informed consent was obtained from all participants. The report of this study was  
25  
26 in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology  
27  
28 (STROBE) guidelines[22].  
29  
30  
31  
32

33 **Procedures**  
34

35 The study questionnaire was self-developed based on two guidelines and one white paper that  
36  
37 are applied in China [23-25]. The questionnaire underwent modifications based on feedback  
38  
39 from three experts, including two ophthalmologists and one teacher, following its initial design.  
40  
41 The questionnaire included four dimensions (Supplementary Materials): the demographic  
42  
43 information, knowledge dimension, attitude dimension, and practice dimension. The  
44  
45 knowledge dimension consisted of 12 questions, scoring 1 point for each correct answer and 0  
46  
47 points for wrong answers, resulting in a possible score range of 0 to 12 points. The attitude  
48  
49 dimension included nine questions scored using a five-point Likert scale ranging from “Very  
50  
51 Positive (5 points)” to “Very Negative (1 point)”, and the scoring was reversed for the negative  
52  
53 questions, and three questions (Question 6-8) were not included in the total score. Therefore,  
54  
55 the possible score range for the attitude dimension was 6 to 30 points. The practice dimension  
56  
57  
58  
59  
60



included 13 questions. Questions 1-3 were scored with 1 point for answering yes and 0 points for answering no. Questions 4-7 were descriptive only and were not scored. Questions 8-13 used a five-point Likert scale ranging from “Very Positive (5 points)” to “Very Negative (1 point)”, with the scoring reversed for the negative questions. The total score for the practice dimension ranged from 6 to 33 points. Higher scores are indicative of more adequate knowledge, a more positive attitude, and more proactive practice. For the quantitative analysis of participants' KAP, scores were assigned based on their responses to the knowledge, attitude, and practice dimensions by the statistician.

The research team obtained permission from the headmaster of a primary school in the Liangxi district of Wuxi City to conduct a survey. Two trained research assistants explained the questionnaire to teachers and provided them with training about the objective and how to answer the questions. The teachers assisted in administering the questionnaire. An electronic version of the questionnaire was generated using the Wen Juan Xing (WJX) platform (<https://www.wjx.cn>), and a quick response code was created for the parents to scan and access the survey via WeChat. To ensure no duplicate results, each IP address was only able to submit one response. The research team reviewed all questionnaires to check for completeness, internal consistency, and reasonableness based on the absence of impossible or out-of-range data or a questionnaire completed using all the same options (e.g., all first choices). The Cronbach's  $\alpha$  score for the valid questionnaires was 0.729, indicating acceptable internal consistency [26].

### Statistical analyses

The minimal sample size was estimated using Cochran's sample size formula for survey studies [27]:

$$n = \frac{Z^2 \times p(1 - p)}{e^2}$$

where  $Z^2$  is the confidence coefficient,  $p$  is the proportion, and  $e$  is the margin of error. The sample size is maximized when  $p=0.5$ . A 95% confidence interval involves a  $Z$ -value of 1.96. Precision was assumed at 5%. Hence, a minimum of 385 participants were needed.

The statistical analysis software was SPSS 26.0 (IBM Corp., Armonk, N.Y., USA). A confirmatory factor analysis (CFA) was performed to examine the reliability of the questionnaire by calculating the confirmatory factor index (CFI) ( $>0.800$  is considered good), the incremental factor index (IFI) ( $>0.800$  is considered good), the Tucker-Lewis index (TLI) ( $>0.800$  is considered good), and the minimum discrepancy divided by its degrees of freedom (CMIN/DF) ( $>1$ ; 1-3 is considered excellent, 3-5 is considered good) [28]. Continuous data confirmed to follow a normal distribution are expressed as mean  $\pm$  standard deviation (SD) and compared using t-test or ANOVA. Continuous data confirmed to follow a skewed distribution are expressed as median (Q1, Q3) and compared using the Wilcoxon rank-sum test or Kruskal-Wallis H test. The categorical data were presented as  $n$  (%). Spearman correlation was used to analyze the correlation between knowledge, attitude, and practice scores. Univariate and multivariate logistic regression analyses were performed to analyze the risk factors of knowledge, attitude, and practice levels. The KAP scores were dichotomized as poor/good knowledge, negative/positive attitudes, and poor/proactive practices based on a cutoff of  $\geq 70\%$  of the total score for each dimension (i.e., 8.4 for knowledge, 21 for attitudes, and 23.1 for practice). A two-sided  $P<0.05$  was considered to be statistically significant.

**Results**

**Questionnaire validation**

The CFA (Figure 1) showed that the CFI was 0.829 ( $>0.800$  is good), the IFI was 0.830 ( $>0.800$  is good), the TLI was 0.813 ( $>0.800$  is good), and the CMIN/DF was 2.517 ( $>1$ ; 1-3 is excellent, 3-5 is good), indicating that the questionnaire had good reliability.

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.  
Enseignement Supérieur (ABES).

## Participant demographics

Out of the 1244 parents in the primary school, 643 (51.69%) questionnaires were returned after obtaining informed consent. However, 91 (7.3%) questionnaires were excluded due to incomplete responses. In total, 552 (44.4%) valid questionnaires were collected. The results revealed that the majority of the parents were female (79.5%), employed (78.1%), and had completed junior college or bachelor's degrees (77.7%). Additionally, 50.9% of participants fell in the 35-44 year-old age range, while 55.3% reported having only one child. Monthly household income per person was reported as 5,000-10,000 yuan for 33.2% of participants. The data also showed that myopia was prevalent among the study population, with 64% of parents and 38% of students reporting the condition, as shown in **Table 1**.

**Table 1.** Baseline characteristics and KAP scores.

	N (%)	Knowledge Median [Q1, Q3]	P	Attitude Median [Q1, Q3]	P	Practice Median [Q1, Q3]	P
<b>Gender</b>			0.411		0.001		0.098
Male	113 (20.47)	9 [7,10]		25 [22,26]		26 [23,29]	
Female	439 (79.53)	9 [7,10]		26 [24,27]		27 [24,29]	
<b>Age</b>			0.295		0.059		0.962
Less than 35 years old	120 (21.74)	9 [7,10]		26 [24,27]		27 [24,29]	
35-44 years old	281 (50.91)	9 [7,10]		25 [23,26]		27 [24,29]	
45 years old and above	151 (27.36)	9 [7,10]		25 [23,27]		27 [24,29]	
<b>Child's grade</b>			0.246		0.553		0.009
1	79 (14.31)	9 [8,10]		26 [23,27]		28 [25,30]	
2	66 (11.96)	9 [7,10]		26 [24,26]		28 [25,30]	
3	100 (18.12)	9 [7,10]		26 [23.5,27]		26 [23.5,29]	
4	155 (28.08)	9 [7,10]		26 [23,27]		26 [23,29]	
5	75 (13.59)	9 [8,10]		25 [23,27]		25 [24,29]	
6	77 (13.95)	9 [7,9]		25 [23,27]		26 [24,29]	
<b>Number of siblings</b>			0.005		0.143		0.906
0	305 (55.25)	9 [8,10]		26 [24,27]		27 [24,30]	
1	206 (37.32)	9 [7,10]		25 [23,27]		27 [24,29]	
≥2	41 (7.43)	9 [7,10]		25 [23,27]		27 [24,28]	
<b>Education</b>			<0.001		0.021		0.003
High School / Technical secondary school and below	90 (16.30)	7.5 [6,9]		24.5 [22,26]		25 [23,28]	
Junior college/Bachelor's degree	429 (77.72)	9 [8,10]		26 [24,27]		27 [24,29]	

Master's degree and above	33 (5.98)	10 [9,10]	26 [24,27]	28 [26,30]
<b>Work Status</b>			0.004	0.427
Employed	431 (78.08)	9 [8,10]	26 [24,27]	27 [24,29]
Unemployed	37 (6.70)	8 [6,9]	26 [23,28]	26 [24,29]
Self-employed	55 (9.96)	9 [7,10]	25 [23,26]	27 [24,30]
Full-time homemaker	29 (5.25)	7 [6,10]	25 [23,26]	27 [25,30]
<b>Monthly Household Income Per Person, yuan</b>			0.005	0.017
<5000	76 (13.77)	8 [6,9]	24 [22,26]	25.5 [23,28.5]
5000-10000	183 (33.15)	9 [7,10]	25 [23,27]	27 [23,29]
10000-20000	170 (30.80)	9 [8,10]	26 [24,27]	27 [24,29]
>20000	123 (22.28)	9 [7,10]	26 [24,27]	28 [25,30]
<b>Are the parents nearsighted?</b>			<0.001	0.001
Yes	353 (63.95)	9 [8,10]	26 [24,27]	26 [24,29]
No	199 (36.05)	8 [6,10]	25 [23,26]	27 [24,29]
<b>Is the child nearsighted?</b>			0.001	0.854
Yes	210 (38.04)	9 [8,10]	25.5 [24,27]	26 [24,29]
No	342 (61.96)	9 [7,10]	25 [23,27]	27 [24,29]

SD, standard deviation; q: quantile.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Knowledge, attitude, and practice toward myopia**

The average knowledge score among participants was  $8.38\pm2.29$  (theoretical minimum-maximum: 0-12). Parents with only one child ( $P=0.005$ ), a master's degree or higher ( $P<0.001$ ), employment ( $P=0.004$ ), a higher income ( $P=0.005$ ), parents with myopia ( $P<0.001$ ), and child with myopia ( $P=0.001$ ) had higher knowledge scores. In terms of attitude, participants had an average score of  $25.01\pm2.79$  (theoretical minimum-maximum: 6-30). Females ( $P=0.001$ ), a bachelor's degree or higher ( $P=0.021$ ), a monthly household income per person of  $>10,000$  yuan ( $P=0.017$ ), and those who were nearsighted ( $P=0.001$ ) tended to have higher attitude scores. Regarding practice, participants had an average score of  $26.37\pm3.96$  (theoretical minimum-maximum: 6-33). Parents with children in first or second grade ( $P=0.009$ ), a master's degree or higher ( $P=0.003$ ), and a monthly income of  $>20,000$  yuan ( $P=0.029$ ) had higher practice scores (**Table 1**).

Regarding the knowledge dimension, participants performed best on questions related to the brightness of electronic devices (with a correct rate of 95.8%) and indoor lighting when reading (92.4%). However, they struggled with questions related to the causes of myopia (with a correct rate of only 27.2%) and outdoor exercise (with a correct rate of 20.3%). In terms of attitude, participants generally exhibited a positive attitude, with the exception of the question about wearing glasses. Only 35.1% of respondents agreed (either "Extremely Positive" or "Positive") with the negative statement, "I believe that glasses should only be worn when necessary to correct vision." Finally, with regard to the practice dimension, most participants reported positive practice, except for outdoor activities and reading while lying down (**Table 2**).

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignement Supérieur (ABES).

**Table 2.** Knowledge, attitudes, and practices.

Knowledge	N=552			
	Correct (%)	Wrong/Unclear (%)		
1. Myopia is the result of overdevelopment of the eyeball, which is essentially a shortening of the eye axis.	421 (76.27)	131 (23.73)		
2. The complications of high myopia are mainly fundus lesions, such as retinal detachment, retinochoroidal atrophy, macular hemorrhage, macular fissure, etc.	389 (70.47)	163 (29.53)		
3. Low-concentration atropine drops are effective in slowing the development of myopia.	267 (48.37)	285 (51.63)		
4. Mydriasis is a routine form of eye examination and treatment.	393 (71.19)	159 (28.81)		
5. To give your eyes adequate rest, get up and move around every 20 minutes when working and studying, and stand in front of a window and look 20 feet (6 meters) away for at least 20 seconds.	507 (91.85)	45 (8.15)		
6. During home Internet classes, you should ensure that the room is well-lit and adjust the brightness of your child's electronic devices appropriately, not too bright or too dark.	507 (91.85)	45 (8.15)		
7. Outdoor exercise is also crucial to myopia prevention and control, but it does not matter whether the child is under daylight or not; he/she should be allowed to do more outdoor activities.	331 (60.00)	221 (39.99)		
8. Children should not read at home in too much or too little light. Make sure that indoor lighting and eye protection lamps are on at the same time.	416 (75.36)	136 (24.64)		
9. Wearing frame glasses is one of the best ways to control myopia; moreover, there are other options, such as Keratoscope, as well as reducing close reading & learning and increasing outdoor activities.	503 (91.12)	49 (8.88)		
10. If you need to do screen reading for a long time, you should wear anti-blue light glasses to block the harmful blue light to the eyes as much as possible.	442 (80.07)	110 (19.93)		
11. When the eyes become tired and dry, you can blink more often to relieve, and if necessary, use artificial tears to relieve the symptoms of dry eyes.	441 (80.07)	111 (20.00)		
12. A simple computerized optometry can accurately obtain the diopters of a child with myopia.	336 (60.89)	216 (39.11)		
Attitude	N (%)			
	Extremely Positive/Agree	Positive/Agree	Neutral	Extremely Negative/Disagree
A1. I believe that glasses should only be worn when necessary to correct vision. (N)	62 (11.23)	132 (23.91)	91 (16.49)	10 (38.04)
A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)	11 (1.99)	15 (2.72)	17 (3.08)	79 (50.54)
A3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)	3 (0.54)	2 (0.36)	11 (1.99)	76 (31.88)
A4. I fully support promoting the importance of vision protection for primary and secondary school students. (P)	430 (77.90)	104 (18.84)	16 (2.90)	2 (0.36)
A5. If a "vision protection" parent-child activity is offered by the school or community, I would be interested in participating. (P)	335 (60.69)	167 (30.25)	46 (8.33)	1 (0.18)



A6. I am concerned that my child's myopia may impact their future life and studies.	330 (59.78)	165 (29.89)	38 (6.88)	55 (2.72)	4 (0.72)
A7. I am worried that my child's myopia may affect their appearance.	273 (49.46)	165 (29.89)	74 (13.41)	55 (6.34)	5 (0.91)
A8. I am concerned that my child's myopia may lead to low self-esteem.	112 (20.29)	75 (13.59)	217 (39.31)	26 (22.83)	22 (3.99)
A9. If I am nearsighted, I think that glasses should only be worn when necessary, but not necessarily all day. (N)	20 (3.62)	71 (12.86)	64 (11.59)	62 (47.46)	135 (24.46)
<b>Practice</b>	<b>N (%)</b>				
	<b>Yes</b>	<b>No</b>			
P1. Encourage your child to participate in outdoor activities for at least 2 hours a day.	208 (37.68)	344 (62.32)	-	-	-
P2. Supervise your child to perform eye exercises regularly.	334 (60.51)	218 (39.49)	-	-	-
P3. Attend scientific lectures or activities on children's and adolescents' vision health.	316 (57.25)	236 (42.75)	-	-	-
	<b>Always</b>	<b>Often</b>	<b>Sometimes</b>	<b>Rarely</b>	<b>Never</b>
P4. Take your child for optical coherence tomography once a year.	118 (21.38)	216 (39.13)	169 (29.37)	89 (16.12)	-
P5. Ensure a balanced diet that includes eggs, meat, fish, or animal liver.	11 (1.99)	200 (36.23)	169 (29.37)	174 (31.52)	-
P6. Provide dairy or soy products for your child.	6 (1.09)	128 (23.19)	169 (29.37)	260 (47.10)	-
P7. Offer plenty of fresh vegetables and fruits.	3 (0.54)	58 (10.51)	169 (29.37)	340 (61.59)	-
	<b>Extremely Positive</b>	<b>Positive</b>	<b>Neutral</b>	<b>Negative</b>	<b>Extremely Negative</b>
P8. Supervise your child's reading and writing posture.	181 (32.79)	254 (46.01)	105 (19.30)	14 (2.54)	2 (0.36)
P9. Discourage your child from using electronic devices such as television, cell phone, or tablet computer in the dark.	364 (65.94)	142 (25.72)	29 (5.25)	12 (2.17)	5 (0.91)
P10. Do not allow your child to lie down while reading books or using electronic devices.	149 (26.99)	90 (16.30)	58 (10.51)	48 (8.70)	207 (37.50)
P11. Discourage your child from reading books or looking at electronic products while using mobile transportation (bus, car).	360 (65.22)	136 (24.64)	42 (7.62)	7 (1.27)	7 (1.27)
P12. Discourage your child from rubbing their eyes.	286 (51.81)	176 (31.88)	68 (12.52)	14 (2.54)	8 (1.45)
P13. Encourage your child to take breaks and relax their eyes during class breaks.	275 (49.82)	172 (31.16)	77 (13.95)	24 (4.35)	4 (0.72)

“P” indicates a positive statement, while “N” indicates a negative statement. It's important to note that the scores for questions marked with N have been adjusted based on different assignment bases and, therefore, are not a direct result of selection.



### Correlation analyses

Pearson correlation analyses showed a significant positive correlation was found between knowledge-attitude ( $r=0.2492$ ,  $P<0.001$ ), knowledge-practice ( $r=0.1736$ ,  $P<0.001$ ), and attitude-practice ( $r=0.2711$ ,  $P<0.001$ ) (Table 3).

**Table 3.** Spearman correlation analyses.

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.2492 ( $P<0.001$ )	1	
Practice	0.1736 ( $P<0.001$ )	0.2711 ( $P<0.001$ )	1

### Risk factors associated with knowledge, attitude, and practice toward myopia

Multivariate logistic regression showed that having a junior college or bachelor's degree (odd ratio [OR]=3.072, 95% confidence interval [CI]: 1.566-6.025,  $P=0.001$ ), having a master's degree or above (OR=6.259, 95%CI=2.327-16.835,  $P<0.001$ ), having monthly household income per person of 10,000-20,000 yuan (OR=1.999, 95% CI: 1.029-3.883,  $P=0.041$ ), being nearsighted (OR=1.547, 95% CI: 1.028-2.330,  $P=0.037$ ), having a nearsighted child (OR=1.923, 95% CI: 1.314-2.813,  $P=0.001$ ), and having two children (OR=0.650, 95% CI: 0.434-0.974,  $P=0.037$ ) were independent associated with adequate knowledge. Knowledge (OR=1.239, 95% CI: 1.131-1.357,  $P<0.001$ ), being female (OR=2.080, 95% CI: 1.307-3.310,  $P=0.002$ ), having monthly household income per person of 10,000-20,000 yuan (OR=1.842, 95% CI: 1.010-3.359,  $P=0.046$ ), having monthly household income per person over 20,000 yuan (OR=2.296, 95% CI: 1.211-4.351,  $P=0.011$ ), being nearsighted (OR=1.549, 95% CI: 1.056-2.273,  $P=0.025$ ), and being aged 33-44 years old (OR=0.533, 95% CI: 0.334-0.851,  $P=0.008$ ) were independent associated with positive attitude. Attitude (OR=1.163, 95% CI: 1.076-1.258,  $P<0.001$ ), and having a child in the fourth grade (OR=0.478, 95% CI: 0.265-0.859,  $P=0.014$ ) were

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

independently associated with proactive attitude (**Supplementary table 1**).

For peer review only

Enseignement Supérieur (ABES) .  
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

## Discussion

This study found that parents of primary school students had inadequate knowledge, positive attitudes, and proactive practice regarding myopia, which might provide valuable insights for future intervention studies to enhance myopia education and promote better eye health for children.

In the present study, 64% of parents reported having myopia, and reported myopia in 38% of their children. Such values are within the reported ranges for Chinese individuals. Indeed, the prevalence of myopia in Chinese adults is 36%-86% [29, 30]. For Chinese primary school children (aged 7-12), the prevalence of myopia is 30.7%-52.7% [3-6].

McCrann et al. reported that 76% of parents of school children recognized the potential health risk of digital technology on the eye [16]. One study conducted in rural China by Li et al. highlighted that some parents have no clear idea of what myopia is, and only a small number knew the anatomical definition of the condition [31], while a study in China highlighted the insufficient understanding of the importance of minimizing near work in children, adequate sleep duration, adopting a proper reading distance, maintaining adequate indoor illumination, and encouraging sports and outdoor activities [18]. Another study comparing myopia control perceptions between parents in the United Kingdom and Hong Kong also found low awareness of the effects of myopia, especially in the United Kingdom [32], which was consistent with the findings observed here. In addition, in the present study, the knowledge among parents was suboptimal, they correctly understood the impact of electronic devices and indoor

lighting, but they have poorer knowledge of the cause of myopia and the impact of outdoor exercises. The vast majority agreed that wearing glasses is one of the best ways to control myopia; however, in Li's study, parents had the misconception that glasses-wearing should be delayed in children and might be harmful to the eyes [31]. This discrepancy can be explained by the fact that the study was conducted in an urban region, and parents might have had higher awareness.

He et al.'s study on parents of primary school students also revealed that family income and parents' education level significantly affected their myopia knowledge [33]. Tao et al. [18] also showed that lower parental education was associated with myopic progression in the children. Furthermore, parents with myopia might have more related knowledge through their experience and they might have more opportunities to seek information from professionals. Therefore, educational interventions need to focus on parents with no myopia history and those whose children have no myopia, as well as parents with lower income and education levels.

One similar survey study conducted in Ireland found parental attitudes to myopia were nonchalant [16]. Only 14% of parents of schoolchildren expressed that they would be concerned if their children were diagnosed with myopia, and 46% considered myopia to be a health risk to their children [16]. The lack of parental concern in the previous study might be due to the low myopia prevalence in Ireland: only 10% of the children had myopia, compared to around 40% in the present study. McCrann et al. also found that myopic parents considered myopia as more of an inconvenience and were more likely to consider limiting screen time [16]. Parents' attitudes toward children's visual

care were associated with a lower risk of myopia in children, and it is of great importance to enhance their attitude toward myopia [34].

Jiang et al.'s study on parents' intention toward preschool children's myopia-prevention behaviors also found that parental attitude was associated with their myopia-preventive behaviors [35]. Parental beneficial behaviors (e.g., spending less time on near work and electronic device use) are positively associated with children's myopia [33]. The practice score was adequate in this study. Furthermore, a higher attitude score was significantly associated with better practice scores, while having a child in the fourth grade was associated with poorer practice. The primary school system in China usually has six grades (grades 1-6). The children usually start attending school (grade 1) at 6 years old. Hence, children in grade 4 are usually 9 years old, which is around the peak for myopia incidence in children in China [3-6]. Still, this study examined associations, not causality, and the results could highlight that the peak of parental carelessness about myopia could occur when their children are around that age. Additional studies are necessary to examine that point. This finding reaffirmed the relationship between knowledge, attitude, and practice and that adequate knowledge can lead to a positive attitude to inform better practice [36, 37]. This study also found significant correlations between knowledge-attitude, knowledge-practice, and attitude-practice. In the practice dimension, most parents answered positively, except on the items of outdoor activities and reading while lying down.

However, there were several limitations in this study. First, this study was conducted in a single school in China, and the results might not be generalized to other cities. The

school was selected because it was one of the myopia prevention and control experimental units of the hospital, which could introduce bias. Second, due to the self-reporting nature of the study, the results might deviate from the actual practice. The parents who did not have a clear self-reported understanding of the research procedures were excluded, which could introduce bias. Furthermore, most participants provided positive answers in the attitude and practice dimensions, while knowledge scores were poor, and the results might be affected by the social desirability bias or overconfidence. Third, 44% of the parents in the selected school returned a valid survey, and there might be non-response bias. Fourth, the teachers helped with administering the questionnaire, but it could introduce a “classroom effect” bias.

**Conclusions**

In conclusion, parents of primary school students had inadequate knowledge, positive attitude, and proactive practice toward myopia. Education programs focusing on the causes and risk factors of myopia, prevention measures, and early detection and treatment should be designed and implemented in this population. There is a need for health education programs that target parents with lower education and income levels to improve knowledge about myopia. Efforts should be made to maintain positive attitudes and improve the knowledge and practice toward myopia by highlighting the benefits of outdoor activities and limiting screening time. In addition, healthcare professionals should encourage parents to take proactive measures such as scheduling regular eye check-ups and creating a myopia-friendly environment at home, i.e.,

Enseignement Supérieur (ABES) .  
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

maximizing outdoor activities, minimizing near work, and having proper lighting intensity and spectral composition [10].

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Supérieur (ABES).

**List of abbreviations**

KAP, knowledge, attitude, and practice

STROBE, Strengthening the Reporting of Observational Studies in Epidemiology

SD, standard deviation

**Declarations**

**Ethics approval and consent to participate**

The study was ethically approved by Wuxi Children's Hospital (approval number: WXCH2022-09-040), and informed consent was obtained from all participants. All methods were performed in accordance with the relevant guidelines and regulations.

**Availability of data and materials**

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

**Competing interests**

The authors declare that they have no competing interests

**Funding**

This study was supported by the Guiding Project of Wuxi Science and Technology Bureau (NZ2021014). The funders had no role in study design, data collection and analyses, decision to publish, or preparation of the manuscript.

**Authors' contributions**

Yujing Tian and Yingqing Yu carried out the studies, participated in collecting data, and drafted the manuscript. Yujing Tian and Yingqing Yu performed the statistical analyses and participated in the design. Yujing Tian and Yingqing participated in the

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Supérieur (ABES).



acquisition, analysis, or interpretation of data and drafted the manuscript. All authors read and approved the final manuscript. Yujing Tian is the guarantor.

## Acknowledgments

Not applicable

## References

1. Morgan IG, Ohno-Matsui K, Saw SM. Myopia. *Lancet* (London, England). 2012;379(9827):1739-48.
2. Baird PN, Saw SM, Lanca C, Guggenheim JA, Smith Iii EL, Zhou X, et al. Myopia. *Nature reviews Disease primers*. 2020;6(1):99.
3. Dong L, Kang YK, Li Y, Wei WB, Jonas JB. PREVALENCE AND TIME TRENDS OF MYOPIA IN CHILDREN AND ADOLESCENTS IN CHINA: A Systemic Review and Meta-Analysis. *Retina* (Philadelphia, Pa). 2020;40(3):399-411.
4. Li T, Wei R, Du B, Wu Q, Yan J, Meng X, et al. Prevalence of myopia among children and adolescents aged 6–16 during COVID-19 pandemic: a large-scale cross-sectional study in Tianjin, China. *British Journal of Ophthalmology*. 2024;108(6):879.
5. Zhang J, Li Z, Ren J, Wang W, Dai J, Li C, et al. Prevalence of myopia: A large-scale population-based study among children and adolescents in weifang, china. *Frontiers in public health*. 2022;10:924566.
6. Pan W, Lan W. The Current and Future Landscape of the Childhood Myopia Epidemic in China-A Review. *Ophthalmology and therapy*. 2024;13(4):883-94.
7. Jones D, Luensmann D. The prevalence and impact of high myopia. *Eye & contact lens*. 2012;38(3):188-96.

8. Sankaridurg P, Tahhan N, Kandel H, Naduvilath T, Zou H, Frick KD, et al. IMI Impact of Myopia. *Investigative ophthalmology & visual science*. 2021;62(5):2.

9. Grzybowski A, Kanclerz P, Tsubota K, Lanca C, Saw SM. A review on the epidemiology of myopia in school children worldwide. *BMC ophthalmology*. 2020;20(1):27.

10. Biswas S, El Kareh A, Qureshi M, Lee DMX, Sun CH, Lam JSH, et al. The influence of the environment and lifestyle on myopia. *J Physiol Anthropol*. 2024;43(1):7.

11. Wang J, Li Y, Musch DC, Wei N, Qi X, Ding G, et al. Progression of Myopia in School-Aged Children After COVID-19 Home Confinement. *JAMA ophthalmology*. 2021;139(3):293-300.

12. He M, Xiang F, Zeng Y, Mai J, Chen Q, Zhang J, et al. Effect of Time Spent Outdoors at School on the Development of Myopia Among Children in China: A Randomized Clinical Trial. *Jama*. 2015;314(11):1142-8.

13. Wu PC, Tsai CL, Wu HL, Yang YH, Kuo HK. Outdoor activity during class recess reduces myopia onset and progression in school children. *Ophthalmology*. 2013;120(5):1080-5.

14. Smith MJ, Walline JJ. Controlling myopia progression in children and adolescents. *Adolescent health, medicine and therapeutics*. 2015;6:133-40.

15. Coverdale S, Rountree L, Webber K, Cufflin M, Mallen E, Alderson A, et al. Eyecare practitioner perspectives and attitudes towards myopia and myopia management in the UK. *BMJ Open Ophthalmol*. 2024;9(1).

16. McCrann S, Flitcroft I, Lalor K, Butler J, Bush A, Loughman J. Parental attitudes to myopia: a key agent of change for myopia control? *Ophthalmic & physiological optics : the journal of the British College of Ophthalmic Opticians (Optometrists)*. 2018;38(3):298-308.
17. Almujailli AA, Almatrafi AA, Aldael AA, Almojali HA, Almujailli AI, Pathan A. Knowledge, attitude, and practice about myopia in school students in Marat city of Saudi Arabia. *Journal of family medicine and primary care*. 2020;9(7):3277-80.
18. Tao ZY, Chen SQ, Tang Y, Zhao J, Wang J, Lin ZH, et al. The Influence of Parents' Background and Their Perception on the Progression of Myopia in Children. *Int J Clin Pract*. 2022;2022:4123470.
19. Naik A, Karthikeyan SK, Ramesh JJ, Bhaskar S, Ganapathi CA, Biswas S. An Insight into Knowledge, Perspective, and Practices of Indian Optometrists towards Childhood Myopia. *Vision*. 2024;8(2).
20. Ahmed T, Hussain S, Zia UU, Rinchen S, Yasir A, Ahmed S, et al. Knowledge, attitude and practice (KAP) survey of canine rabies in Khyber Pakhtunkhwa and Punjab Province of Pakistan. *BMC public health*. 2020;20(1):1293.
21. Qian Y, Lu P. Parents' or Guardians' Knowledge, Attitudes and Practices in the Prevention and Management of Childhood Myopia. *Ophthalmology and therapy*. 2024;13(12):3095-109.
22. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ (Clinical research ed)*.

2007;335(7624):806-8.

23. China TNHWCotPsRo. Guidelines on myopia prevention and treatment. 2018;6(5).

24. Equipment OPCoCAoM. Application standard for detection and prevention and control of myopia in children and adolescents. Chin J Ophthalmol Med. 2018;8(6):276-88.

25. Jiang J. White paper on myopia management. Chinese Journal of Optometry Ophthalmology and Visual Science. 2019;21(3):161-5.

26. Taber KS. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Research in Science Education. 2018;48(6):1273-96.

27. Cochran WG. Sampling Techniques (3rd ed.). New York: John Wiley & Sons; 1977.

28. Goretzko D, Siemund K, Sterner P. Evaluating Model Fit of Measurement Models in Confirmatory Factor Analysis. Educ Psychol Meas. 2024;84(1):123-44.

29. Zhang HM, Li BQ, Zhu Y, Liu SX, Wei RH. Time trends in myopia and high myopia prevalence in young university adults in China. International journal of ophthalmology. 2023;16(10):1676-81.

30. Wang X, Luo R, Shan G, He H, Chen T, Wang X, et al. Prevalence and risk factors for refractive error in older adults in eight ethnicities in China: The China national health survey. Heliyon. 2024;10(17):e36354.

31. Li L, Lam J, Lu Y, Ye Y, Lam DS, Gao Y, et al. Attitudes of students, parents,

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignment Supérieur (ABES).

and teachers toward glasses use in rural China. *Archives of ophthalmology* (Chicago, Ill : 1960). 2010;128(6):759-65.

32. Dias L, Brennan N, Sulley A. A comparison of myopia control perceptions between parents in UK and Hong Kong. *Contact Lens and Anterior Ey*. 2018;41:S33.

33. He AQ, Liu SA, He SY, Yao H, Chen P, Li Y, et al. Investigation of children's habits of smartphone usage and parental awareness of myopia control in underdeveloped areas of China. *International journal of ophthalmology*. 2022;15(10):1691-8.

34. Zhou S, Yang L, Lu B, Wang H, Xu T, Du D, et al. Association between parents' attitudes and behaviors toward children's visual care and myopia risk in school-aged children. *Medicine*. 2017;96(52):e9270.

35. Jiang N, Chen J, Cao H, Liu Y, Zhang Y, Wang Q, et al. Parents' intentions toward preschool children's myopia preventive behaviors: Combining the health belief model and the theory of planned behavior. *Frontiers in public health*. 2022;10:1036929.

36. ul Haq N, Hassali MA, Shafie AA, Saleem F, Farooqui M, Haseeb A, et al. A cross-sectional assessment of knowledge, attitude and practice among Hepatitis-B patients in Quetta, Pakistan. *BMC public health*. 2013;13:448.

37. Evans G, Durant J. The relationship between knowledge and attitudes in the public understanding of science in Britain. *Public Understanding of Science*. 1995;4(1):57-74.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Figure Legends**

**Figure 1 Confirmatory factor analysis for KAP**

For peer review only

Enseignement Supérieur (ABES) .  
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

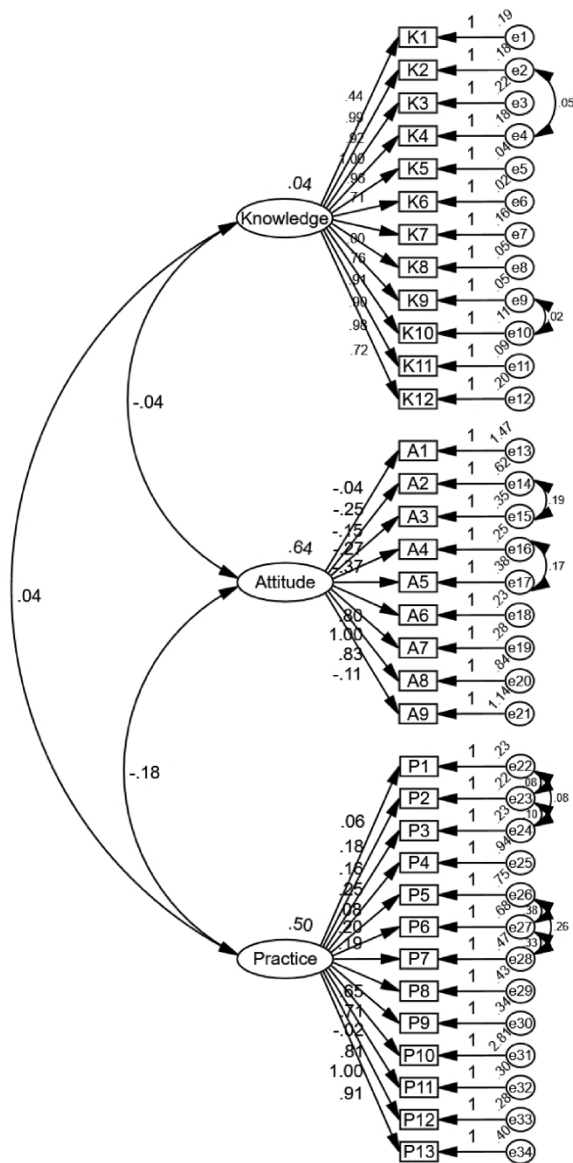


Figure 1 Confirmatory factor analysis for KAP

170x287mm (300 x 300 DPI)

Supplementary table 1. Univariate and multivariate logistic regression analyses.

Knowledge	Univariate logistic regression		Multivariate logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
<b>Gender</b>				
Male	ref			
Female	1.110 (0.717-1.717)	0.640		
<b>Age</b>				
Less than 35 years old	ref			
35-44 years old	1.307 (0.830-2.058)	0.248		
45 years old and above	1.133 (0.680-1.888)	0.631		
<b>Child's grade</b>				
1	ref			
2	0.985 (0.500-1.942)	0.966		
3	0.928 (0.502-1.717)	0.813		
4	1.031 (0.588-1.807)	0.915		
5	1.283 (0.672-2.451)	0.450		
6	0.526 (0.262-1.058)	0.071		
<b>Number of siblings</b>				
0	ref		ref	
1	0.614 (0.421-0.895)	0.011	0.650 (0.434-0.974)	0.037
≥2	0.535 (0.259-1.108)	0.092	0.655 (0.301-1.423)	0.655
<b>Education</b>				
High School / Technical secondary school and below	ref		ref	



Junior college/Bachelor's degree	3.739 (2.013-6.943)	<0.001	3.072 (1.566-6.025)	0.001
Master's degree and above	6.293 (2.557-15.491)	<0.001	6.259 (2.327-16.835)	<0.001
<b>Work Status</b>				
Employed	ref		ref	
Unemployed	0.387 (0.166-0.902)	0.028	0.720 (0.290-1.785)	0.478
Self-employed	0.876 (0.486-1.579)	0.661	1.295 (0.677-2.477)	0.434
Full-time homemaker	0.633 (0.274-1.461)	0.284	0.876 (0.359-2.141)	0.772
<b>Monthly household income per person</b>				
<5000	ref		ref	
5000-10000	2.166 (1.156-4.059)	0.016	1.859 (0.960-3.596)	0.066
10000-20000	2.689 (1.432-5.050)	0.002	1.999 (1.029-3.883)	0.041
>20000	1.944 (0.999-3.783)	0.050	1.452 (0.716-2.947)	0.301
<b>Are the parents nearsighted?</b>				
Yes	2.023 (1.380-2.965)	<0.001	1.547 (1.028-2.330)	0.037
No	ref		ref	
<b>Is the child nearsighted?</b>				
Yes	1.784 (1.249-2.550)	0.01	1.923 (1.314-2.813)	0.001
No	ref		ref	
<b>Attitude</b>				
<b>Knowledge score</b>				
	1.265 (1.161-1.379)	<0.001	1.239 (1.131-1.357)	<0.001
<b>Gender</b>				
Male	ref		ref	
Female	2.083 (1.357-3.198)	0.001	2.080 (1.307-3.310)	0.002
<b>Age</b>				
Less than 35 years old	ref		ref	
35-44 years old	0.629 (0.408-0.970)	0.036	0.533 (0.334-0.851)	0.008

45 years old and above	0.581 (0.358-0.943)	0.028	0.632 (0.372-1.074)	0.090
<b>Child's grade</b>				
1	ref			
2	1.170 (0.608-2.253)	0.639		
3	1.145 (0.634-2.067)	0.654		
4	0.988 (0.574-1.698)	0.964		
5	0.949 (0.505-1.786)	0.872		
6	0.589 (0.311-1.115)	0.104		
<b>Number of siblings</b>				
0	ref			
1	0.751 (0.527-1.070)	0.113		
≥2	0.772 (0.402-1.485)	0.439		
<b>Education</b>				
High School / Technical secondary school and below	ref		ref	
Junior college/Bachelor's degree	1.870 (1.170-2.988)	0.009	1.172 (0.691-1.989)	0.556
Master's degree and above	2.073 (0.924-4.651)	0.077	1.231 (0.495-3.065)	0.655
<b>Work Status</b>				
Employed	ref			
Unemployed	1.031 (0.527-2.019)	0.928		
Self-employed	0.756 (0.430-1.331)	0.333		
Full-time homemaker	0.794 (0.373-1.690)	0.549		
<b>Monthly household income per person</b>				
<5000	ref		ref	
5000-10000	1.540 (0.886-2.676)	0.126	1.230 (0.685-2.207)	0.488
10000-20000	2.141 (1.225-3.741)	0.008	1.842 (1.010-3.359)	0.046

>20000	2.478 (1.373-4.472)	0.003	2.296 (1.211-4.351)	0.011
<b>Are the parents nearsighted?</b>				
Yes	1.875 (1.317-2.668)	<0.001	1.549 (1.056-2.273)	0.025
No	ref		ref	
<b>Is the child nearsighted?</b>				
Yes	1.024 (0.726-1.443)	0.894		
No	ref			
<b>Practice</b>				
<b>Knowledge score</b>				
	1.128 (1.033-1.231)	0.007	1.062 (0.962-1.172)	0.233
<b>Attitude score</b>				
	1.187 (1.103-1.277)	<0.001	1.163 (1.076-1.258)	<0.001
<b>Gender</b>				
Male	ref			
Female	1.147 (0.730-1.803)	0.552		
<b>Age</b>				
Less than 35 years old	ref			
35-44 years old	0.942 (0.598-1.485)	0.798		
45 years old and above	0.822 (0.490-1.379)	0.459		
<b>Child's grade</b>				
1	ref		ref	
2	1.172 (0.608-2.262)	0.636	1.205 (0.616-2.359)	0.586
3	0.541 (0.291-1.005)	0.052	0.576 (0.305-1.086)	0.088
4	0.445 (0.251-0.790)	0.006	0.478 (0.265-0.859)	0.014
5	0.481 (0.244-0.949)	0.035	0.512 (0.253-1.033)	0.062
6	0.496 (0.254-0.971)	0.041	0.576 (0.288-1.150)	0.118
<b>Number of siblings</b>				
0	ref			

1					
2					
3					
4					
5	1	0.945 (0.647-1.380)	0.770		
6	≥2				
7		0.577 (0.265-1.254)	0.165		
8					
9	Education				
10	High School / Technical secondary				
11	school and below	ref		ref	
12					
13	Junior college/Bachelor's degree	1.714 (1.002-2.929)	0.049	1.284 (0.723-2.281)	0.393
14	Master's degree and above	2.275 (0.966-5.360)	0.060	1.751 (0.713-4.297)	0.222
15	Work Status				
16	Employed	ref			
17					
18	Unemployed	1.214 (0.600-2.457)	0.590		
19					
20	Self-employed	1.090 (0.599-1.985)	0.778		
21	Full-time homemaker	1.179 (0.534-2.605)	0.683		
22	Monthly household income per				
23	person				
24	<5000	ref			
25					
26	5000-10000	0.598 (0.317-1.131)	0.114		
27					
28	10000-20000	0.694 (0.425-1.133)	0.144		
29					
30	>20000	0.979 (0.603-1.590)	0.933		
31	Are the parents nearsighted?				
32	Yes	0.955 (0.658-1.387)	0.808		
33	No	ref			
34	Is the child nearsighted?				
35	Yes	0.716 (0.491-1.045)	0.083		
36	No	ref			
37					

Abbreviation: OR: odd ratio; CI: confidence interval; ref: reference.

Questionnaire No. \_\_\_\_\_

Dear Parents:

We are researchers from Wuxi Children's Hospital. We sincerely invite you to participate in our research project. This study aims to understand the knowledge, attitude, and practice towards myopia among parents of primary school students to serve as the basis for developing scientific intervention strategies, which may help many others in the future to improve their vision conditions. Your participation in this study is voluntary, and the research has been approved by the Ethics Review Committee. If you agree to participate, please read the following instructions:

1. Please complete the questionnaire. There are no right or wrong answers; you only need to provide responses based on your actual experiences. If you have any questions during the process, feel free to reach out to us, and please submit the completed questionnaire in a timely manner.
2. This study is a simple questionnaire survey and will not cause any harm to your physical or psychological well-being. However, it may involve some personal information such as your gender and age. Please rest assured that we will strictly maintain confidentiality and will not disclose your information.
3. As a participant, you can always stay informed about the information and progress related to this study. If you decide to withdraw from the study, please let us know, and your data will not be included in the research results.

Finally, we sincerely thank you for taking the time to support our scientific research amid your busy schedule!

☐ I have been informed and agreed to the use of the collected data for scientific research.

Informant Consent Signature: \_\_\_\_\_

Date of participation: \_\_\_\_\_ Year \_\_\_\_\_ Month \_\_\_\_\_ Day

bmjopen-2024-093565 on 21 March 2025. Downloaded from <http://bmjopen.bmj.com/> on June 7, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES) . All rights reserved. No reuse allowed without permission. For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Part I Basic Information

1. Your gender:	a. Male	b. Female
2. Your age: _____.		
3. Child's grade:	a. First year of primary school b. Second year of primary school c. Third year of primary school d. Fourth year of primary school e. Fifth year of primary school f. Sixth year of primary school	
4. The child currently has a total of _____ siblings (related by blood, this child is not counted).		
5. Your education:	a. Primary school and below b. Middle school c. High school/Technical secondary school d. Junior college/Bachelor's degree e. Master's degree and above	
6. Your work Status:	a. Employed b. Unemployed c. Self-employed d. Housewives e. Others	
7. In the past year, your monthly per capita household income was (including income in kind and rental income, etc.): _____ yuan	a. <2000 b. 2000-5000 c. 5000-10000 d. 10000-20000 e. >20000	

8.Are you nearsighted?	a. Nearsighted	
	b. Not nearsighted	
9. Is your child nearsighted?	a. Nearsighted	
	b. Not nearsighted	

For peer review only

Part II Knowledge of myopia

1. Myopia is the result of overdevelopment of the eyeball, which is essentially a shortening of the axis.	a. Correct	b. Wrong	c. Unclear
2. The complications of high myopia are mainly fundus lesions, such as: retinal detachment, retinochoroidal atrophy, macular haemorrhage, macular fissure, etc.	a. Correct	b. Wrong	c. Unclear
3. Low-density atropine drops are effective in slowing the development of myopia.	a. Correct	b. Wrong	c. Unclear
4. Mydriasis is a routine form of eye examination and treatment.	a. Correct	b. Wrong	c. Unclear
5. To give your eyes adequate rest, get up and move around every 20 minutes when working and studying, and stand in front of a window and look 20 feet (6m) away for at least 20 seconds.	a. Correct	b. Wrong	c. Unclear
6. During home Internet classes, you should ensure that the room is well-lit and adjust the brightness of your child's electronic devices appropriately, not too bright or too dark.	a. Correct	b. Wrong	c. Unclear
7. Outdoor exercise is also crucial to myopia prevention and control, but it does not matter whether the child is under daylight or not, he/she should be allowed to do more outdoor activities. (Wrong)	a. Correct	b. Wrong	c. Unclear
8. Children should not read at home in too much or too little light. Make sure that indoor lighting and eye protection lamps are on at the same time.	a. Correct	b. Wrong	c. Unclear
9. Wearing frame glasses is one of the best ways to control myopia; moreover, there are other options, such as Keratoscope, as well as reducing close reading & learning and increasing outdoor activities.	a. Correct	b. Wrong	c. Unclear



10. If you need to do screen reading for a long time, you should wear anti-blue light glasses to block the harmful blue light to the eyes as much as possible.	a. Correct	b. Wrong	c. Unclear
11. When the eyes become tired and dry, you can blink more often to relieve, and if necessary, artificial tears to relieve the symptoms of dry eyes.	a. Correct	b. Wrong	c. Unclear
12. A simple computerized optometry can accurately obtain the diopters of child with myopia. (Wrong)	a. Correct	b. Wrong	c. Unclear

Part III Attitude to myopia

1. I believe that glasses should only be worn when necessary to correct vision. (N)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
4. I fully support promoting the importance of vision protection for primary and secondary school students. (P)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
5. If a "vision protection" parent-child activity is offered by the school or community, I would be interested in participating. (P)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
6. I am concerned that my child's myopia may impact their future life and studies.	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
7. I am worried that my child's myopia may affect their appearance.	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
8. I am concerned that my child's myopia may lead to low self-esteem.	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
9. If I am nearsighted, I think that glasses should only be worn when	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree

necessary, but not necessarily all day. (N)

For peer review only

bmjopen-2024-093565 on 21 March 2025. Downloaded from <http://bmjopen.bmj.com/> on June 7, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES). All rights reserved. No reuse allowed without permission. For peer review only - <http://bmjopen.bmj.com/site/about/guidelines.xhtml>

Part IV Practice on myopia

1. Do you take your child to engage in outdoor activities for more than 2 hours a day as much as possible? (P)	a. Yes	b. No
2. Do you supervise your child to do eye exercises? (P)	a. Yes	b. No
3. Do you take your child to attend lectures or activities on popular science topics related to children's and adolescents' vision health? (P)	a. Yes	b. No
4. How often you take your child to a specialised facility for an optical eye examination each year:	a. Never b. Once a year c. Twice a year d. More than twice a year	
Your daily meal preparation:		
5. If it contains eggs, meat, fish or animal liver?	a. Never prepare b. 1~2 times a week on average c. 3~4 times a week on average d. 5 or more times a week on average	
6. If it contains dairy or soya products?	a. Never prepare b. 1~2 times a week on average c. 3~4 times a week on average d. 5 or more times a week on average	
7. If it contains fresh fruits and vegetables?	a. Never prepare b. 1~2 times a week on average c. 3~4 times a week on average d. 5 or more times a week on average	
8. Supervise your child's reading and writing posture. (P)	a. Extremely Positive	b. Positive c. Neutral d. Negative e. Extremely Negative

9. Discourage your child from using electronic devices such as TV, cell phone, or tablet computer in the dark. (P)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative
10. Do not allow your child to lie down while reading books or using electronic devices. (N)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative
11. Discourage your child from reading books or looking at electronic products while using mobile transportation (bus, car). (P)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative
12. Discourage your child from rubbing their eyes. (P)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative
13. Encourage your child to take breaks and relax their eyes during class breaks. (P)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative

# BMJ Open

## Knowledge, attitude, and practice toward myopia among parents of primary school students: A cross-sectional study

Journal:	BMJ Open
Manuscript ID	bmjopen-2024-093565.R2
Article Type:	Original research
Date Submitted by the Author:	13-Feb-2025
Complete List of Authors:	Tian, Yujing; Children's Hospital Affiliated to Jiangnan University, Department of Ophthalmology Yu, Yingqing; Affiliated Children's Hospital of Jiangnan University, Department of Ophthalmology
<b>Primary Subject Heading</b>:	Ophthalmology
Secondary Subject Heading:	Ophthalmology
Keywords:	Knowledge, Attitude, Parents, Myopia

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Supérieur (ABES).

**Knowledge, attitude, and practice toward myopia among parents of primary school students: A cross-sectional study**

**Running title:** Parents' KAP on myopia

Yujing Tian<sup>¶\*</sup>, Yingqing Yu<sup>¶</sup>

Department of Ophthalmology, Affiliated Children's Hospital of Jiangnan University, 214023, Wuxi, Jiangsu, China

<sup>¶</sup>These authors contributed equally to this work.

**\*Corresponding author**

Yujing Tian

Department of Ophthalmology, Affiliated Children's Hospital of Jiangnan University, 214023, Wuxi, Jiangsu, China

E-mail: 601892303@qq.com

Tel: +86-15061871190



**Abstract**

**Background** Myopia is a common visual condition that requires proper management and prevention strategies, especially among children.

**Objective** To investigate the knowledge, attitude, and practice (KAP) toward myopia among parents of primary school-age children.

**Design** Cross-sectional study using a self-administered questionnaire.

**Participants/Setting** A total of 552 parents of primary school-age children participated in the study, which was conducted at a primary school in Wuxi City, China, between October and November 2022.

**Intervention** No intervention was applied; the study was observational, collecting data through questionnaires.

**Main Outcome Measures** Knowledge, attitude, and practice scores regarding myopia among parents.

**Statistical Analyses Performed** Univariable and multivariable logistic regression analyses were performed to identify associations between demographic factors and KAP scores.

**Results** Mean scores for knowledge, attitude, and practice were 8.38±2.29 (theoretical minimum-maximum: 0-12), 25.01±2.79 (theoretical minimum-maximum: 6-30), and 26.37±3.96 (theoretical minimum-maximum: 6-33), respectively. Higher education, income, personal and child myopia, and having two children were associated with better knowledge. Parental female gender, higher income, myopia, and age 33-44 years were associated with positive attitudes. Better attitudes and having a child in the fourth grade were associated with proactive practices.

**Conclusions** Parents of primary school-age children showed positive attitudes and proactive practices but had inadequate knowledge about myopia. Targeted health education programs for parents with lower education and income levels could be recommended to improve knowledge

and maintain positive attitudes toward myopia management.

**Keywords:** Knowledge, Attitude and Practice; Myopia; Refractive Errors; Parents; Primary School; Students

### **Strengths and limitations of this study**

- Identified specific demographics needing targeted health education, enhancing intervention effectiveness.
- Cross-sectional design limits causal inference between KAP and demographic factors.
- Self-administered questionnaires may introduce bias due to self-reporting inaccuracies.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Background**

Myopia is a common condition that typically starts in childhood, in which light from distant objects focuses in front of the retina, resulting in blurred distance vision [1, 2]. While myopia is one of the most prevalent eye diseases globally, the highest prevalence in school children has been reported in urban areas of Asia, including China [1]. The prevalence of myopia among Chinese primary school-age children (aged 7-12) is 30.7%-52.7% [3-6]. Furthermore, the onset of myopia has shifted to a younger age, and the number of children diagnosed with high myopia has drastically increased in the past decades [3, 7]. Myopia can lead to decreased productivity and reduced vision-related quality of life in children. Severe forms of myopia are associated with an increased risk of other ophthalmic problems, leading to visual impairment and blinding complications [1, 7, 8]. Myopia in school-age children is a global public health problem, and strategies to prevent myopia and limit its progression are urgently needed.

A recent review on the epidemiology of myopia in school children worldwide found that the risk factors for myopia in this population include female sex, low outdoor time, parental myopia, increasing age, time of near work or studying, and urban environment, high population density, and small home size [9]. On the other hand, Biswas et al. [10] identified excessive near work as the sole solid risk factor for myopia, while other factors like visual environment, circadian rhythm, sleep, nutrition, smoking, socioeconomic status, and education remain debatable. In addition, the development of myopia increased during the coronavirus disease 2019 (COVID-19) pandemic in school children due to home confinement and decreased outdoor activities [3, 11]. A growing body of evidence demonstrates that myopia risk can be managed by interventions such as increased time spent outdoors and other optical and pharmacological treatments [12-14]. Parents are essential in managing myopia in school children [15]. They influence their children's lifestyle choices, behavior modifications, and environmental exposure, which can prevent or slow down myopia. They can work with teachers and school

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignement Supérieur (ABES).

administrators to ensure the classroom environment is conducive to good eye health. Parental involvement is crucial for successfully managing myopia in children [16]. Parents are also the main source of information about myopia in school-age children [17]. However, a study in China showed that most parents misunderstood the influence of the environment and sports and extracurricular activities on myopia [18]. A previous study showed that Indian optometrists had gaps in knowledge regarding childhood myopia [19], preventing the effective transfer of accurate knowledge, but the possible knowledge gap in parents remains poorly understood. It is particularly important to study their understanding since the awareness and practice of parents toward myopia will have a strong impact on the prevention and treatment of myopia in school children.

A knowledge, attitude, and practice (KAP) survey is a quantitative method widely used for evaluating the understanding and application of health-related topics based on the principle that knowledge impacts behavior and practice of disease management [20]. Despite China having a high prevalence of myopia, research on the KAP of parents of primary school-age children remains limited. Only one study has reported that parents or guardians of children demonstrated adequate knowledge, positive attitudes, and proactive practices in preventing and managing childhood myopia, but that study did not specifically enroll parents of primary school-age children [21]. Gaining a better understanding of their KAP could inform strategies to improve myopia prevention and management among school-age children.

Therefore, this study aimed to assess the KAP toward myopia among parents of primary school-age children and to investigate the factors associated with the KAP levels, which would be valuable information in identifying parents who require further education on myopia.

## Methods

### Patient and public involvement

The parents of primary school-age children were included in this study as participants, but they were not involved in the study design.

**Study design and participants**

This cross-sectional study was conducted between October 2022 and November 2022 in Wuxi City, China, involving parents of children attending a primary school in the Liangxi District. The school is in the city center, and the surrounding population has an intermediate socioeconomic status. It was selected because it was one of the myopia prevention and control experimental units of Wuxi Children's Hospital. The parents who declined to participate or did not clearly understand (self-reported) the research procedures were excluded from the study. The study was ethically approved by Wuxi Children's Hospital (approval number: WXCH2022-09-040), and informed consent was obtained from all participants. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [22].

**Procedures**

The study questionnaire was self-developed based on two guidelines and one white paper applied in China [23-25]. Following its initial design, the questionnaire underwent modifications based on feedback from three experts, including two ophthalmologists and one teacher.

The questionnaire included four dimensions (Supplementary Materials): the demographic information, knowledge dimension, attitude dimension, and practice dimension. The knowledge dimension consisted of 12 questions scored 1 point for each correct answer and 0 points for wrong answers, resulting in a possible score range of 0 to 12 points. The attitude dimension included nine questions scored using a five-point Likert scale ranging from “Very Positive (5 points)” to “Very Negative (1 point)”, and the scoring was reversed for the negative questions and three questions (questions 6-8) were not included in the total score. Therefore,

the possible score range for the attitude dimension was 6 to 30 points. The practice dimension included 13 questions. Questions 1-3 were scored with 1 point for answering yes and 0 points for answering no. Questions 4-7 were descriptive and were not scored. Questions 8-13 were scored using a five-point Likert scale ranging from “Very Positive (5 points)” to “Very Negative (1 point)”, with the scoring being reversed for the negative questions. The total score for the practice dimension ranged from 6 to 33 points. Higher scores indicated more adequate knowledge, positive attitudes, and proactive practice. For the quantitative analysis of the participants' KAP, the scores were assigned based on their responses to the knowledge, attitude, and practice dimensions by the statistician.

The research team obtained permission from the headmaster of the selected primary school in the Liangxi district of Wuxi City to conduct the survey. Two trained research assistants explained the questionnaire to the teachers and provided them with training about the objective and how to answer the questions. The teachers assisted in administering the questionnaire. An electronic version of the questionnaire was generated using the Wen Juan Xing (WJX) platform (<https://www.wjx.cn>), and a quick response code was created for the parents to scan and access the survey via WeChat. Each IP address was allowed to submit only one response to minimize the risk of duplicates. The research team reviewed all questionnaires to check for completeness, internal consistency, and reasonableness based on the absence of impossible or out-of-range data or a questionnaire completed using all the same options (e.g., all first choices). The Cronbach's  $\alpha$  score for the valid questionnaires was 0.729, indicating acceptable internal consistency [26].

### Statistical analyses

The minimal sample size was estimated using Cochran's sample size formula for survey studies [27]:

$$n = \frac{Z^2 \times p(1 - p)}{e^2}$$

where  $Z^2$  is the confidence coefficient,  $p$  is the proportion, and  $e$  is the margin of error. The sample size is maximized when  $p=0.5$ . A 95% confidence interval involves a  $Z$ -value of 1.96. Precision was assumed at 5%. Hence, a minimum of 385 participants were needed.

The statistical analysis was conducted using SPSS 26.0 (IBM Corp., Armonk, N.Y., USA). A confirmatory factor analysis (CFA) was performed to examine the reliability of the questionnaire by calculating the confirmatory factor index (CFI) ( $>0.800$  is considered good), the incremental factor index (IFI) ( $>0.800$  is considered good), the Tucker-Lewis index (TLI) ( $>0.800$  is considered good), and the minimum discrepancy divided by its degrees of freedom (CMIN/DF) (1-3 is considered excellent, 3-5 is considered good) [28]. Continuous data following a normal distribution were expressed as means  $\pm$  standard deviations (SD) and compared using the  $t$ -test or ANOVA. Continuous data following a skewed distribution were expressed as median (Q1, Q3) and compared using the Wilcoxon rank-sum test or Kruskal-Wallis H test. The categorical data were presented as  $n$  (%). Spearman correlation was used to analyze the correlation between knowledge, attitude, and practice scores. Univariable and multivariable logistic regression analyses were performed to analyze the factors associated with knowledge, attitude, and practice levels. The KAP scores were dichotomized as poor/good knowledge, negative/positive attitudes, and poor/proactive practices based on a cutoff of  $\geq 70\%$  of the total score for each dimension (i.e., 8.4 for knowledge, 21 for attitudes, and 23.1 for practice). A two-sided  $P<0.05$  was considered statistically significant.

**Results**

**Questionnaire validation**

The CFA (Figure 1) showed that the CFI was 0.829 ( $>0.800$  is good), the IFI was 0.830 ( $>0.800$

is good), the TLI was 0.813 ( $>0.800$  is good), and the CMIN/DF was 2.517 ( $>1$ ; 1-3 is excellent, 3-5 is good), indicating that the questionnaire had good reliability.

### Participant demographics

Out of the 1244 parents with children attending the study school, 643 (51.69%) questionnaires were returned after obtaining informed consent. Ninety-one (7.3%) questionnaires were excluded due to incomplete responses. In total, 552 (44.4%) non-problematic questionnaires were included. The majority of the participants were female (79.5%), employed (78.1%), and had completed junior college or bachelor's degrees (77.7%). In addition, 50.9% of the participants were in the 35-44-year-old age range, while 55.3% reported having only one child. Monthly household income per person was 5000-10,000 yuan for 33.2% of participants. The data also showed that myopia was prevalent among the study population, with 64% of parents and 38% of students reporting the condition, as shown in Table 1.



**Table 1.** Baseline characteristics and KAP scores.

	N (%)	Knowledge Median [Q1, Q3]	P	Attitude Median [Q1, Q3]	P	Practice Median [Q1, Q3]	P
<b>Gender</b>			0.411		0.001		0.098
Male	113 (20.47)	9 [7,10]		25 [22,26]		26 [23,29]	
Female	439 (79.53)	9 [7,10]		26 [24,27]		27 [24,29]	
<b>Age</b>			0.295		0.059		0.962
Less than 35 years old	120 (21.74)	9 [7,10]		26 [24,27]		27 [24,29]	
35-44 years old	281 (50.91)	9 [7,10]		25 [23,26]		27 [24,29]	
45 years old and above	151 (27.36)	9 [7,10]		25 [23,27]		27 [24,29]	
<b>Child's grade</b>			0.246		0.553		0.009
1	79 (14.31)	9 [8,10]		26 [23,27]		28 [25,30]	
2	66 (11.96)	9 [7,10]		26 [24,26]		28 [25,30]	
3	100 (18.12)	9 [7,10]		26 [23.5,27]		26 [23.5,29]	
4	155 (28.08)	9 [7,10]		26 [23,27]		26 [23,29]	
5	75 (13.59)	9 [8,10]		25 [23,27]		25 [24,29]	
6	77 (13.95)	9 [7,9]		25 [23,27]		26 [24,29]	
<b>Number of siblings</b>			0.005		0.143		0.906
0	305 (55.25)	9 [8,10]		26 [24,27]		27 [24,30]	
1	206 (37.32)	9 [7,10]		25 [23,27]		27 [24,29]	
≥2	41 (7.43)	9 [7,10]		25 [23,27]		27 [24,28]	
<b>Education</b>			<0.001		0.021		0.003
High school / technical secondary school and below	90 (16.30)	7.5 [6,9]		24.5 [22,26]		25 [23,28]	
Junior college / bachelor's degree	429 (77.72)	9 [8,10]		26 [24,27]		27 [24,29]	

Master's degree and above	33 (5.98)	10 [9,10]	26 [24,27]	28 [26,30]
<b>Work status</b>			0.004	0.427
Employed	431 (78.08)	9 [8,10]	26 [24,27]	27 [24,29]
Unemployed	37 (6.70)	8 [6,9]	26 [23,28]	26 [24,29]
Self-employed	55 (9.96)	9 [7,10]	25 [23,26]	27 [24,30]
Full-time homemaker	29 (5.25)	7 [6,10]	25 [23,26]	27 [25,30]
<b>Monthly household income per person, yuan</b>			0.005	0.017
<5000	76 (13.77)	8 [6,9]	24 [22,26]	25.5 [23,28.5]
5000-10,000	183 (33.15)	9 [7,10]	25 [23,27]	27 [23,29]
10,000-20,000	170 (30.80)	9 [8,10]	26 [24,27]	27 [24,29]
>20,000	123 (22.28)	9 [7,10]	26 [24,27]	28 [25,30]
<b>Do the parents have myopia?</b>			<0.001	0.001
Yes	353 (63.95)	9 [8,10]	26 [24,27]	26 [24,29]
No	199 (36.05)	8 [6,10]	25 [23,26]	27 [24,29]
<b>Does the child have myopia?</b>			0.001	0.854
Yes	210 (38.04)	9 [8,10]	25.5 [24,27]	26 [24,29]
No	342 (61.96)	9 [7,10]	25 [23,27]	27 [24,29]

SD, standard deviation; q: quantile.

**Knowledge, attitude, and practice toward myopia**

The average knowledge score among participants was 8.38±2.29 (theoretical minimum-maximum: 0-12). Parents with only one child (P=0.005), a master's degree or higher (P<0.001), employment (P=0.004), a higher income (P=0.005), parents with myopia (P<0.001), and children with myopia (P=0.001) had higher knowledge scores. In terms of attitude, participants had an average score of 25.01±2.79 (theoretical minimum-maximum: 6-30). Females (P=0.001), a bachelor's degree or higher (P=0.021), a monthly household income per person of >10,000 yuan (P=0.017), and those with myopia (P=0.001) tended to have higher attitude scores. Regarding practice, participants had an average score of 26.37±3.96 (theoretical minimum-maximum: 6-33). Parents with children in first or second grade (P=0.009), a master's degree or higher (P=0.003), and a monthly income of >20,000 yuan (P=0.029) had higher practice scores (Table 1).

Regarding the knowledge dimension, participants performed best on questions related to the brightness of electronic devices (with a correct rate of 95.8%) and indoor lighting when reading (92.4%). However, they struggled with questions related to the causes of myopia (with a correct rate of only 27.2%) and outdoor exercise (with a correct rate of 20.3%). In terms of attitude, participants generally exhibited a positive attitude, except for the question about wearing glasses. Only 35.1% of the participants agreed (either "Extremely Positive" or "Positive") with the negative statement, "I believe that glasses should only be worn when necessary to correct vision." Finally, with regard to the practice dimension, most participants reported positive practice, except for outdoor activities and reading while lying down (Table 2).

**Table 2.** Knowledge, attitudes, and practices.

Knowledge	N (%)	Correct (%)	Wrong/unclear (%)
1. Myopia is the result of overdevelopment of the eyeball, which is essentially a shortening of the eye axis.	31 (27.17)	402 (72.83)	
2. The complications of high myopia are mainly fundus lesions, such as retinal detachment, retinoblastoma, macular hemorrhage, macular fissure, etc.	31 (68.84)	172 (31.16)	
3. Low-concentration atropine drops are effective in slowing the development of myopia.	31 (48.37)	285 (51.63)	
4. Mydriasis is a routine form of eye examination and treatment.	31 (66.85)	183 (33.15)	
5. To give your eyes adequate rest, get up and move around every 20 minutes when working and studying, and stand in front of a window and look 20 feet (6 meters) away for at least 20 seconds.	31 (91.85)	45 (8.15)	
6. During home Internet classes, you should ensure that the room is well-lit and adjust the brightness of your child's electronic devices appropriately, not too bright or too dark.	31 (95.83)	23 (4.17)	
7. Outdoor exercise is also crucial to myopia prevention and control, but it does not matter whether the child is under daylight or not; he/she should be allowed to do more outdoor activities.	31 (20.29)	440 (79.71)	
8. Children should not read at home in too much or too little light. Make sure that indoor lighting and eye protection lamps are on at the same time.	31 (92.39)	42 (7.61)	
9. Wearing frame glasses is one of the best ways to control myopia; moreover, there are other options, such as Keratoscope, as well as reducing close reading & learning and increasing outdoor activities.	31 (91.12)	49 (8.88)	
10. If you need to do screen reading for a long time, you should wear anti-blue light glasses to block the harmful blue light to the eyes as much as possible.	31 (83.70)	90 (16.30)	
11. When the eyes become tired and dry, you can blink more often to relieve, and if necessary, use artificial tears to relieve the symptoms of dry eyes.	31 (85.33)	81 (14.67)	
12. A simple computerized optometry can accurately obtain the diopters of a child with myopia.	31 (66.30)	186 (33.70)	
Attitude	N (%)		
	Extremely positive/agree	Positive/agree	Neutral
A1. I believe that glasses should only be worn when necessary to correct vision. (N)	62 (11.23)	132 (23.91)	91 (16.49)
A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)	11 (1.99)	15 (2.72)	17 (3.08)
A3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)	3 (0.54)	2 (0.36)	11 (1.99)
A4. I fully support promoting the importance of vision protection for primary and secondary school students. (P)	430 (77.90)	104 (18.84)	16 (2.90)
A5. If a "vision protection" parent-child activity is offered by the school or community, I would be interested in participating. (P)	335 (60.69)	167 (30.25)	46 (8.33)
A6. I am concerned that my child's myopia may impact their future life and	330 (59.78)	165 (29.89)	38 (6.93)

studies.			(6.88)		
A7. I am worried that my child's myopia may affect their appearance.	273 (49.46)	165 (29.89)	74 (13.41)	5 (6.34)	5 (0.91)
A8. I am concerned that my child's myopia may lead to low self-esteem.	112 (20.29)	75 (13.59)	217 (39.31)	26 (22.83)	22 (3.99)
A9. If I am nearsighted, I think that glasses should only be worn when necessary, but not necessarily all day. (N)	20 (3.62)	71 (12.86)	64 (11.59)	62 (47.46)	135 (24.46)
<b>Practice</b>	<b>N (%)</b>				
	<b>Yes</b>	<b>No</b>			
P1. Encourage your child to participate in outdoor activities for at least 2 hours a day.	208 (37.68)	344 (62.32)	-	-	-
P2. Supervise your child to perform eye exercises regularly.	334 (60.51)	218 (39.49)	-	-	-
P3. Attend scientific lectures or activities on children's and adolescents' vision health.	316 (57.25)	236 (42.75)	-	-	-
	<b>Always</b>	<b>Often</b>	<b>Sometimes</b>	<b>Rarely</b>	<b>Never</b>
P4. Take your child for optical coherence tomography once a year.	118 (21.38)	216 (39.13)	120 (21.37)	89 (16.12)	-
P5. Ensure a balanced diet that includes eggs, meat, fish, or animal liver.	11 (1.99)	200 (36.23)	187 (33.25)	174 (31.52)	-
P6. Provide dairy or soy products for your child.	6 (1.09)	128 (23.19)	187 (33.25)	260 (47.10)	-
P7. Offer plenty of fresh vegetables and fruits.	3 (0.54)	58 (10.51)	187 (33.25)	340 (61.59)	-
	<b>Extremely positive</b>	<b>Positive</b>	<b>Neutral</b>	<b>Negative</b>	<b>Extremely negative</b>
P8. Supervise your child's reading and writing posture.	181 (32.79)	254 (46.01)	165 (29.89)	14 (2.54)	2 (0.36)
P9. Discourage your child from using electronic devices such as television, cell phone, or tablet computer in the dark.	364 (65.94)	142 (25.72)	29 (5.15)	12 (2.17)	5 (0.91)
P10. Do not allow your child to lie down while reading books or using electronic devices.	149 (26.99)	90 (16.30)	58 (10.51)	48 (8.70)	207 (37.50)
P11. Discourage your child from reading books or looking at electronic products while using mobile transportation (bus, car).	360 (65.22)	136 (24.64)	42 (7.61)	7 (1.27)	7 (1.27)
P12. Discourage your child from rubbing their eyes.	286 (51.81)	176 (31.88)	68 (12.22)	14 (2.54)	8 (1.45)
P13. Encourage your child to take breaks and relax their eyes during class breaks.	275 (49.82)	172 (31.16)	77 (13.95)	24 (4.35)	4 (0.72)

“P” indicates a positive statement, while “N” indicates a negative statement. The questions marked with “N” were reverse-scored.

## Correlations

Pearson correlation analyses showed a significant positive correlation was found between knowledge-attitude ( $r=0.2492$ ,  $P<0.001$ ), knowledge-practice ( $r=0.1736$ ,  $P<0.001$ ), and attitude-practice ( $r=0.2711$ ,  $P<0.001$ ) (**Table 3**).

**Table 3.** Spearman correlation analyses.

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.2492 ( $P<0.001$ )	1	
Practice	0.1736 ( $P<0.001$ )	0.2711 ( $P<0.001$ )	1

## Factors associated with knowledge, attitude, and practice toward myopia

Multivariable logistic regression showed that having a junior college or bachelor's degree (odd ratio [OR]=3.072, 95% confidence interval [CI]: 1.566-6.025,  $P=0.001$ ), having a master's degree or above (OR=6.259, 95%CI=2.327-16.835,  $P<0.001$ ), having a monthly household income per person of 10,000-20,000 yuan (OR=1.999, 95% CI: 1.029-3.883,  $P=0.041$ ), having myopia (OR=1.547, 95% CI: 1.028-2.330,  $P=0.037$ ), having a child with myopia (OR=1.923, 95% CI: 1.314-2.813,  $P=0.001$ ), and having two children (OR=0.650, 95% CI: 0.434-0.974,  $P=0.037$ ) were independently associated with adequate knowledge. The knowledge scores (OR=1.239, 95% CI: 1.131-1.357,  $P<0.001$ ), being female (OR=2.080, 95% CI: 1.307-3.310,  $P=0.002$ ), having monthly household income per person of 10,000-20,000 yuan (OR=1.842, 95% CI: 1.010-3.359,  $P=0.046$ ), having monthly household income per person over 20,000

yuan (OR=2.296, 95% CI: 1.211-4.351, P=0.011), having myopia (OR=1.549, 95% CI: 1.056-2.273, P=0.025), and being aged 33-44 years old (OR=0.533, 95% CI: 0.334-0.851, P=0.008) were independently associated with positive attitudes. The attitude scores (OR=1.163, 95% CI: 1.076-1.258, P<0.001) and having a child in the fourth grade (OR=0.478, 95% CI: 0.265-0.859, P=0.014) were independently associated with proactive practice (**Supplementary Table 1**)

**Discussion**

This study found that parents of primary school-age children had inadequate knowledge, positive attitudes, and proactive practice regarding myopia, which might provide valuable insights for future intervention studies to enhance myopia education and promote better eye health for children.

In the present study, 64% of the parents reported having myopia, and reported myopia in 38% of their children. Such values are within the Chinese ranges for myopia prevalence. Indeed, the prevalence of myopia in Chinese adults is 36%-86% [29, 30]. For Chinese primary school children (aged 7-12), the prevalence of myopia is 30.7%-52.7% [3-6].

McCrann et al. reported that 76% of parents of school-age children recognized the potential health risks of digital technology for the eyes [16]. One study conducted in rural China by Li et al. highlighted that some parents have no clear idea of what myopia is, and only a small number knew the anatomical definition of the condition [31]. Another study in China highlighted the insufficient understanding of the importance of minimizing near work in children, having adequate sleep duration, adopting a proper

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignment Supérieur (ABES).



reading distance, maintaining adequate indoor illumination, and encouraging sports and outdoor activities [18]. Another study comparing myopia control perceptions between parents in the United Kingdom and Hong Kong also found low awareness of the effects of myopia, especially in the United Kingdom [32], which was consistent with the findings observed here. In addition, in the present study, the knowledge among parents was suboptimal, they correctly understood the impact of electronic devices and indoor lighting, but they had poorer knowledge of the cause of myopia and the impact of outdoor exercises. The vast majority agreed that wearing glasses is one of the best ways to control myopia; however, in Li's study, parents had the misconception that glasses-wearing should be delayed in children and might harm the eyes [31]. This discrepancy can be explained by the fact that the study was conducted in an urban area, and parents might have had higher awareness.

The study by He et al. on parents of primary school students also revealed that family income and parents' education level significantly affected their myopia knowledge [33]. Tao et al. [18] also showed that lower parental education was associated with myopic progression in their children. Furthermore, parents with myopia might have more related knowledge through their experience and more opportunities to seek information from professionals. Therefore, educational interventions need to focus on parents with no myopia history and those whose children have no myopia, as well as parents with lower income and education levels.

One similar survey study conducted in Ireland found parental attitudes to myopia were nonchalant [16]. Only 14% of parents of school-age children expressed that they would



be concerned if their children were diagnosed with myopia, and 46% considered myopia to be a health risk to their children [16]. The lack of parental concern in the previous study might be due to the low myopia prevalence in Ireland: only 10% of the children had myopia, compared with around 40% in the present study. McCrann et al. also found that myopic parents considered myopia as more of an inconvenience and were more likely to consider limiting screen time [16]. Parents' attitudes toward children's visual care were associated with a lower risk of myopia in children, and it is important to enhance their attitude toward myopia [34].

Jiang et al.'s study on parents' intention toward preschool children's myopia-prevention behaviors also found that parental attitude was associated with their myopia-preventive behaviors [35]. Parental beneficial behaviors (e.g., spending less time on near work and electronic device use) are positively associated with children's myopia [33]. The practice score was adequate in the present study. Furthermore, a higher attitude score was significantly associated with better practice scores, while having a child in the fourth grade was associated with poorer practice. The primary school system in China usually has six grades (grades 1-6). The children usually start attending school (grade 1) at 6 years old. Hence, children in grade 4 are usually 9 years old, which is around the peak for myopia incidence in children in China [3-6]. Still, this study examined associations, not causality, and the results could highlight that the peak of parental carelessness about myopia could occur when their children are around that age. Additional studies are necessary to examine that point. This finding reaffirmed the relationship between knowledge, attitude, and practice and that adequate knowledge

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignement Supérieur (ABES).

can lead to a positive attitude to inform better practice [36, 37]. This study also found significant correlations between knowledge-attitude, knowledge-practice, and attitude-practice. In the practice dimension, most parents answered positively, except on the items of outdoor activities and reading while lying down.

There were several limitations in this study. First, this study was conducted in a single school in China, and the results might not be generalized to other cities. The school was selected because it was one of the myopia prevention and control experimental units of the hospital, which could introduce bias. Second, due to the self-reporting nature of the study, the results might deviate from the actual practice. The parents who did not have a clear self-reported understanding of the research procedures were excluded, which could introduce bias. Furthermore, most participants provided positive answers in the attitude and practice dimensions, while knowledge scores were poor, and the results might be affected by the social desirability bias or overconfidence. Third, 44% of the parents in the selected school returned a non-problematic questionnaire, and there might be a non-response bias. Fourth, the teachers helped administer the questionnaire, but it could introduce a “classroom effect” bias.

## Conclusions

Parents of primary school-age children had inadequate knowledge but a positive attitude and proactive practice toward myopia. Education programs focusing on the causes and risk factors of myopia, prevention measures, and early detection and treatment should be designed and implemented for parents. There is a need for health

education programs that target parents with lower education and income levels to improve knowledge about myopia. Efforts should be made to maintain positive attitudes and improve the knowledge and practice toward myopia by highlighting the benefits of outdoor activities and limiting screening time. In addition, healthcare professionals should encourage parents to take proactive measures such as scheduling regular eye check-ups and creating a myopia-friendly environment at home, i.e., maximizing outdoor activities, minimizing near work, and having proper lighting intensity and spectral composition [10].

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Supérieur (ABES).

## List of abbreviations

KAP, knowledge, attitude, and practice

STROBE, Strengthening the Reporting of Observational Studies in Epidemiology

SD, standard deviation

## Declarations

### Ethics approval and consent to participate

The study was ethically approved by Wuxi Children's Hospital (approval number: WXCH2022-09-040), and informed consent was obtained from all participants. All methods were performed in accordance with the relevant guidelines and regulations.

### Availability of data and materials

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

### Competing interests

The authors declare that they have no competing interests

### Funding

This study was supported by the Guiding Project of Wuxi Science and Technology Bureau (NZ2021014). The funders had no role in study design, data collection and analyses, publication decisions, or manuscript preparation.

### Authors' contributions

Yujing Tian and Yingqing Yu carried out the studies, participated in collecting data, and drafted the manuscript. Yujing Tian and Yingqing Yu performed the statistical analyses and participated in the design. Yujing Tian and Yingqing participated in the

acquisition, analysis, or interpretation of data and drafted the manuscript. All authors read and approved the final manuscript. Yujing Tian is the guarantor.

**Acknowledgments**

Not applicable

**References**

1. Morgan IG, Ohno-Matsui K, Saw SM. Myopia. Lancet (London, England). 2012;379(9827):1739-48.

2. Baird PN, Saw SM, Lanca C, Guggenheim JA, Smith Iii EL, Zhou X, et al. Myopia. Nature reviews Disease primers. 2020;6(1):99.

3. Dong L, Kang YK, Li Y, Wei WB, Jonas JB. PREVALENCE AND TIME TRENDS OF MYOPIA IN CHILDREN AND ADOLESCENTS IN CHINA: A Systemic Review and Meta-Analysis. Retina (Philadelphia, Pa). 2020;40(3):399-411.

4. Li T, Wei R, Du B, Wu Q, Yan J, Meng X, et al. Prevalence of myopia among children and adolescents aged 6–16 during COVID-19 pandemic: a large-scale cross-sectional study in Tianjin, China. British Journal of Ophthalmology. 2024;108(6):879.

5. Zhang J, Li Z, Ren J, Wang W, Dai J, Li C, et al. Prevalence of myopia: A large-scale population-based study among children and adolescents in weifang, china. Frontiers in public health. 2022;10:924566.

6. Pan W, Lan W. The Current and Future Landscape of the Childhood Myopia Epidemic in China-A Review. Ophthalmology and therapy. 2024;13(4):883-94.

7. Jones D, Luensmann D. The prevalence and impact of high myopia. Eye &

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Ensignment Superior (ABES).

contact lens. 2012;38(3):188-96.

8. Sankaridurg P, Tahhan N, Kandel H, Naduvilath T, Zou H, Frick KD, et al. IMI Impact of Myopia. *Investigative ophthalmology & visual science*. 2021;62(5):2.

9. Grzybowski A, Kanclerz P, Tsubota K, Lanca C, Saw SM. A review on the epidemiology of myopia in school children worldwide. *BMC ophthalmology*. 2020;20(1):27.

10. Biswas S, El Kareh A, Qureshi M, Lee DMX, Sun CH, Lam JSH, et al. The influence of the environment and lifestyle on myopia. *J Physiol Anthropol*. 2024;43(1):7.

11. Wang J, Li Y, Musch DC, Wei N, Qi X, Ding G, et al. Progression of Myopia in School-Aged Children After COVID-19 Home Confinement. *JAMA ophthalmology*. 2021;139(3):293-300.

12. He M, Xiang F, Zeng Y, Mai J, Chen Q, Zhang J, et al. Effect of Time Spent Outdoors at School on the Development of Myopia Among Children in China: A Randomized Clinical Trial. *Jama*. 2015;314(11):1142-8.

13. Wu PC, Tsai CL, Wu HL, Yang YH, Kuo HK. Outdoor activity during class recess reduces myopia onset and progression in school children. *Ophthalmology*. 2013;120(5):1080-5.

14. Smith MJ, Walline JJ. Controlling myopia progression in children and adolescents. *Adolescent health, medicine and therapeutics*. 2015;6:133-40.

15. Coverdale S, Rountree L, Webber K, Cufflin M, Mallen E, Alderson A, et al. Eyecare practitioner perspectives and attitudes towards myopia and myopia

management in the UK. *BMJ Open Ophthalmol.* 2024;9(1).

16. McCrann S, Flitcroft I, Lalor K, Butler J, Bush A, Loughman J. Parental attitudes to myopia: a key agent of change for myopia control? *Ophthalmic & physiological optics : the journal of the British College of Ophthalmic Opticians (Optometrists).* 2018;38(3):298-308.

17. Almujaalli AA, Almatrafi AA, Aldael AA, Almojali HA, Almujaalli AI, Pathan A. Knowledge, attitude, and practice about myopia in school students in Marat city of Saudi Arabia. *Journal of family medicine and primary care.* 2020;9(7):3277-80.

18. Tao ZY, Chen SQ, Tang Y, Zhao J, Wang J, Lin ZH, et al. The Influence of Parents' Background and Their Perception on the Progression of Myopia in Children. *Int J Clin Pract.* 2022;2022:4123470.

19. Naik A, Karthikeyan SK, Ramesh JJ, Bhaskar S, Ganapathi CA, Biswas S. An Insight into Knowledge, Perspective, and Practices of Indian Optometrists towards Childhood Myopia. *Vision.* 2024;8(2).

20. Ahmed T, Hussain S, Zia UU, Rinchen S, Yasir A, Ahmed S, et al. Knowledge, attitude and practice (KAP) survey of canine rabies in Khyber Pakhtunkhwa and Punjab Province of Pakistan. *BMC public health.* 2020;20(1):1293.

21. Qian Y, Lu P. Parents' or Guardians' Knowledge, Attitudes and Practices in the Prevention and Management of Childhood Myopia. *Ophthalmology and therapy.* 2024;13(12):3095-109.

22. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)

statement: guidelines for reporting observational studies. BMJ (Clinical research ed). 2007;335(7624):806-8.

23. China TNHWCotPsRo. Guidelines on myopia prevention and treatment. 2018;6(5).

24. Equipment OPCoCAoM. Application standard for detection and prevention and control of myopia in children and adolescents. Chin J Ophthalmol Med. 2018;8(6):276-88.

25. Jiang J. White paper on myopia management. Chinese Journal of Optometry Ophthalmology and Visual Science. 2019;21(3):161-5.

26. Taber KS. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Research in Science Education. 2018;48(6):1273-96.

27. Cochran WG. Sampling Techniques (3rd ed.). New York: John Wiley & Sons; 1977.

28. Goretzko D, Siemund K, Sterner P. Evaluating Model Fit of Measurement Models in Confirmatory Factor Analysis. Educ Psychol Meas. 2024;84(1):123-44.

29. Zhang HM, Li BQ, Zhu Y, Liu SX, Wei RH. Time trends in myopia and high myopia prevalence in young university adults in China. International journal of ophthalmology. 2023;16(10):1676-81.

30. Wang X, Luo R, Shan G, He H, Chen T, Wang X, et al. Prevalence and risk factors for refractive error in older adults in eight ethnicities in China: The China national health survey. Heliyon. 2024;10(17):e36354.



31. Li L, Lam J, Lu Y, Ye Y, Lam DS, Gao Y, et al. Attitudes of students, parents, and teachers toward glasses use in rural China. *Archives of ophthalmology (Chicago, Ill : 1960)*. 2010;128(6):759-65.
32. Dias L, Brennan N, Sulley A. A comparison of myopia control perceptions between parents in UK and Hong Kong. *Contact Lens and Anterior Ey*. 2018;41:S33.
33. He AQ, Liu SA, He SY, Yao H, Chen P, Li Y, et al. Investigation of children's habits of smartphone usage and parental awareness of myopia control in underdeveloped areas of China. *International journal of ophthalmology*. 2022;15(10):1691-8.
34. Zhou S, Yang L, Lu B, Wang H, Xu T, Du D, et al. Association between parents' attitudes and behaviors toward children's visual care and myopia risk in school-aged children. *Medicine*. 2017;96(52):e9270.
35. Jiang N, Chen J, Cao H, Liu Y, Zhang Y, Wang Q, et al. Parents' intentions toward preschool children's myopia preventive behaviors: Combining the health belief model and the theory of planned behavior. *Frontiers in public health*. 2022;10:1036929.
36. ul Haq N, Hassali MA, Shafie AA, Saleem F, Farooqui M, Haseeb A, et al. A cross-sectional assessment of knowledge, attitude and practice among Hepatitis-B patients in Quetta, Pakistan. *BMC public health*. 2013;13:448.
37. Evans G, Durant J. The relationship between knowledge and attitudes in the public understanding of science in Britain. *Public Understanding of Science*. 1995;4(1):57-74.

## Figure Legends

### Figure 1 Confirmatory factor analysis for KAP

For peer review only

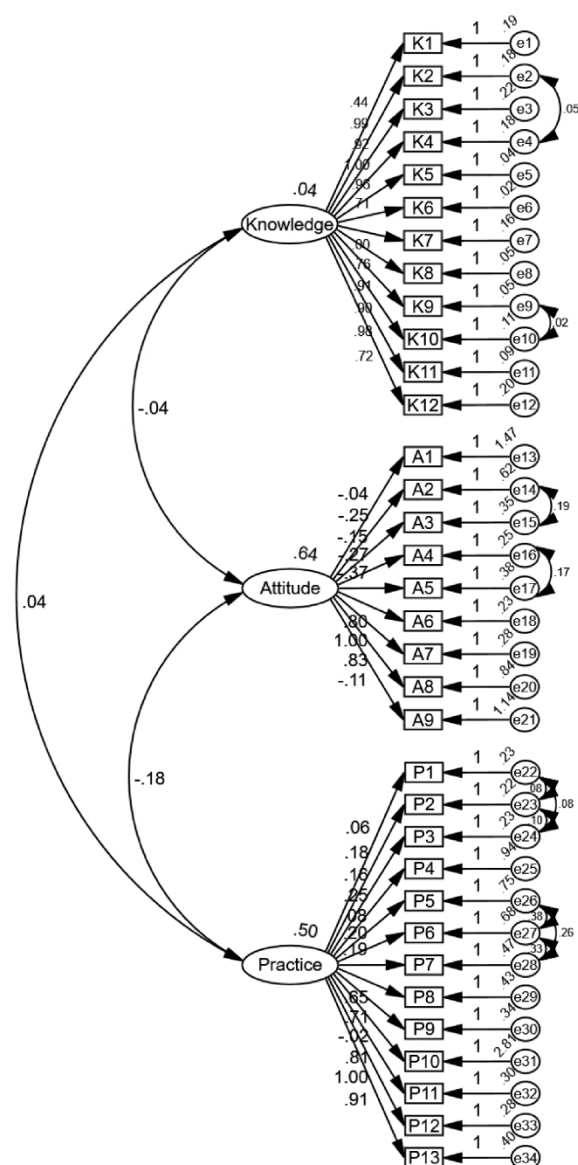


Figure 1 Confirmatory factor analysis for KAP

170x287mm (300 x 300 DPI)

**Supplementary table 1.** Univariate and multivariate logistic regression analyses.

Knowledge	Univariate logistic regression		Multivariate logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
<b>Gender</b>				
Male	ref			
Female	1.110 (0.717-1.717)	0.640		
<b>Age</b>				
Less than 35 years old	ref			
35-44 years old	1.307 (0.830-2.058)	0.248		
45 years old and above	1.133 (0.680-1.888)	0.631		
<b>Child's grade</b>				
1	ref			
2	0.985 (0.500-1.942)	0.966		
3	0.928 (0.502-1.717)	0.813		
4	1.031 (0.588-1.807)	0.915		
5	1.283 (0.672-2.451)	0.450		
6	0.526 (0.262-1.058)	0.071		
<b>Number of siblings</b>				
0	ref		ref	
1	0.614 (0.421-0.895)	0.011	0.650 (0.434-0.974)	0.037
≥2	0.535 (0.259-1.108)	0.092	0.655 (0.301-1.423)	0.655
<b>Education</b>				
High School / Technical secondary school and below	ref		ref	

Junior college/Bachelor's degree	3.739 (2.013-6.943)	<0.001	3.072 (1.566-6.025)	0.001
Master's degree and above	6.293 (2.557-15.491)	<0.001	6.259 (2.327-16.835)	<0.001
<b>Work Status</b>				
Employed	ref		ref	
Unemployed	0.387 (0.166-0.902)	0.028	0.720 (0.290-1.785)	0.478
Self-employed	0.876 (0.486-1.579)	0.661	1.295 (0.677-2.477)	0.434
Full-time homemaker	0.633 (0.274-1.461)	0.284	0.876 (0.359-2.141)	0.772
<b>Monthly household income per person</b>				
<5000	ref		ref	
5000-10000	2.166 (1.156-4.059)	0.016	1.859 (0.960-3.596)	0.066
10000-20000	2.689 (1.432-5.050)	0.002	1.999 (1.029-3.883)	0.041
>20000	1.944 (0.999-3.783)	0.050	1.452 (0.716-2.947)	0.301
<b>Are the parents nearsighted?</b>				
Yes	2.023 (1.380-2.965)	<0.001	1.547 (1.028-2.330)	0.037
No	ref		ref	
<b>Is the child nearsighted?</b>				
Yes	1.784 (1.249-2.550)	0.01	1.923 (1.314-2.813)	0.001
No	ref		ref	
<b>Attitude</b>				
<b>Knowledge score</b>				
	1.265 (1.161-1.379)	<0.001	1.239 (1.131-1.357)	<0.001
<b>Gender</b>				
Male	ref		ref	
Female	2.083 (1.357-3.198)	0.001	2.080 (1.307-3.310)	0.002
<b>Age</b>				
Less than 35 years old	ref		ref	
35-44 years old	0.629 (0.408-0.970)	0.036	0.533 (0.334-0.851)	0.008

45 years old and above	0.581 (0.358-0.943)	0.028	0.632 (0.372-1.074)	0.090
<b>Child's grade</b>				
1	ref			
2	1.170 (0.608-2.253)	0.639		
3	1.145 (0.634-2.067)	0.654		
4	0.988 (0.574-1.698)	0.964		
5	0.949 (0.505-1.786)	0.872		
6	0.589 (0.311-1.115)	0.104		
<b>Number of siblings</b>				
0	ref			
1	0.751 (0.527-1.070)	0.113		
≥2	0.772 (0.402-1.485)	0.439		
<b>Education</b>				
High School / Technical secondary school and below	ref		ref	
Junior college/Bachelor's degree	1.870 (1.170-2.988)	0.009	1.172 (0.691-1.989)	0.556
Master's degree and above	2.073 (0.924-4.651)	0.077	1.231 (0.495-3.065)	0.655
<b>Work Status</b>				
Employed	ref			
Unemployed	1.031 (0.527-2.019)	0.928		
Self-employed	0.756 (0.430-1.331)	0.333		
Full-time homemaker	0.794 (0.373-1.690)	0.549		
<b>Monthly household income per person</b>				
<5000	ref		ref	
5000-10000	1.540 (0.886-2.676)	0.126	1.230 (0.685-2.207)	0.488
10000-20000	2.141 (1.225-3.741)	0.008	1.842 (1.010-3.359)	0.046

>20000	2.478 (1.373-4.472)	0.003	2.296 (1.211-4.351)	0.011
<b>Are the parents nearsighted?</b>				
Yes	1.875 (1.317-2.668)	<0.001	1.549 (1.056-2.273)	0.025
No	ref		ref	
<b>Is the child nearsighted?</b>				
Yes	1.024 (0.726-1.443)	0.894		
No	ref			
<b>Practice</b>				
<hr/>				
<b>Knowledge score</b>	1.128 (1.033-1.231)	0.007	1.062 (0.962-1.172)	0.233
<b>Attitude score</b>	1.187 (1.103-1.277)	<0.001	1.163 (1.076-1.258)	<0.001
<b>Gender</b>				
Male	ref			
Female	1.147 (0.730-1.803)	0.552		
<b>Age</b>				
Less than 35 years old	ref			
35-44 years old	0.942 (0.598-1.485)	0.798		
45 years old and above	0.822 (0.490-1.379)	0.459		
<b>Child's grade</b>				
1	ref		ref	
2	1.172 (0.608-2.262)	0.636	1.205 (0.616-2.359)	0.586
3	0.541 (0.291-1.005)	0.052	0.576 (0.305-1.086)	0.088
4	0.445 (0.251-0.790)	0.006	0.478 (0.265-0.859)	0.014
5	0.481 (0.244-0.949)	0.035	0.512 (0.253-1.033)	0.062
6	0.496 (0.254-0.971)	0.041	0.576 (0.288-1.150)	0.118
<b>Number of siblings</b>				
0	ref			

1					
2					
3					
4					
5	1	0.945 (0.647-1.380)	0.770		
6	≥2				
7		0.577 (0.265-1.254)	0.165		
8					
9	<b>Education</b>				
10	High School / Technical secondary				
11	school and below	ref		ref	
12					
13	Junior college/Bachelor's degree	1.714 (1.002-2.929)	0.049	1.284 (0.723-2.281)	0.393
14	Master's degree and above	2.275 (0.966-5.360)	0.060	1.751 (0.713-4.297)	0.222
15	<b>Work Status</b>				
16	Employed	ref			
17					
18	Unemployed	1.214 (0.600-2.457)	0.590		
19	Self-employed	1.090 (0.599-1.985)	0.778		
20	Full-time homemaker	1.179 (0.534-2.605)	0.683		
21	<b>Monthly household income per</b>				
22	<b>person</b>				
23					
24	<5000	ref			
25					
26	5000-10000	0.598 (0.317-1.131)	0.114		
27	10000-20000	0.694 (0.425-1.133)	0.144		
28	>20000	0.979 (0.603-1.590)	0.933		
29	<b>Are the parents nearsighted?</b>				
30					
31	Yes	0.955 (0.658-1.387)	0.808		
32	No	ref			
33	<b>Is the child nearsighted?</b>				
34					
35	Yes	0.716 (0.491-1.045)	0.083		
36	No	ref			
37					

Abbreviation: OR: odd ratio; CI: confidence interval; ref: reference.



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

Questionnaire No. \_\_\_\_\_

Dear Parents:

We are researchers from Wuxi Children's Hospital. We sincerely invite you to participate in our research project. This study aims to understand the knowledge, attitude, and practice towards myopia among parents of primary school students to serve as the basis for developing scientific intervention strategies, which may help many others in the future to improve their vision conditions. Your participation in this study is voluntary, and the research has been approved by the Ethics Review Committee. If you agree to participate, please read the following instructions:

- 1. Please complete the questionnaire. There are no right or wrong answers; you only need to provide responses based on your actual experiences. If you have any questions during the process, feel free to reach out to us, and please submit the completed questionnaire in a timely manner.
- 2. This study is a simple questionnaire survey and will not cause any harm to your physical or psychological well-being. However, it may involve some personal information such as your gender and age. Please rest assured that we will strictly maintain confidentiality and will not disclose your information.
- 3. As a participant, you can always stay informed about the information and progress related to this study. If you decide to withdraw from the study, please let us know, and your data will not be included in the research results.

Finally, we sincerely thank you for taking the time to support our scientific research amid your busy schedule!

☐ I have been informed and agreed to the use of the collected data for scientific research.

Informant Consent Signature: \_\_\_\_\_

Date of participation: \_\_\_\_\_ Year \_\_\_\_\_ Month \_\_\_\_\_ Day

bmjopen-2024-093565 on 21 March 2025. Downloaded from <http://bmjopen.bmj.com/> on June 7, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES). All rights reserved. No reuse allowed without permission. For full text and data, please refer to the original article.

Part I Basic Information

1. Your gender:	a. Male	b. Female
2. Your age: ____.		
3. Child's grade:	a. First year of primary school b. Second year of primary school c. Third year of primary school d. Fourth year of primary school e. Fifth year of primary school f. Sixth year of primary school	
4. The child currently has a total of ____ siblings (related by blood, this child is not counted).		
5. Your education:	a. Primary school and below b. Middle school c. High school/Technical secondary school d. Junior college/Bachelor's degree e. Master's degree and above	
6. Your work Status:	a. Employed b. Unemployed c. Self-employed d. Housewives e. Others	
7. In the past year, your monthly per capita household income was (including income in kind and rental income, etc.): ____ yuan	a. <2000 b. 2000-5000 c. 5000-10000 d. 10000-20000 e. >20000	

8.Are you nearsighted?	a. Nearsighted
	b. Not nearsighted
9. Is your child nearsighted?	a. Nearsighted
	b. Not nearsighted

For peer review only

## Part II Knowledge of myopia

1. Myopia is the result of overdevelopment of the eyeball, which is essentially a shortening of the axis.	a. Correct	b. Wrong	c. Unclear
2. The complications of high myopia are mainly fundus lesions, such as: retinal detachment, retinoblastoma, retinoproliferative disease, retinopathy of prematurity, retinoid degeneration, retinoblastoma, retinoproliferative disease, retinopathy of prematurity, retinoid degeneration, etc.	a. Correct	b. Wrong	c. Unclear
3. Low-density atropine drops are effective in slowing the development of myopia.	a. Correct	b. Wrong	c. Unclear
4. Mydriasis is a routine form of eye examination and treatment.	a. Correct	b. Wrong	c. Unclear
5. To give your eyes adequate rest, get up and move around every 20 minutes when working and studying, and stand in front of a window and look 20 feet (6m) away for at least 20 seconds.	a. Correct	b. Wrong	c. Unclear
6. During home Internet classes, you should ensure that the room is well-lit and adjust the brightness of your child's electronic devices appropriately, not too bright or too dark.	a. Correct	b. Wrong	c. Unclear
7. Outdoor exercise is also crucial to myopia prevention and control, but it does not matter whether the child is under daylight or not, he/she should be allowed to do more outdoor activities. (Wrong)	a. Correct	b. Wrong	c. Unclear
8. Children should not read at home in too much or too little light. Make sure that indoor lighting and eye protection lamps are on at the same time.	a. Correct	b. Wrong	c. Unclear
9. Wearing frame glasses is one of the best ways to control myopia; moreover, there are other options, such as Keratoscope, as well as reducing close reading & learning and increasing outdoor activities.	a. Correct	b. Wrong	c. Unclear

bmjopen-2024-093565 on 21 March 2025. Downloaded from <http://bmjopen.bmj.com/> on June 7, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES) .  
For uses related to text and data mining, AI training, and similar technologies.

10. If you need to do screen reading for a long time, you should wear anti-blue light glasses to block the harmful blue light to the eyes as much as possible.	a. Correct	b. Wrong	c. Unclear
11. When the eyes become tired and dry, you can blink more often to relieve, and if necessary, artificial tears to relieve the symptoms of dry eyes.	a. Correct	b. Wrong	c. Unclear
12. A simple computerized optometry can accurately obtain the diopters of child with myopia. (Wrong)	a. Correct	b. Wrong	c. Unclear

### Part III Attitude to myopia

1. I believe that glasses should only be worn when necessary to correct vision. (N)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
4. I fully support promoting the importance of vision protection for primary and secondary school students. (P)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
5. If a "vision protection" parent-child activity is offered by the school or community, I would be interested in participating. (P)	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
6. I am concerned that my child's myopia may impact their future life and studies.	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
7. I am worried that my child's myopia may affect their appearance.	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
8. I am concerned that my child's myopia may lead to low self-esteem.	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree
9. If I am nearsighted, I think that glasses should only be worn when	a.Strongly agree	b.Agree	c.Neutral	d.Disagree	e.Strongly disagree

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

necessary, but not necessarily all day. (N)	
---	--

For peer review only

## Part IV Practice on myopia

1. Do you take your child to engage in outdoor activities for more than 2 hours a day as much as possible? (P)	a. Yes	b. No
2. Do you supervise your child to do eye exercises? (P)	a. Yes	b. No
3. Do you take your child to attend lectures or activities on popular science topics related to children's and adolescents' vision health? (P)	a. Yes	b. No
4. How often you take your child to a specialised facility for an optical eye examination each year:	a. Never b. Once a year c. Twice a year d. More than twice a year	
<b>Your daily meal preparation:</b>		
5. If it contains eggs, meat, fish or animal liver?	a. Never prepare b. 1~2 times a week on average c. 3~4 times a week on average d. 5 or more times a week on average	
6. If it contains dairy or soya products?	a. Never prepare b. 1~2 times a week on average c. 3~4 times a week on average d. 5 or more times a week on average	
7. If it contains fresh fruits and vegetables?	a. Never prepare b. 1~2 times a week on average c. 3~4 times a week on average d. 5 or more times a week on average	
8. Supervise your child's reading and writing posture. (P)	a. Extremely Positive	b. Positive c. Neutral d. Negative e. Extremely Negative



9. Discourage your child from using electronic devices such as TV, cell phone, or tablet computer in the dark. (P)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative
10. Do not allow your child to lie down while reading books or using electronic devices. (N)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative
11. Discourage your child from reading books or looking at electronic products while using mobile transportation (bus, car). (P)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative
12. Discourage your child from rubbing their eyes. (P)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative
13. Encourage your child to take breaks and relax their eyes during class breaks. (P)	a. Extremely Positive	b. Positive	c. Neutral	d. Negative	e. Extremely Negative