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

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

Running title: Parents' KAP on myopia

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## 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

- 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.

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## 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

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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.

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## 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

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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.

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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

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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

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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**.

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	N=552	N=552 Knowledge score Attitude score		e	Practice scor	e	
	(%)	Mean ± SD	Р	Mean ± SD	Р	Mean ± SD	Р
Total		8.38±2.288		25.01±2.792		26.37±3.955	
Gender			0.646		0.007		0.11
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	
Age	( )		0.774		0.0496		0.82
Less than 35 years old	120(21.74)	8.28±2.046		25.55±2.517		26.18±4.107	
35-44 years old	281(50.91)	8.44±2.393		24.81±2.860		26.41±4.014	
45 years old and	151(27.36)	8.34±2.280		24.97±2.834		26.46±3.736	
above Child's grade			0.175		0.42		0.00
-	79(14.31)	8.63±1.995	0.1/5	25.41±2.550	0.43	27.29±3.371	0.00
1 2						$27.29\pm 3.371$ $27.64\pm 3.418$	
3	66(11.96) 100(18.12)	8.41±2.000 8.26±2.410		25.45±2.142 25.00±3.005		$27.64 \pm 3.418$ $26.13 \pm 3.946$	
4	155(28.08)	$8.20\pm2.410$ $8.54\pm2.118$		$23.00\pm 3.003$ 24.87±2.718		$20.13\pm 3.940$ $25.85\pm 4.232$	
5	75(13.59)	8.54±2.118 8.55±2.479		$24.87\pm2.718$ $24.85\pm3.199$		$25.83 \pm 4.232$ $26.03 \pm 3.763$	
6	73(13.39) 77(13.95)	8.33±2.479 7.78±2.698		$24.83 \pm 3.199$ $24.69 \pm 2.953$		$26.03\pm3.703$ $26.04\pm4.275$	
o Number of	//(15.95)	7.78±2.098		24.09±2.933		20.04±4.273	
children			0.002		0.041		0.85
0	305(55.25)	8.67±2.063	0.002	25.28±2.618	0.011	26.43±4.025	0.05
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	
			.0.001		0.007		0.00
Education			< 0.001		0.087		0.00
High School / Technical							
secondary school	90(16.30)	$7.00 \pm 2.727$		24.38±2.951		25.08±4.217	
and below							
Junior							
college/Bachelor's	429(77.72)	8.64±2.092		25.14±2.733		26.57±3.909	
degree Master's degree							
Master's degree and above	33(5.98)	8.82±2.113		25.12±2.955		27.33±3.058	
Work Status			0.004		0.422		0.80
Employed	431(78.08)	8.54±2.156	0.001	25.04±2.764	~·· <i>22</i>	26.31±3.902	0.00
Unemployed	37(6.70)	$7.32 \pm 2.678$		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	
Monthly							
Household							
Income Per			0.01		0.040		0.02
Person, yuan	76(12 77)	761-2511	0.01	24 22-2 074	0.048	25 66-2 769	0.03
<5000	76(13.77)	7.64±2.544		24.22±2.974		$25.66 \pm 3.768$	
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	

 Table 1. Baseline characteristics and KAP scores.

nearsighted?			< 0.001		0.002		0.4
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	
Is the child			0.000		0.000		0.1
nearsighted?	210(29.04)	0 77 1 0 1 40	0.002	25.00+2.002	0.608	26.02 + 4.005	0.1
Yes	210(38.04) 242(61.06)	8.77±2.140		25.09±2.662		26.03±4.085 26.58±3.864	
No	342(61.96)	8.14±2.346		24.96±2.871		20.38±3.804	
SD, standard devia	ation.						

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# Knowledge, attitude, and practice toward myopia

The average knowledge score among participants was  $8.38\pm2.29$  (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  $25.01\pm2.79$  (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  $26.37\pm3.96$  (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**).

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	Table 2. Knowledge, attitudes and practices.			by copyright, includin	omjopen-2024-093565 c	
	Knowledge				N 2552	
					Cerrect (%)	Wrong/Unclear (%)
	1. Myopia is the result of overdevelopment of the eyeball, which is essentially	St L	<b>5(</b> 27.17) 4	402(72.83)		
	<ol> <li>Myopia is the result of overdevelopment of the eyeball, which is essentially</li> <li>The complications of high myopia are mainly fundus lesions, such as: retinal haemorrhage, macular fissure, etc.</li> <li>Low-concentration atropine drops are effective in slowing the development</li> <li>Mydriasis are a routine form of eve examination and treatment</li> </ol>	l detachment, retir	nochoroidal atroph	iy, macular	<b>88</b> (68.84)	172(31.16)
	3 Low-concentration atroping drops are effective in slowing the development	of myopia		ed t	<b>5</b> 67(48 37)	285(51.63)
	4. Mydriasis are a routine form of eye examination and treatment.			fo t	<b>6</b> (66.85)	183(33.15)
	5. To give your eyes adequate rest, get up and move around every 20 minutes v of a window and look 20 foot (6 meters) away for at least 20 seconds	when working and	l studying, and sta	and in front	<b>3</b> (0) (01 95)	45(8.15)
	of a window and look 20 loot (0 meters) away for at least 20 seconds.			2 2	. <b>O</b> .	43(8.13)
	<ul> <li>6. During home Internet classes, you should ensure that the room is well lit and devices appropriately, not too bright or too dark.</li> <li>7. Outdoor exercise is also crucial to myopia prevention and control, but it is not, he/she should be allowed to do more outdoor activities.</li> <li>8. Children should not read at home in too much or too little light. Make sure are on at the same time.</li> </ul>	adjust the brightr	ess of your child's	s electronic	29(95.83)	23(4.17)
	7 Outdoor exercise is also crucial to myonia prevention and control, but it is no	ot matter whether	the child is under	daylight or		
	not, he/she should be allowed to do more outdoor activities.	of matter whether	the ennu is under	in a subscription of the s	<b>(</b> 20.29)	440(79.71)
	8. Children should not read at home in too much or too little light. Make sure	that indoor lighti	ng and eye protec	tion lamps	<b>1</b> (19(02 30)	42(7.61)
	are on at the same time.		. 1	≥		+2(7.01)
	<ol> <li>Wearing frame glasses is one of the best ways to control myopia, moreover, as well as reducing close reading &amp; learning and increasing outdoor activities.</li> </ol>	there have other	options such as Ke	eratoscope, fa 5	(91.12)	49(8.88)
	as well as reducing close reading & learning and increasing outdoor activities. 10. If you need to do screen reading for a long time, you should wear anti-blue	light glasses to bl	ock the harmful b	lue light to <b>n</b>	en.	
						90(16.30)
	11. When the eyes become tired and dry, you can blink more often to relieve,	and if necessary,	use artificial tears	s to relieven	$\frac{1}{12}$ (85.33)	
					$\mathbf{N}$	81(14.67)
	the symptoms of dry eyes.			<u>s.</u>	3	81(14.67)
	the symptoms of dry eyes. 12. A simple computerized optometry can accurately obtain the diopters of chi	ld with myopia.	<u> </u>	<u>s.</u>	z	81(14.67) 186(33.70)
	the symptoms of dry eyes.	ld with myopia. N (%)	Ċ	<u>s.</u>	3	
	the symptoms of dry eyes.	ld with myopia. N (%) Extremely	Positive/Agre	similar tec	ع (66.30) د س	186(33.70)
	12. A simple computerized optometry can accurately obtain the diopters of chi	ld with myopia. N (%)	Positive/Agre	similar tec	کر (66.30) پر Negative/Disagre	186(33.70) Extremely
	12. A simple computerized optometry can accurately obtain the diopters of chi         Attitude         A1. I believe that glasses should only be worn when necessary to correct	ld with myopia. N (%) Extremely Positive/Agre e	e	similar technologie	Negative/Disagre	Extremely Negative/Disagree
	12. A simple computerized optometry can accurately obtain the diopters of chi         Attitude         A1. I believe that glasses should only be worn when necessary to correct vision. (N)	ld with myopia. N (%) Extremely Positive/Agre	ē	Neutralogie 91(16.499	2 Seg(66.30) 2 Segative/Disagre 2 2 2 2 2 2 2 2 2 2 2 2 2	186(33.70) Extremely
	12. A simple computerized optometry can accurately obtain the diopters of chi         Attitude         A1. I believe that glasses should only be worn when necessary to correct vision. (N)         A2. I don't think regular vision checks are necessary until there are signs of	ld with myopia. N (%) Extremely Positive/Agre e 62(11.23)	e 132(23.91)	Neutralogie 91(16.499	2 Seg(66.30) 2 Segative/Disagre 2 2 2 2 2 2 2 2 2 2 2 2 2	Extremely Negative/Disagree 57(10.33)
	12. A simple computerized optometry can accurately obtain the diopters of chi         Attitude         A1. I believe that glasses should only be worn when necessary to correct vision. (N)         A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)	ld with myopia. N (%) Extremely Positive/Agre e	e	Neutralogie 91(16.499	Negative/Disagre	Extremely Negative/Disagree
	12. A simple computerized optometry can accurately obtain the diopters of chi         Attitude         A1. I believe that glasses should only be worn when necessary to correct vision. (N)         A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)         A3. I don't think it matters whether my child reads in a lying down position or	ld with myopia. N (%) Extremely Positive/Agre e 62(11.23) 11(1.99)	e 132(23.91) 15(2.72)	sin 3 ar technoo gie 91(16.499 17(3.08)	2 (66.30) 2 2 2 2 2 2 2 2 2 2 2 2 2	Extremely           Negative/Disagree           57(10.33)           230(41.67)
	12. A simple computerized optometry can accurately obtain the diopters of chi         Attitude         A1. I believe that glasses should only be worn when necessary to correct vision. (N)         A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)         A3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)         A4. I fully support promoting the importance of vision protection for primary	ld with myopia. N (%) Extremely Positive/Agre e 62(11.23) 11(1.99) 3(0.54)	e 132(23.91)	sin 3 ar technolo gie 91(16.499 17(3.08) 11(1.99)	2 (66.30) 2 2 2 2 2 2 2 2 2 2 2 2 2	Extremely Negative/Disagree 57(10.33)
	12. A simple computerized optometry can accurately obtain the diopters of chi         Attitude         A1. I believe that glasses should only be worn when necessary to correct vision. (N)         A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)         A3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)         A4. I fully support promoting the importance of vision protection for primary and secondary school students. (P)	ld with myopia. N (%) Extremely Positive/Agre e 62(11.23) 11(1.99) 3(0.54) 430(77.90)	e 132(23.91) 15(2.72) 2(0.36) 104(18.84)	sin 3 ar technolog gie 91(16.499 17(3.08) 11(1.99) 16(2.90)	2 (m) (66.30) 2 (100 (10)	Extremely           Negative/Disagree           57(10.33)           230(41.67)           360(65.22)           2(0.36)
	12. A simple computerized optometry can accurately obtain the diopters of chi         Attitude         A1. I believe that glasses should only be worn when necessary to correct vision. (N)         A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)         A3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)         A4. I fully support promoting the importance of vision protection for primary	ld with myopia. N (%) Extremely Positive/Agre e 62(11.23) 11(1.99) 3(0.54)	e 132(23.91) 15(2.72) 2(0.36)	sin 3 ar technolo gie 91(16.499 17(3.08) 11(1.99)	2 (66.30) 2 2 2 2 2 2 2 2 2 2 2 2 2	Extremely           Negative/Disagree           57(10.33)           230(41.67)           360(65.22)

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	273(49.46) 112(20.29)	75(13.59)	74(13.419, ₩5(6.) 217(39.35)m 126(2 8 m c	22.83)	5(0.91) 22(3.99)	
necessary, but not necessarily all day. (N)	20(3.62)	71(12.86)	64(11.59) 62(4	47.46)	135(24.46)	-
Practice	N (%)	<b>.</b>	ated			-
P1. Encourage your child to participate in outdoor activities for at least 2 hours a	Yes	No	Dov to t			
day.	<sup>a</sup> 208(37.68)	344(62.32)	) - text	-	-	
P2. Supervise your child to perform eye exercises regularly.	334(60.51)	218(39.49)	Superie	-	-	
P3. Attend scientific lectures or activities on children's and adolescents' vision health.	316(37.23)	236(42.75)	<u>a</u> Po	-	-	
	Always	Often	Sometimes	Rarely	Never	
P4. Take your child for optical coherence tomography once a year.	118(21.38)	216(39.13)		89(16.12) 174(31.52)	-	
P5. Ensure a balanced diet that includes eggs, meat, fish, or animal liver. P6. Provide dairy or soy products for your child.	11(1.99) 6(1.09)	200(36.23) 128(23.19)		174(31.52) 260(47.10)		
P7. Offer plenty of fresh vegetables and fruits.	3(0.54)	58(10.51)	<u>-</u>	340(61.59)		
Tr. onlei pienty of noon vegetaties and natio.	Extremely Positive	Positive	Neterate	Negative	, Extremel y Negative	
P8. Supervise your child's reading and writing posture.	181(32.79)	254(46.01)	· · · · · · · · · · · · · · · · · · ·	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.	304(03.94)	142(25.72)		12(2.17)	5(0.91)	
P10. Do not allow your child to lie down while reading books or using electronic devices.	c 149(26.99)	90(16.30)	58( <b>J</b> 0.5 <b>L</b> )	48(8.70)	207(37.50)	
P11. Discourage your child from reading books or looking at electronic products during mobile transportation (bus, car).	500(05.22)	136(24.64)	) 42( <b>7</b> .61 <b>7</b> )	7(1.27)	7(1.27)	
P12. Discourage your child from rubbing their eyes.	286(51.81)	176(31.88)	) 68( <b>4</b> 2.3 <b>8</b> )	14(2.54)	8(1.45)	
P13. Encourage your child to take breaks and relax their eyes during class breaks.	· · · · · · · · · · · · · · · · · · ·	172(31.16)	<u>, 77(\$93.9\$)</u>	24(4.35)	4(0.72)	-
"P" indicates a positive statement, while "N" indicates a negative sta been adjusted based on different assignment bases, and therefore are			enc	I questions n	harked with ry have	

# **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 uncertain (OR=1.63, 95% CI: 1.076-1.258, P<0.001), and

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having a child in the fourth grade (OR=0.478, 95% CI: 0.265-0.859, P=0.014) were independently associated with proactive attitude (Table 4).

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BMJ Open       by copyright, including         Table 4. Univariate and multivariate logistic regression analyses.       by copyright, including					
Knowledge	Univariate logistic regression	P	Multivariata logistic rograssion		
Gender	OR (95%CI)	Р	OR (95%CI) ses related to t	Р	
Male	ref		s rch		
Female	1.110(0.717-1.717)	0.640	religion 2		
Age		5.010	ne atr		
Less than 35 years old	ref		ed mo		
35-44 years old	1.307(0.830-2.058)	0.248	ton		
45 years old and above	1.133(0.680-1.888)	0.631	te sw		
Child's grade			x up of		
1	ref	0.044	Downloaded to text and d		
2	0.985(0.500-1.942)	0.966	d <u>e e</u>		
5 A	0.928(0.502-1.717) 1.031(0.588-1.807)	0.813 0.915			
<del>,</del> 5	1.031(0.388-1.807) 1.283(0.672-2.451)	0.450			
6	0.526(0.262-1.058)	0.450			
Number of siblings			nir S)		
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	ref 0.655(0.301-1.423) ref 0.72(1.566-6.025) 6.259(2.327-16.835) ref 0.720(0.290-1.785) 1.295(0.677-2.477) 0.876(0.359-2.141)	0.655	
Education			lin pe		
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) 6.259(2.327-16.835) ref 0.720(0.290-1.785) 1.295(0.677-2.477) 0.876(0.359-2.141) ref 1.859(0.960-3.596) 1.999(1.029-3.883)	0.001	
Master's degree and above	6.293(2.557-15.491)	< 0.001	6.259(2.327-16.835) <b>d</b>	< 0.001	
Work Status					
Employed	ref		ref line of		
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) <b>fe u</b>	0.434	
Full-time homemaker Monthly household income per person	0.633(0.274-1.461)	0.284	0.876(0.359-2.141)	0.772	
<5000	ref		ref <b>2</b>		
5000-10000	2.166(1.156-4.059)	0.016	ref 1.859(0.960-3.596) <b>2025</b> 1.000(1.020.2.882) <b>6</b>	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	
Are the parents nearsighted?			Å Å		
Yes	2.023(1.380-2.965)	< 0.001	1.547(1.028-2.330) ref	0.037	
No	ref		ref <b>6</b>		
Is the child nearsighted?	1 70 4/1 0 40 0 550	<b>A A I</b>		A 4 4 4	
Yes	1.784(1.249-2.550)	0.01	1.923(1.314-2.813)	0.001	
No	ref		ref <b>j</b>		
Attitude Knowledge seere	1 265(1 161 1 270)	<0.001	1.923(1.314-2.813)     Bi       ref     Og       1.239(1.131-1.357)     Data       Incomparing the set of the	~0.001	
Knowledge score	1.265(1.161-1.379)	<0.001	1.239(1.131-1.357) <b>B</b>	< 0.00	

bmjopen-2024-093565 on 21 March 2025. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 Enseignement Superieur (ABES) . I by copyright, including for uses related to text and data mining, Al training, and similar technologie Gender Male ref ref 2.083(1.357-3.198) 0.001 0.002 Female 2.080(1.307-3.310) Age 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 Child's grade ref 1.170(0.608-2.253) 0.639 2 3 1.145(0.634-2.067) 0.654 0.988(0.574-1.698) 0.964 4 5 0.949(0.505-1.786) 0.872 0.589(0.311-1.115) 0.104 6 Number of siblings ref 0 0.113 0.751(0.527-1.070)  $\geq 2$ 0.772(0.402-1.485) 0.439 Education High School / Technical secondary ref ref school and below 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 Al training, and similar technologie Work Status Employed ref Unemployed 1.031(0.527-2.019) 0.928 0.333 Self-employed 0.756(0.430-1.331) 0.549 Full-time homemaker 0.794(0.373-1.690) Monthly household income per person <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 0.003 2.296(1.211-4.351) 0.011 2.478(1.373-4.472) Are the parents nearsighted? Yes 1.875(1.317-2.668) < 0.001 1.549(1.056-2.273) 0.025 No ref ref Is the child nearsighted? 0.894 Yes 1.024(0.726-1.443) No ref ą Practice Agence Bibliographique **Knowledge score** 1.128(1.033-1.231) 0.007 1.062(0.962 - 1.172)0.233 < 0.001 < 0.001 Attitude score 1.187(1.103-1.277) 1.163(1.076-1.258) Gender Male ref 0.552 Female 1.147(0.730-1.803) Age 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

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	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		0.088
	4	$\begin{array}{c} 0.445(0.251 \hbox{-} 0.790) \\ 0.481(0.244 \hbox{-} 0.949) \end{array}$	0.006 0.035	0.478(0.265-0.859) <b>o b b c b c c c c c c c c c c</b>	0.014 0.062
	5	0.496(0.254-0.971)	0.041	0.576(0.288-1.150)	0.002
	Number of siblings	0.490(0.294 0.971)	0.041	0.512(0.253-1.033) 0.576(0.288-1.150) related uses related ted	0.110
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	1	0.945(0.647-1.380)	0.770	lat	
	$\geq 2$	0.577(0.265-1.254)	0.165	ed m S	i i i i i i i i i i i i i i i i i i i
		0.577(0.2051.254)	0.105	to en co	
	Education			ts	
	High School / Technical secondary school and below	ref		ref SAN	
	Junior college/Bachelor's degree	1.714(1.002-2.929)	0.049	1.284(0.723-2.281) and a	0.393
	Master's degree and above	2.275(0.966-5.360)	0.060	1.751(0.713-4.297)	0.222
	Work Status	(0);00000000)			•·
	Employed	ref		ata	
	Unemployed	1.214(0.600-2.457)	0.590	mining,	
	Self-employed	1.090(0.599-1.985)	0.778	nir S)	
	Full-time homemaker	1.179(0.534-2.605)	0.683		
	Monthly household income per			≥ ≥	
	served states st	ref		ਜ ਦੋ ਦੋ	
	5000-10000	0.598(0.317-1.131)	0.114	air b	
	10000-20000	0.694(0.425-1.133)	0.144		i de la companya de l
	>20000	0.979(0.603-1.590)	0.933	Ģ Ģ	
	Are the parents nearsighted?			an	
		0.955(0.658-1.387)	0.808	d G	
	Yes			<u>v</u> .	
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	No Is the child nearsighted?	ref	0.000		
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# 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.

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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 knowledgeattitude, 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 selfreporting 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.

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# 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.

# 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.

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# 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

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# **Figure Legends**

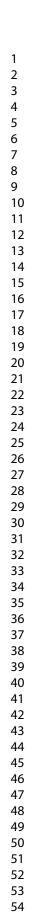
Figure 1 Confirmatory factor analysis for KAP.

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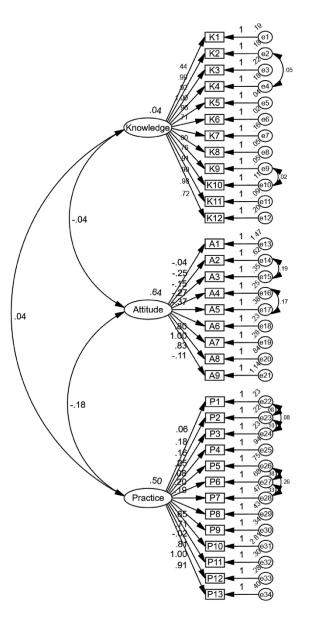
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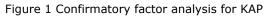
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# Knowledge, attitude, and practice toward myopia among parents of primary school students: A cross-sectional study

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

Running title: Parents' KAP on myopia

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## 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  $8.38\pm2.29$  (theoretical minimum-maximum: 0-12),  $25.01\pm2.79$  (theoretical minimum-maximum: 6-30), and  $26.37\pm3.96$  (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.

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## 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

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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

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The parents of primary school students 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 students attending a primary school in the Liangxi District. The school is located in a city center, and the socioeconomic status is intermediate in the study area. It was selected because it was one of the myopia prevention and control experimental units of Wuxi Children's Hospital. Parents who declined to participate or did not have a clear understanding (self-reported) 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[22].

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## Procedures

The study questionnaire was self-developed based on two guidelines and one white paper that are applied in China [23-25]. The questionnaire underwent modifications based on feedback from three experts, including two ophthalmologists and one teacher, following its initial design. The questionnaire included four dimensions (Supplementary Materials): the demographic information, knowledge dimension, attitude dimension, and practice dimension. The knowledge dimension consisted of 12 questions, scoring 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 (Question 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

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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 α 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]:

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

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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 >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.

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## 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.

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## 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. 

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Table 1. Baseline charac	teristics and KA	AP scores. Knowledge		Attitude	Ű	bmjopen-2024-093565 on Practice	
		Median [Q1, Q3]	Р	Median [Q1, Q3]	Р	$\frac{Q}{2} \ge \frac{Q}{2}$ Median [Q1, Q3]	Р
Gender			0.411		0.001	L Median [Q1, Q3]	0.09
Male	113 (20.47)	9 [7,10]		25 [22,26]		226 [23,29] 27 [24,29] 5 27 [24,29] 5 27 [24,29] 5 27 [24,29] 5 27 [24,29] 6 27 [24,29]	
Female	439 (79.53)	9 [7,10]		26 [24,27]		27 [24,29]	
Age			0.295		0.059	o te	0.96
Less than 35 years old	120 (21.74)	9 [7,10]		26 [24,27]		ž u po 27 [24,29]	
35-44 years old	281 (50.91)	9 [7,10]		25 [23,26]	5	d e 27 [24,29]	
45 years old and above	151 (27.36)	9 [7,10]		25 [23,27]			
Child's grade			0.246		0.553		0.00
1	79 (14.31)	9 [8,10]		26 [23,27]		<u> </u>	
2	66 (11.96)	9 [7,10]		26 [24,26]		28 [25,30]	
3	100 (18.12)	9 [7,10]		26 [23.5,27]	,	<b>2</b> .28 [25,30] <b>2</b> .26 [23.5,29] <b>2</b> .26 [23.29]	
4	155 (28.08)	9 [7,10]		26 [23,27]			
5	75 (13.59)	9 [8,10]		25 [23,27]		25 [24,29] 26 [24,29] 27 [24,30] 27 [24,29] 27 [24,29] 27 [24,29] 27 [24,29] 27 [24,29]	
6	77 (13.95)	9 [7,9]		25 [23,27]		26 [24,29]	
Number of siblings			0.005		0.143	ar te	0.90
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]	
$\geqslant 2$	41 (7.43)	9 [7,10]		25 [23,27]		27 [24,28]	
Education			< 0.001		0.021		0.00
High School / Technical secondary school and below	90 (16.30)	7.5 [6,9]		24.5 [22,26]		Agen 25 [23,28] Big	
Junior college/Bachelor's degree	429 (77.72)	9 [8,10]		26 [24,27]		Biblio graphique	

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Employed       431 (78.08)       9 [8,10]       26 [24,27]       7 [24,29]       27 [24,29]         Unemployed       37 (6.70)       8 [6.9]       26 [23,28]       9 [27 [24,30]       27 [24,30]         Self-employed       55 0.96)       9 [7,10]       25 [23,26]       97 [27 [24,30]       27 [24,30]         Full-time homemake       29 (5.25)       7 [6,10]       25 [23,26]       97 [23,27]       0.029         Monthly Household       5000       183 (33.15)       9 [7,10]       25 [23,27]       0.014       0 [20,27]       27 [24,29]       27 [23,29]       27 [24,29]       <	ster's degree and above 3		
Employed       431 (78.08)       9 [8,10]       26 [24,27]       7 [24,29]       27 [24,29]         Unemployed       37 (6.70)       8 [6.9]       26 [23,28]       9 [27 [24,30]       27 [24,30]         Self-employed       55 0.96)       9 [7,10]       25 [23,26]       97 [27 [24,30]       27 [24,30]         Full-time homemake       29 (5.25)       7 [6,10]       25 [23,26]       97 [23,27]       0.029         Monthly Household       5000       183 (33.15)       9 [7,10]       25 [23,27]       0.014       0 [20,27]       27 [24,29]       27 [23,29]       27 [24,29]       <	rk Status	0.765	
Monthly Household Income Per Person, yuan <5000	ployed 4.°		
Monthly Household Income Per Person, yuan <5000	employed 3 <sup>-</sup>		
Monthly Household Income Per Person, yuan <5000	<i>i</i> -employed 55		
Monthly Household Income Per Person, yuan <5000	1-time homemaker 25		
10000-20000       170 (30.80)       9 [8,10]       26 [24,27]       27 [24,29]         >20000       123 (22.28)       9 [7,10]       26 [24,27]       0.001       28 [25,30]         Are the parents mearsighted?       0.001       0.001       0.001       0.243         Yes       353 (63.95)       9 [8,10]       26 [24,27]       0.001       0.243         No       199 (36.05)       8 [6,10]       25 [23,26]       0.854       0.074         Yes       210 (38.04)       9 [8,10]       25.5 [24,27]       0.854       0.074         Yes       210 (38.04)       9 [8,10]       25 [23,27]       0.854       0.074         SD, standard deviation; q: quantile.       Vertice       Vertice       Vertice       Vertice       Vertice	come Per Person, yuan	0.029	
10000-20000       170 (30.80)       9 [8,10]       26 [24,27]       ar (24,29)         >20000       123 (22.28)       9 [7,10]       26 [24,27]       0.001       28 [25,30]         Are the parents nearsighted?       <0.001			
10000-20000       170 (30.80)       9 [8,10]       26 [24,27]       27 [24,29]         >20000       123 (22.28)       9 [7,10]       26 [24,27]       0.001       28 [25,30]         Are the parents nearsighted?       0.001       0.001       0.001       0.243         Yes       353 (63.95)       9 [8,10]       26 [24,27]       0.001       0.243         No       199 (36.05)       8 [6,10]       25 [23,26]       0.854       0.074         Yes       210 (38.04)       9 [8,10]       25.5 [24,27]       0.854       0.074         Yes       210 (38.04)       9 [8,10]       25 [23,27]       0.854       0.074         SD, standard deviation; q: quantile.       Very set in the	0-10000 18		
Are the parents       <0.001	00-20000 17		
No       199 (36.05)       8 [6,10]       25 [23,26]       0.854         Is the child nearsighted?       0.001       0.854       0.074         Yes       210 (38.04)       9 [8,10]       25.5 [24,27]       0.074         No       342 (61.96)       9 [7,10]       25 [23,27]       0.074         SD, standard deviation; quantile.       Very standard deviation; quantile.       Image: standard deviation; standard deviation	/000 12		
No       199 (36.05)       8 [6,10]       25 [23,26]       0.854         Is the child nearsighted?       0.001       0.854       0.074         Yes       210 (38.04)       9 [8,10]       25.5 [24,27]       0.074         No       342 (61.96)       9 [7,10]       25 [23,27]       0.074         SD, standard deviation; quantile.       Very standard deviation; quantile.       Image: standard deviation; standard deviation	arsighted?	0.243	
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7, 2025 at nologies.	34		
For peer review only - http://bmiopen.pmi com/site/about/guidelines.xhtml	standard deviation; q: qu		

### Knowledge, attitude, and practice toward myopia

The average knowledge score among participants was  $8.38\pm2.29$  (theoretical minimummaximum: 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**).

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<b>Fable 2.</b> Knowledge, attitudes, and practices.			nclu	-2024-09356		
Knowledge			by copyright, including	No 552		_
-			for_	Correct (%)	Wrong/Unclear (%)	_
1. Myopia is the result of overdevelopment of the eyeball, which is essentially a 2. The complications of high myopia are mainly fundus lesions, such as retinal d hemorrhage, macular fissure, etc.	0		, macular	<b>150</b> (27.17) <b>50</b> (68.84)	402 (72.83) 172 (31.16)	
<ol> <li>Low-concentration atropine drops are effective in slowing the development of</li> <li>Mydriasis is a routine form of eye examination and treatment.</li> </ol>	myopia.		gneme elated t	(48.37) (48.35) (66.85)	285 (51.63) 183 (33.15)	
<ul><li>5. To give your eyes adequate rest, get up and move around every 20 minutes whof a window and look 20 feet (6 meters) away for at least 20 seconds.</li><li>6. During home Internet classes, you should ensure that the room is well-lit and a devices appropriately, not too bright or too dark.</li></ul>	ien working and s	tudying, and stand	d in frontext	667 (91.85)	45 (8.15)	
<ul> <li>6. During home Internet classes, you should ensure that the room is well-lit and a devices appropriately, not too bright or too dark.</li> <li>7. Outdoor exercise is also crucial to myopia prevention and control, but it does r or not: he/she should be allowed to do more outdoor activities.</li> </ul>	djust the brightnes	ss of your child's e	r davlighta	5 <b>8</b> 9 (95.83)	23 (4.17)	
or not; he/she should be allowed to do more outdoor activities.			a 2	<b>15</b> 2 (20.29)	440 (79.71)	
8. Children should not read at home in too much or too little light. Make sure that	indoor lighting ar	nd eye protection l	lamps are	92.39)	42 (7.61)	
<ul> <li>or not; he/she should be allowed to do more outdoor activities.</li> <li>8. Children should not read at home in too much or too little light. Make sure that on at the same time.</li> <li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> </ul>				5 (91.12)	42 (7.61) 49 (8.88)	
<ol> <li>Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> <li>If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li> </ol>	there are other opt ght glasses to bloc	tions, such as Kera ck the harmful blu	atoscope atoscope train train train	563 (91.12) 662 (83.70)		
<ul> <li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> <li>10. If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li> <li>11. When the eyes become tired and dry, you can blink more often to relieve, a the symptoms of dry eyes.</li> </ul>	there are other opt ght glasses to bloc nd if necessary, us	tions, such as Kera ck the harmful blu	atoscope atoscope le light training to relieve and	563 (91.12) 462 (83.70) 421 (85.33)	49 (8.88) 90 (16.30) 81 (14.67)	
<ul> <li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> <li>10. If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li> <li>11. When the eyes become tired and dry, you can blink more often to relieve, a</li> </ul>	there are other opt ght glasses to bloc nd if necessary, us ld with myopia.	tions, such as Kera ck the harmful blu	atoscope Altra le light training to relieve s. 2	563 (91.12) 662 (83.70)	49 (8.88) 90 (16.30)	_
<ul> <li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> <li>10. If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li> <li>11. When the eyes become tired and dry, you can blink more often to relieve, a the symptoms of dry eyes.</li> </ul>	there are other opt ght glasses to bloc nd if necessary, us	tions, such as Kera ck the harmful blu	to relieve and similar tec	563 (91.12) 462 (83.70) 421 (85.33)	49 (8.88) 90 (16.30) 81 (14.67) 186 (33.70) e Extremely	_
<ul> <li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> <li>10. If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li> <li>11. When the eyes become tired and dry, you can blink more often to relieve, a the symptoms of dry eyes.</li> <li>12. A simple computerized optometry can accurately obtain the diopters of a chil</li> <li>Attitude</li> <li>A1. I believe that glasses should only be worn when necessary to correct vision. (N)</li> </ul>	there are other opt ght glasses to bloc nd if necessary, us d with myopia. <u>N (%)</u> Extremely Positive/Agre	tions, such as Kera ck the harmful blu se artificial tears t	to relieve and similar technology of the second sec	5 (91.12) 5 (83.70) 4 (85.33) 3 (66.30) 9	49 (8.88) 90 (16.30) 81 (14.67) 186 (33.70)	
<ul> <li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> <li>10. If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li> <li>11. When the eyes become tired and dry, you can blink more often to relieve, a the symptoms of dry eyes.</li> <li>12. A simple computerized optometry can accurately obtain the diopters of a chil</li> <li>Attitude</li> <li>Attitude</li> <li>Attitude regular vision checks are necessary until there are signs of unclear vision. (N)</li> </ul>	there are other opt ght glasses to bloc nd if necessary, us d with myopia. <u>N (%)</u> Extremely Positive/Agre e	tions, such as Kera ck the harmful blu se artificial tears t Positive/Agre e	to relieve and similar technology of the second sec	503 (91.12) 402 (83.70) 421 (85.33) 306 (66.30) 9 Junegative/Disagroups	49 (8.88) 90 (16.30) 81 (14.67) 186 (33.70) e Extremely Negative/Disagree	_
<ul> <li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> <li>10. If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li> <li>11. When the eyes become tired and dry, you can blink more often to relieve, a the symptoms of dry eyes.</li> <li>12. A simple computerized optometry can accurately obtain the diopters of a chil <b>Attitude</b></li> <li>A1. I believe that glasses should only be worn when necessary to correct vision. (N)</li> <li>A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)</li> <li>A3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)</li> <li>A4. I fully support promoting the importance of vision protection for primary</li> </ul>	there are other opt ght glasses to bloc nd if necessary, us d with myopia. N (%) Extremely Positive/Agre e 62 (11.23) 11 (1.99) 3 (0.54)	tions, such as Kera ck the harmful blu se artificial tears t Positive/Agre e 132 (23.91) 15 (2.72) 2 (0.36)	to relieve and similar tec Neutral 91 00 (16.499es (3.08) 11 (1.99) 16	2025 10 (38.04) at 279 (50.54) Bi (91.12) (83.70) 421 (85.33) 366 (66.30) 07 10 (38.04) at 279 (50.54) Bi	49 (8.88) 90 (16.30) 81 (14.67) 186 (33.70) <b>e Extremely</b> Negative/Disagree 57 (10.33) 230 (41.67) 360 (65.22)	
<ul> <li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li> <li>10. If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li> <li>11. When the eyes become tired and dry, you can blink more often to relieve, a the symptoms of dry eyes.</li> <li>12. A simple computerized optometry can accurately obtain the diopters of a chil <b>Attitude</b></li> <li>A1. I believe that glasses should only be worn when necessary to correct vision. (N)</li> <li>A2. I don't think regular vision checks are necessary until there are signs of unclear vision. (N)</li> <li>A3. I don't think it matters whether my child reads in a lying down position or uses electronic devices. (N)</li> </ul>	there are other opt ght glasses to bloc nd if necessary, us d with myopia. N (%) Extremely Positive/Agre e 62 (11.23) 11 (1.99)	tions, such as Kera ck the harmful blu se artificial tears t Positive/Agre e 132 (23.91) 15 (2.72)	to relieve and similar tec Neutral 91 (16.499; s. (3.08) 11 (1.99)	202510 (38.04) at 202510 (50.54)	49 (8.88) 90 (16.30) 81 (14.67) 186 (33.70) e Extremely Negative/Disagree 57 (10.33) 230 (41.67)	

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Page 15 of 43	E	BMJ Open		bmjopen-2024-0935 d by copyright, inclu 38		
1 2				-2024-09 rright, ir		
3 4	A6. I am concerned that my child's myopia may impact their future life and studies.	330 (59.78)	165 (29.89)	, including 38 (6.88)ding 74 g	(2.72)	4 (0.72)
5 6	A7. I am worried that my child's myopia may affect their appearance.	273 (49.46)	165 (29.89)	(13.41 <b>ð 1</b> 35	(6.34)	5 (0.91)
7 8	A8. I am concerned that my child's myopia may lead to low self-esteem.	112 (20.29)	75 (13.59)	217 u S Marzon (39.31% S C 20	6 (22.83)	22 (3.99)
9 10	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 reign 2062		135 (24.46)
11	Practice	N (%)		eme led		
12		Yes	No	Dov to t		
13 14	P1. Encourage your child to participate in outdoor activities for at least 2 hours day.	<sup>a</sup> 208 (37.68)	344 (62.32	2) - Superieu 2) - And c	-	-
15	P2. Supervise your child to perform eye exercises regularly.	334 (60.51)	218 (39.49	) - de	-	-
16 17	P3. Attend scientific lectures or activities on children's and adolescents' visio health.	on 316 (57.25)	236 (42.75	월 - 근	-	-
18		Always	Often	Senterm	es Rarely	Never
19	P4. Take your child for optical coherence tomography once a year.	<b>118 (21.38)</b>	216 (39.13			-
20	P5. Ensure a balanced diet that includes eggs, meat, fish, or animal liver.	11 (1.99)	200 (36.23		, , ,	-
21 22	P6. Provide dairy or soy products for your child.	6 (1.09)	128 (23.19	· · · · · · · · · · · · · · · · · · ·	2) 260 (47.10)	-
22	P7. Offer plenty of fresh vegetables and fruits.	3 (0.54)	58 (10.51)	) 15 (23.3	6) 340 (61.59)	-
24		Extremely Positive	Positive		Negative	Extremel y Negative
25 26	P8. Supervise your child's reading and writing posture.	181 (32.79)	254 (46.01	1) 10 <b>2</b> (1 <mark>9</mark> .3	0) 14 (2.54)	2 (0.36)
27	P9. Discourage your child from using electronic devices such as television, ce phone, or tablet computer in the dark.	ell 364 (65.94)	142 (25.72	<u> </u>	12 (2.17)	5 (0.91)
28 29	P10. Do not allow your child to lie down while reading books or using electronidevices.	ic 149 (26.99)	90 (16.30)	586(10551)	48(870)	207 (37.50)
30 31	P11. Discourage your child from reading books or looking at electronic product while using mobile transportation (bus, car).	ts 360 (65.22)	136 (24.64		7 (1.27)	7 (1.27)
32	P12. Discourage your child from rubbing their eyes.	286 (51.81)	176 (31.88	8) 68 <b>8</b> (12 <b>3</b> 32)	) 14 (2.54)	8 (1.45)
33 34	P13. Encourage your child to take breaks and relax their eyes during class breaks. "P" indicates a positive statement, while "N" indicates a negative state	275 (49.82)	172 (31.16	<u>5) 77 (13</u> )	) 24 (4.35)	4 (0.72)
35	"P" indicates a positive statement, while "N" indicates a negative state	ement. It's imp	portant to note th	at the scores	for questions m	narked with N have
36				Се		
37	been adjusted based on different assignment bases and, therefore, are	not a direct re	sult of selection	I. Bib		
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## **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.
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	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 of 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 adequate (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

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3	independently associated with proactive attitude (Supplementary table 1).
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## 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

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

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

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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 myopiaprevention behaviors also found that parental attitude was associated with their myopiapreventive 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 attitudepractice. 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

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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.,

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

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## 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.

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## 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

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## **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.

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Not applicable

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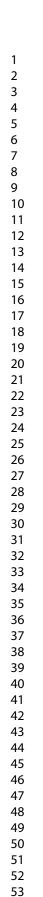
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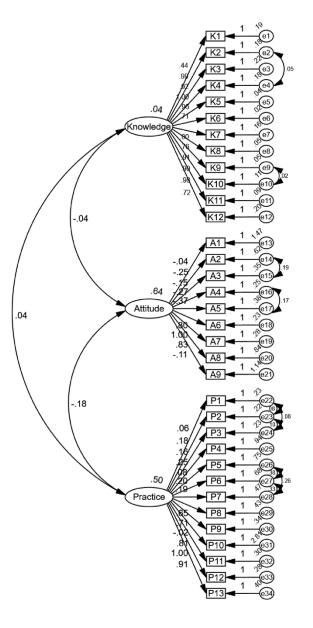
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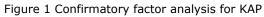
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2 3 4 5	Figure Legends
6 7 8 9	Figure 1 Confirmatory factor analysis for KAP
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Supplementary table 1 U	nivariate and multivariate logistic	ragression analyses	bmjopen-2024-093565 on 4 by copyright, including	
Supplementary table 1. 0	Univariate logistic regression		for 21	
Knowledge	OR (95%CI)	Р	Multivariate logistic retrestion OR (95%CI)	Р
Gender		-	elated elated	
Male	ref		ed t	
Female	1.110 (0.717-1.717)	0.640	Downloaded from http://bmjopen.bmj.com/ on June ent Superieur (ABES) . to text and data mining, AI training, and similar tech	
Age			nloa xt a	
Less than 35 years old	ref		and d	
35-44 years old	1.307 (0.830-2.058)	0.248	ata fror	
45 years old and above	1.133 (0.680-1.888)	0.631	min BESS	
Child's grade			ing,	
1	ref		Alt	
2	0.985 (0.500-1.942)	0.966	• irain	
3	0.928 (0.502-1.717)	0.813	n.b	
4	1.031 (0.588-1.807)	0.915	, an	
5	1.283 (0.672-2.451)	0.450	d sii m	
6	0.526 (0.262-1.058)	0.071	mila	
Number of siblings			Jun	
0	ref		ref C, ,	
1	0.614 (0.421-0.895)	0.011	0.650 (0.434-0.974) Ooge 2025	0.037
≥2	0.535 (0.259-1.108)	0.092	0.655 (0.301-1.423) <b>?</b>	0.655
Education			ref Bibliographique de	
High School / Technical secondary			Ce E	
school and below	ref		ref <b>B</b>	

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			bmjopen-2024-093565 J by copyright, includ	
Junior college/Bachelor's degree	3.739 (2.013-6.943)	<0.001	3.072 (1.566-6.025) <b>in o</b>	0.001
Master's degree and above	6.293 (2.557-15.491)	< 0.001	6.259 (2.327-16.835) <b>of</b>	< 0.001
Work Status			Marcl uses	
Employed	ref		ref seit	
Unemployed	0.387 (0.166-0.902)	0.028	0.720 (0.290-1.785) eignet	0.478
Self-employed	0.876 (0.486-1.579)	0.661	1.295 (0.677-2.477) <b>6 m D</b>	0.434
Full-time homemaker	0.633 (0.274-1.461)	0.284	0.876 (0.359-2.141)	0.772
Monthly household income per pers	on		tt an	
<5000	ref		ref Quid	
5000-10000	2.166 (1.156-4.059)	0.016	1.295 (0.677-2.477) to text superieur 0.876 (0.359-2.141) to text and clauded from ref 1.859 (0.960-3.596) ref	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) 1.547 (1.028-2.330) ref 1.923 (1.314-2.813) ref 1.923 (1.314-2.813) ref	0.301
Are the parents nearsighted?				
Yes	2.023 (1.380-2.965)	<0.001	1.547 (1.028-2.330)	0.037
No	ref		ref <b>j</b>	
Is the child nearsighted?			, an mic	
Yes	1.784 (1.249-2.550)	0.01	1.923 (1.314-2.813) <b>d g</b>	0.001
No	ref		1.547 (1.028-2.330) ref 1.923 (1.314-2.813) ref <b>A training</b> , and similar on	
Attitude			1 239 (1 131-1 357) <b>Ch</b>	
Knowledge score	1.265 (1.161-1.379)	< 0.001	1.239 (1.131-1.357)	< 0.001
Gender			1.239 (1.131-1.357) <b>chrologie</b> <b>7, 2025</b> a	
Male	ref		ref gies at	
Female	2.083 (1.357-3.198)	0.001	· #	0.002
Age			2.080 (1.307-3.310) Agence Bibliographique de lite/about/guidelines.xhtml	
I (h	ref		ref <b>G</b>	
Less than 35 years old		0.036	0.533 (0.334-0.851)	0.008

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45 11 1.1	0.501 (0.050 0.040)	0.020	<u>4</u> 0	0.000
45 years old and above	0.581 (0.358-0.943)	0.028	0.632 (0.372-1.074) <b>ng fc N</b>	0.090
Child's grade	f		5 <u>1</u>	
2	ref	0.639	n 21 March 2025. Enseignem y for uses related	
3	1.170 (0.608-2.253) 1.145 (0.634-2.067)	0.654	eignem related	
4	0.988 (0.574-1.698)	0.964	lated	
		0.904	Dow to to	
5	0.949 (0.505-1.786) 0.589 (0.311-1.115)	0.872	Sup text a	
6 Number of siblings	0.389 (0.511-1.115)	0.104	ande	
0	ref		wnloaded from ht Superieur (ABES text and data min	
1	0.751 (0.527-1.070)	0.113	a mini	
1 ≥2	0.772 (0.402-1.485)	0.439	ining	
Education	0.772 (0.402-1.483)	0.439		
High School / Technical secondary			Al training	
school and below	ref		ref ni P	
Junior college/Bachelor's degree	1.870 (1.170-2.988)	0.009	1.172 (0.691-1.989) <b>a</b>	0.556
Master's degree and above	2.073 (0.924-4.651)	0.077	1.231 (0.495-3.065)	0.655
Work Status	2.073 (0.924 4.051)	0.077		0.035
Employed	ref		1.172 (0.691-1.989) 1.231 (0.495-3.065) 1.231 (0.495-3.065) 1.231 (0.495-3.065)	
Unemployed	1.031 (0.527-2.019)	0.928	ech	
Self-employed	0.756 (0.430-1.331)	0.333	7, 2	
Full-time homemaker	0.794 (0.373-1.690)	0.549	ologie	
Monthly household income per pers				
<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
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>20000	2.478 (1.373-4.472)	0.003	2.296 (1.211-4.351)	<b>_</b> , <b>.</b>	0.011
Are the parents nearsighted?				on 21 March 2025. Enseignem ng for uses related	
Yes	1.875 (1.317-2.668)	< 0.001	1.549 (1.056-2.273)	March Ense uses	0.025
No	ref		ref	ch 2 seic s rei	
Is the child nearsighted?				า 2025. eignem related	
Yes	1.024 (0.726-1.443)	0.894		nen d to	
No	ref			own t Su tex	
Practice				load Iperi	
Knowledge score	1.128 (1.033-1.231)	0.007	1.062 (0.962-1.172)	led from http://bmjopen.bmj.com/ on June ieur (ABES) . d data mining, Al training, and similar tech	0.233
Attitude score	1.187 (1.103-1.277)	<0.001	1.163 (1.076-1.258)	fron (AE	< 0.001
Gender				n ht	
Male	ref			tp://	
Female	1.147 (0.730-1.803)	0.552		Alt	
Age				rain	
Less than 35 years old	ref			ing	
35-44 years old	0.942 (0.598-1.485)	0.798		, mj.c	
45 years old and above	0.822 (0.490-1.379)	0.459		d si	
Child's grade				/ on	
1	ref		ref	Jur Ir te	
2	1.172 (0.608-2.262)	0.636	1.205 (0.616-2.359)	ne 7, chnc	0.586
3	0.541 (0.291-1.005)	0.052	0.576 (0.305-1.086)	bmjopen.bmj.com/ on June 7, 2025 at Al training, and similar technologies.	0.088
4	0.445 (0.251-0.790)	0.006	0.478 (0.265-0.859)	2025 at plogies.	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)	yenc	0.118
Number of siblings				Agence Bibliøgraphique de I	
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1	0.945 (0.647-1.380)	0.770	ing for	
≥2	0.577 (0.265-1.254)	0.165	i on 21 March ; Enseig ing for uses re	
Education			rch 2 es re	
High School / Technical secondary	ref		elated ref def	
school and below	lei			
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	1.284 (0.723-2.281) 1.751 (0.713-4.297) 1.751 (0.713-4.297)	0.222
Work Status			d da	
Employed	ref		l from Ir (ABE ata m	
Unemployed	1.214 (0.600-2.457)	0.590		
Self-employed	1.090 (0.599-1.985)	0.778	ng,	
Full-time homemaker	1.179 (0.534-2.605)	0.683	Alt	
Monthly household income per			tp://bmjopen.bmj.com/ on June 7, 2025 at ) . ing, Al training, and similar technologies.	
person			ing b	
<5000	ref		an	
5000-10000	0.598 (0.317-1.131)	0.114	d sin	
10000-20000	0.694 (0.425-1.133)	0.144	mila	
>20000	0.979 (0.603-1.590)	0.933	Jun	
Are the parents nearsighted?			chn	
Yes	0.955 (0.658-1.387)	0.808	7, 2025 at nologies.	
No	ref		yies	
Is the child nearsighted?			Þ	
Yes	0.716 (0.491-1.045)	0.083	gence	
No	ref		ĕ	

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Questionnaire No.

## Dear Parents:

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

1. Please complete the questionnaire. There are no right or wrong answers; you only need to provide be posses based on your actual experiences. If you have any questions during the process, feel free to reach out to us, and please submit experiences are a submit experiences. timely manner.

2. This study is a simple questionnaire survey and will not cause any harm to your physical or psyce gical well-being. However, it may involve some personal information such as your gender and age. Please rest assured that we will strictly and that in 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 bus schedule!

 $\Box$ I have been informed and agreed to the use of the E ollected data for scientific research.

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Informer Consent Signature: Date of participation: Dav

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Part I Basic	e Information	
1.Your gender:	a.Male	
2.Your age:	s reich :	
3.Child's grade:	a. First year of primary school	
	b. Second year of primary school g	
	c. Third year of primary school g 23	
	d Fourth your of primary sahoon 50	
	e. Fifth year of primary school	
	f. Sixth year of primary school	
4. The child currently has a total of siblings (related by blood,	e. Fifth year of primary school f. Sixth year of primary school this child is not counted).	
5.Your education:	a. Primary school and below	
	<b>○</b> 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	
	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	b 2000 5000 b	
	c.5000-10000	
	e.>20000	
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8.Are you nearsighted?	a. Nearsighted	
9. Is your child nearsighted?	a. Nearsighted	
	a. Nearsighted b. Not nearsighted b. Not nearsighted a. Nearsighted b. Not nearsighted b.	
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_	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 of 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 by eye protection lamps are on at the same time.		b.Wrong	c.Unclear
	9. Wearing frame glasses is one of the best ways to control myopia; moreover, there are other options,		b.Wrong	c.Unclear
	such as Keratoscope, as well as reducing close reading & learning and increasing outdoor activities.			

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ngefor use	a.Correct	b.Wrong	c.Unclear	
s related to	a.Correct	b.Wrong	c.Unclear	
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	Part III Attitude to	o myopia		.4-093565 on 21 ht, including fo		
	1. I believe that glasses should only be worn when necessary to correct vision. (N)	a.Strongly agree	b.Agree	Moutral March 202	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	5. Butral for text ar	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	nd data min	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	ing: Neutral Al train	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	ing, and si	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	mitar techn	d.Disagree	e.Strongly disagree
,	7. I am worried that my child's myopia may affect their appearance.	a.Strongly agree	b.Agree	oc.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.N <del>u</del> tral	d.Disagree	e.Strongly disagree
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	Part IV Practice o	n myopia		cluding for	3565 on 2'			
	1. Do you take your child to engage in outdoor activities for more than	a.Yes		Бш	March	No		
	2 hours a day as much as possible? (P)			<u>e.c</u> .	N			
	2. Do you supervise your child to do eye exercises? (P)	a.Yes		Inem	<u>о</u>	.No		
	<b>3.</b> 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		ent Su I to tex	Down	No		
4	4. How often you take your child to a specialised facility for an optical	a.Never		lper t an	loac			
e	eye examination each year:	b.Once a year		ieur d da	led i			
		c.Twice a year	r	ata r	from			
		d. More than t	twice a ye	ar ni ES	Ē			
J	Your daily meal preparation:			ng,	<b>D</b>			
5	5. If it contains eggs, meat, fish or animal liver?	a.Never prepar	ire	A t	mi			
		b.1~2 times a	week on a	averag				
		c.3~4 times a						
		d.5 or more tir	mes a wee	ek <b>e</b> n a	yerag	ge		
6	6. If it contains dairy or soya products?	a.Never prepar		sim	ž			
		b.1~2 times a		5	•			
		c.3~4 times a		0 -	<b>x</b>			
		d.5 or more tir		ek <b>e</b> n a	werag	ge		
7	7. If it contains fresh fruits and vegetables?	a.Never prepar		ogie	2025			
		b.1~2 times a			—			
		c.3~4 times a				~~		
		d.5 or more tir a. Extremely	b.		Ö	<u>ge</u> d.	e.	Extreme
_	8. Supervise your child's reading and writing posture. (P)		U.	U.	<u>00</u>	u.	υ.	LAUCINC

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9. Discourage your child from using electronic devices such as TV, cell	•		5 on	d.	e. Extremely
phone, or tablet computer in the dark. (P)	Positive	Positive	Neutal	Negative	Negative
10. Do not allow your child to lie down while reading books or using	•	b.	Marc Ens uses	d.	e. Extremely
electronic devices. (N)	Positive	Positive	Ngentral	Negative	Negative
11. Discourage your child from reading books or looking at electronic	-	b.	025. Inem lated	d.	e. Extremely
products while using mobile transportation (bus, car). (P)	Positive	Positive	Ngegitgal	Negative	Negative
12. Discourage your child from rubbing their eyes. (P)	a. Extremely	b.	Sup	d.	e. Extremely
	Positive	Positive	Ngengal	Negative	Negative
13. Encourage your child to take breaks and relax their eyes during class	a. Extremely	b.	ed fi eur ( dar	d.	e. Extremely
breaks. (P)	Positive	Positive	Ne hate	Negative	Negative
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# **BMJ Open**

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

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

Running title: Parents' KAP on myopia

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## 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  $8.38\pm2.29$  (theoretical minimum-maximum: 0-12),  $25.01\pm2.79$  (theoretical minimum-maximum: 6-30), and  $26.37\pm3.96$  (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

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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.

# 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

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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 schoolage 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,

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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]:

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

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 >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

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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.

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Table 1. Baseline charact	teristics and K	AP scores.			cludi	3 56 5	
	N (%)	Knowledge		Attitude	ng f	S Practice	
		Median [Q1, Q3]	Р	Median [Q1, Q3]	P g	$\mathbf{\Xi}^{\mathbf{Q}}$ Median [Q1, Q3]	1
Gender			0.411		0.001	Area Median [Q1, Q3]	(
Male	113 (20.47)	9 [7,10]		25 [22,26]	related	<b>2</b> 26 [23,29]	
Female	439 (79.53)	9 [7,10]		26 [24,27]	ed t	27 [24,29]	
Age			0.295		0.059 <b>e</b>	nt S	0
Less than 35 years old	120 (21.74)	9 [7,10]		26 [24,27]	tt. ar	<b>1 0 2</b> 7 [24,29]	
35-44 years old	281 (50.91)	9 [7,10]		25 [23,26]	nd da	<b>e</b> 8 27 [24,29]	
45 years old and above	151 (27.36)	9 [7,10]		25 [23,27]	ata r	ÂB 27 [24,29]	
Child's grade			0.246		0.553 <b>n</b> i	m <sup>-</sup>	C
1	79 (14.31)	9 [8,10]		26 [23,27]	ng, /	28 [25,30]	
2	66 (11.96)	9 [7,10]		26 [24,26]	A tr	<b>2</b> 8 [25,30]	
3	100 (18.12)	9 [7,10]		26 [23.5,27]	Al training	<b>2</b> 6 [23.5,29]	
4	155 (28.08)	9 [7,10]		26 [23,27]	-	<b>2</b> 6 [23,29]	
5	75 (13.59)	9 [8,10]		25 [23,27]	0.143 0.143	<mark>8</mark> 25 [24,29]	
6	77 (13.95)	9 [7,9]		25 [23,27]		<b>2</b> 6 [24,29]	
Number of siblings			0.005		0.143 <b>ar</b>	n Ju	0
0	305 (55.25)	9 [8,10]		26 [24,27]	echr	27 [24,30]	
1	206 (37.32)	9 [7,10]		25 [23,27]	olog	27 [24,29]	
≥2	41 (7.43)	9 [7,10]		25 [23,27]	gies	<b>B</b> 27 [24,28]	
Education			< 0.001		0.021	t Ag	0
High school / technical secondary school and below	90 (16.30)	7.5 [6,9]		24.5 [22,26]		Agen 25 [23,28] Bit	
Junior college / bachelor's degree	429 (77.72)	9 [8,10]		26 [24,27]		Bi io 27 [24,29]	

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26 [24,27] 26 [24,27] 26 [23,28] 25 [23,26] 25 [23,26] 24 [22,26] 25 [23,27]	0.42	for 1227 [24,29] Warch 26 [24,29] Enseignment 27 [24,30] ted to	0.765 ] 1
26 [24,27] 26 [23,28] 25 [23,26] 25 [23,26] 24 [22,26]		27 Ing for 227 [24,29] for 227 [24,29] uses related to the set of	0.765 ] ] ]
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26 [23,28] 25 [23,26] 25 [23,26] 24 [22,26]	0.01	for 227 [24,29] Wa26 [24,29] Enseignment 27 [24,30] ated to	] ] ]
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25 [23,27]		ar up en 25.5 [23,2]	28.5]
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	25 [23,26] 25.5 [24,27]	26 [24,27] 25 [23,26] 0.8 25.5 [24,27]	26 [24,27] 25 [23,26] 25.5 [24,27] 0.854 0.854 0.854 0.854 0.854 0.854 0.854 0.854 0.854 0.854 0.854

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## Knowledge, attitude, and practice toward myopia

The average knowledge score among participants was  $8.38\pm2.29$  (theoretical minimummaximum: 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 minimummaximum: 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**).

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Table 2. Knowledge, attitudes, and practices.			<u>c</u> l	-0935		
				N=552		
Knowledge			y for	Gorrect (%)	Wrong/unclear (%)	_
1. Myopia is the result of overdevelopment of the eyeball, which is essentially a			USe	<b>150</b> (27.17)	402 (72.83)	-
2. The complications of high myopia are mainly fundus lesions, such as retinal d hemorrhage, macular fissure, etc.	letachment, retinoc	choroidal atrophy,	maculară re	<b>39</b> 0 (68.84)	172 (31.16)	
3. Low-concentration atropine drops are effective in slowing the development of	myopia.		late	(48.37) (48.35) (66.85)	285 (51.63)	
4. Mydriasis is a routine form of eve examination and treatment.			d to	369 (66.85)	183 (33.15)	
5. To give your eyes adequate rest, get up and move around every 20 minutes who f a window and look 20 feet (6 meters) away for at least 20 seconds.	hen working and s	tudying, and stand	l in front	<b>66</b> 7 (91.85)	45 (8.15)	
6. During home Internet classes, you should ensure that the room is well-lit and a devices appropriately, not too bright or too dark	djust the brightnes	s of your child's e	lectronicand	5 80 (95.83)	23 (4.17)	
<ul> <li>7. Outdoor exercise is also crucial to myopia prevention and control, but it does r or not: he/she should be allowed to do more outdoor activities</li> </ul>	not matter whether	the child is under	dayligh	<b>52</b> (20.29)	440 (79.71)	
or not; ne/sne should be allowed to do more outdoor activities.	ᆿ┍	ρΒ	· ·			
8. Children should not read at home in too much or too little light. Make sure that	amps are 🗄 🕻		40 (7 (1)			
or not; he/she should be allowed to do more outdoor activities. 8. Children should not read at home in too much or too little light. Make sure that on at the same time.					42 (7.61)	
9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading & learning and increasing outdoor activities.	there are other opti	ions, such as Kera		5 (91.12)	42 (7.61) 49 (8.88)	
<ul><li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li><li>10. If you need to do screen reading for a long time, you should wear anti-blue li</li></ul>	there are other opti	ions, such as Kera		5 (91.12)	49 (8.88)	
<ul><li>9. Wearing frame glasses is one of the best ways to control myopia; moreover, t as well as reducing close reading &amp; learning and increasing outdoor activities.</li><li>10. If you need to do screen reading for a long time, you should wear anti-blue li the eyes as much as possible.</li></ul>	there are other opti- ight glasses to bloc	ions, such as Kera	e light tonin	5 (91.12) 4 (83.70)	49 (8.88) 90 (16.30)	
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1 2 3	studies.			right, inc	n-2024-093565		
4 5	A7. I am worried that my child's myopia may affect their appearance.	273 (49.46)	165 (29.89)	· =·	<b>565</b> <b>03</b> 5 (6.3	34)	5 (0.91)
6 7	A8. I am concerned that my child's myopia may lead to low self-esteem.	112 (20.29)	75 (13.59)	217 <b>ਰੂੰ</b>	<b>≥</b> 26 (0.2 <b>≥</b> 26 (2		22 (3.99)
8 9	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 ses (11.59 <del>2</del> 6)	<u>م</u>	,	135 (24.46)
10	Practice	N (%)		gne	202		
11		Yes	No	ed	<u>5</u>		
12 13	P1. Encourage your child to participate in outdoor activities for at least 2 hours day.	<sup>a</sup> 208 (37.68)	344 (62.32	2) - to text and 2) - v	Down	-	-
14	P2. Supervise your child to perform eye exercises regularly.	334 (60.51)	218 (39.49	9) - aipe	loa	-	-
15 16	P3. Attend scientific lectures or activities on children's and adolescents' visio health.	· · · · ·	236 (42.75	- <u>2</u> 6	e	-	-
17		Always	Often	September 1	e Emes	Rarely	Never
18	P4. Take your child for optical coherence tomography once a year.	118 (21.38)	216 (39.13	3) 1299	37)	89 (16.12)	_
19	P5. Ensure a balanced diet that includes eggs, meat, fish, or animal liver.	11 (1.99)	200 (36.23	· _ · -		174 (31.52)	-
20	P6. Provide dairy or soy products for your child.	6 (1.09)	128 (23.19	>	- 1	260 (47.10)	-
21	P7. Offer plenty of fresh vegetables and fruits.	3 (0.54)	58 (10.51)	· · · ·	2.36)	340 (61.59)	-
22 23 24		Extremely positive	Positive	Ngutr	O	Negative	Extremel y negative
24	P8. Supervise your child's reading and writing posture.	181 (32.79)	254 (46.01	1) 1 <b>(2)</b> (1	§:30)	14 (2.54)	2 (0.36)
26 27	P9. Discourage your child from using electronic devices such as television, ce phone, or tablet computer in the dark.	<sup>11</sup> 364 (65.94)	142 (25.72	2) 2 <b>%</b> (5.2	<b>ই</b> )	12 (2.17)	5 (0.91)
28 29	P10. Do not allow your child to lie down while reading books or using electronic devices.	ic 149 (26.99)	90 (16.30)	<b>X</b>	ກ ຜູ1) ແ	48 (8.70)	207 (37.50)
30	P11. Discourage your child from reading books or looking at electronic product while using mobile transportation (bus, car).	ts 360 (65.22)	136 (24.64	4) 428(7.6	(لم	7 (1.27)	7 (1.27)
31 32	P12. Discourage your child from rubbing their eyes.	286 (51.81)	176 (31.88			14 (2.54)	8 (1.45)
33	P13. Encourage your child to take breaks and relax their eyes during class breaks.		172 (31.16		<b>3</b> 95)	24 (4.35)	4 (0.72)
33 34 35 36 37 38 39 40 41 42 43	"P" indicates a positive statement, while "N" indicates a negative stat For peer review only - http://bmjo			with "N"	Avere : Averce Bibliographique de	reverse-scor	ed.

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# 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	01		
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]. Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

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

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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 glasseswearing 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

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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 myopiaprevention behaviors also found that parental attitude was associated with their myopiapreventive 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

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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]. 

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# 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

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### **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.

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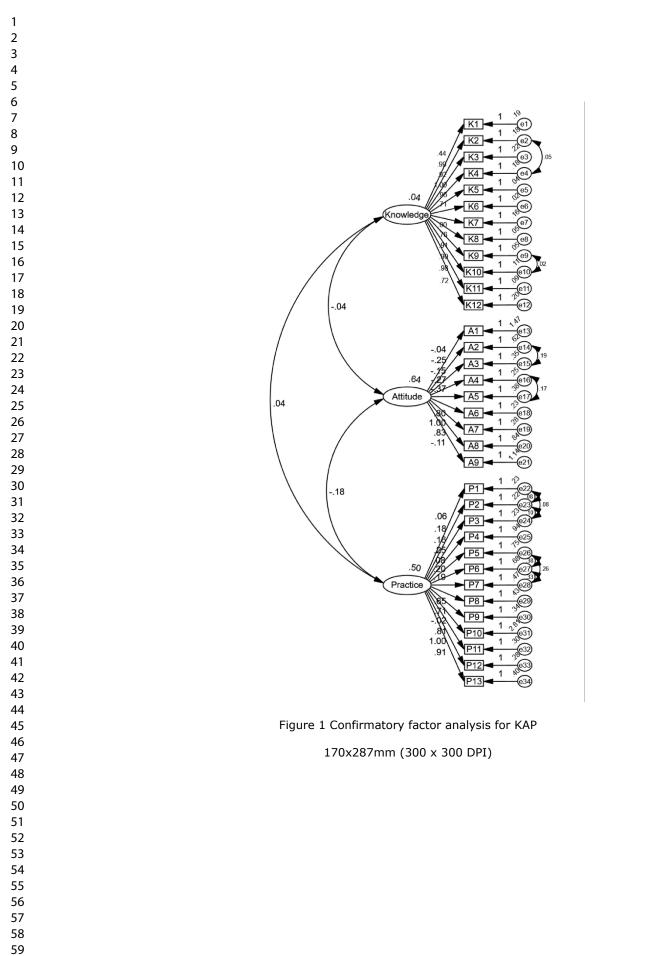
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# Figure 1 Confirmatory factor analysis for KAP

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<b>Supplementary table 1</b> . U	nivariate and multivariate logistic	regression analyses.	bmjopen-2024-093565 on 21 4 by copyright, including for	
	Univariate logistic regression		Multivariate logistic regression OR (95%CI)	
Knowledge	OR (95%CI)	Р		Р
Gender			anem ated	
Male	ref		d to	
Female	1.110 (0.717-1.717)	0.640	t Sup text	
Age			an	
Less than 35 years old	ref		d da	
35-44 years old	1.307 (0.830-2.058)	0.248	from (AE	
45 years old and above	1.133 (0.680-1.888)	0.631	n http:// 3ES) . mining	
Child's grade			ng,	
1	ref		Alt	
2	0.985 (0.500-1.942)	0.966	http://bmjopen.bmj.com/ on June ES) . Ining, Al training, and similar tech	
3	0.928 (0.502-1.717)	0.813	ing, br	
4	1.031 (0.588-1.807)	0.915	anc	
5	1.283 (0.672-2.451)	0.450	d sir	
6	0.526 (0.262-1.058)	0.071	nila n	
Number of siblings			Jun	
0	ref		ref <b>hnc 7</b> ,	
1	0.614 (0.421-0.895)	0.011	ref 0.650 (0.434-0.974) 0 655 (0 301-1 423)	0.037
≥2	0.535 (0.259-1.108)	0.092		0.655
Education			(gence	
High School / Technical secondary				
school and below	ref		ref Bibliographique	

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		BMJ Open	bmjopen-2024-093565 J by copyright, includ	
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			it, in in	
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Junior college/Bachelor's	degree 3.739 (2.013-6.943)	< 0.001	3.072 (1.566-6.025) <b>ng</b>	0.001
Master's degree and abov	e 6.293 (2.557-15.491)	< 0.001	6.259 (2.327-16.835) for uses related to 121 March 2025. I	<0.001
Work Status			use:	
Employed	ref		ref seit X	
Unemployed	0.387 (0.166-0.902)	0.028	0.720 (0.290-1.785) are en 25	0.478
Self-employed	0.876 (0.486-1.579)	0.661		0.434
Full-time homemaker	0.633 (0.274-1.461)	0.284	0.876 (0.359-2.141) <b>t</b>	0.772
Monthly household inco	me per person		1.295 (0.677-2.477)       To text and comparison of	
<5000	ref		ref during	
5000-10000	2.166 (1.156-4.059)	0.016	1.859 (0.960-3.596) a Aron	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
Are the parents nearsig	nted?		1.452 (0.716-2.947) 1.547 (1.028-2.330) ref 1.923 (1.314-2.813) ref	
Yes	2.023 (1.380-2.965)	<0.001	1.547 (1.028-2.330) training	0.037
No	ref		ref <b>Jing</b>	
Is the child nearsighted	,		, an mi i	
Yes	1.784 (1.249-2.550)	0.01	1.923 (1.314-2.813) ref	0.001
No	ref		ref <b>min</b> on	
Attitude			Jur ır te	
Knowledge score	1.265 (1.161-1.379)	< 0.001	1.239 (1.131-1.357)	< 0.001
Gender			olog	
Male	ref		1.239 (1.131-1.357) Choologie 7, 2025 at ref	
Female	2.083 (1.357-3.198)	0.001	• •	0.002
Age			gen	
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
			2.080 (1.307-3.310) Agence Bibliographique de lite/about/quidelines xhtml	
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			bmjopen-2024-093565 on 21 March 2025. Enseignem 0.632 (0.372-1.074) 0.632 (0.372-1.074)	
45 years old and above	0.581 (0.358-0.943)	0.028	0.632 (0.372-1.074) <b>G G</b>	0.090
Child's grade			for 21	
1	ref		use use	
2	1.170 (0.608-2.253)	0.639	s reic s reic	
3	1.145 (0.634-2.067)	0.654	2025 Jate	
4	0.988 (0.574-1.698)	0.964	d to	
5	0.949 (0.505-1.786)	0.872	t Sul	
6	0.589 (0.311-1.115)	0.104	loade trand	
Number of siblings				
0	ref		ata ata	
1	0.751 (0.527-1.070)	0.113	min BES	
≥2	0.772 (0.402-1.485)	0.439	m http:// BES) . mining,	
Education			Alt	
High School / Technical secondary	f			
school and below	ref		ref ning	
Junior college/Bachelor's degree	1.870 (1.170-2.988)	0.009	1.172 (0.691-1.989) an E.	0.556
Master's degree and above	2.073 (0.924-4.651)	0.077	ref 1.172 (0.691-1.989) 1.231 (0.495-3.065) <b>A training, and similar technologies.</b>	0.655
Work Status			milt on	
Employed	ref		r te Jur	
Unemployed	1.031 (0.527-2.019)	0.928	chnc	
Self-employed	0.756 (0.430-1.331)	0.333	, 2025 ologie	
Full-time homemaker	0.794 (0.373-1.690)	0.549	25 at gies.	
Monthly household income per pers	0 <b>n</b>			
<5000	ref		ref <b>1.230 (0.685-2.207)</b>	
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
			1.842 (1.010-3.359)	
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>20000	2.478 (1.373-4.472)	0.003	2.296 (1.211-4.351) <b>D</b>	0.011
Are the parents nearsighted?			for 21	
Yes	1.875 (1.317-2.668)	< 0.001	1.549 (1.056-2.273)	0.025
No	ref		ref a 🖳	
Is the child nearsighted?			2025 9late	
Yes	1.024 (0.726-1.443)	0.894	d to	
No	ref		t Su	
Practice			loac t an	
Knowledge score	1.128 (1.033-1.231)	0.007	1.062 (0.962-1.172)	0.233
Attitude score	1.187 (1.103-1.277)	<0.001	1.163 (1.076-1.258)	< 0.001
Gender			mini a ht	
Male	ref		ing,	
Female	1.147 (0.730-1.803)	0.552	A Dim	
Age			irair	
Less than 35 years old	ref		ref	
35-44 years old	0.942 (0.598-1.485)	0.798	, an mi	
45 years old and above	0.822 (0.490-1.379)	0.459	ref 1.205 (0.616-2.359) 0.576 (0.305-1.086) 0.478 (0.265-0.859)	
Child's grade			mit on	
1	ref		ref te E	
2	1.172 (0.608-2.262)	0.636	1.205 (0.616-2.359) China 7,	0.586
3	0.541 (0.291-1.005)	0.052	0.576 (0.305-1.086) 00 0.478 (0.265-0.859) 025	0.088
4	0.445 (0.251-0.790)	0.006	0.478 (0.265-0.859) <b>Given State</b>	0.014
5	0.481 (0.244-0.949)	0.035		0.062
6	0.496 (0.254-0.971)	0.041	0.576 (0.288-1.150)	0.118
Number of siblings			Cê E	
0	ref		3ibli	
			0.512 (0.253-1.033) Agence Biblio graphique de	
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1	0.945 (0.647-1.380)	0.770			
≥2	0.577 (0.265-1.254)	0.165	on 21 March : Enseig ing for uses re		
Education			s reic		
High School / Technical secondary	ref		eignem ref ed		
school and below	rei				
Junior college/Bachelor's degree	1.714 (1.002-2.929)	0.049	1.284 (0.723-2.281) 1.751 (0.713-4.297) 1.751 (0.713-4.297) text and cata from	0.393	
Master's degree and above	2.275 (0.966-5.360)	0.060	1.751 (0.713-4.297)	0.222	
Work Status			d da		
Employed	ref		(AB ata n		
Unemployed	1.214 (0.600-2.457)	0.590	득·낐		
Self-employed	1.090 (0.599-1.985)	0.778	ing,		
Full-time homemaker	1.179 (0.534-2.605)	0.683	Alt		
Monthly household income per			ttp://bmjopen.bmj.com/ on June 7, 2025 3) . hing, Al training, and similar technologie		
person			n.br		
<5000	ref		anc		
5000-10000	0.598 (0.317-1.131)	0.114	d diama di sir		
10000-20000	0.694 (0.425-1.133)	0.144	nila on		
>20000	0.979 (0.603-1.590)	0.933	nj.com/ on June 7, 2025 at and similar technologies.		
Are the parents nearsighted?			e 7,		
Yes	0.955 (0.658-1.387)	0.808	202		
No	ref		yies.		
Is the child nearsighted?					
Yes	0.716 (0.491-1.045)	0.083	Agence		
No	ref		ω		
Abbreviation: OR: odd ratic	o; CI: confidence interval; ref:	: reference.	ibliographique de l		

## Dear Parents:

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

1. Please complete the questionnaire. There are no right or wrong answers; you only need to provide be posses based on your actual experiences. If you have any questions during the process, feel free to reach out to us, and please submit experiences are a submit experiences. timely manner.

2. This study is a simple questionnaire survey and will not cause any harm to your physical or psyce gical well-being. However, it may involve some personal information such as your gender and age. Please rest assured that we will strictly and that in confidentiality and will not disclose your information.

3. As a participant, you can always stay informed about the information and progress related to this 25, 16 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 bus schedule!

 $\Box$ I have been informed and agreed to the use of the E ollected data for scientific research.

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Informer Consent Signature: Date of participation: Dav

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Part I Basic	c Information	ng t	on 21	
1.Your gender:			a.Female	
2.Your age:		seic s re		
3.Child's grade:	a. First year of primary school	gnen	2025	
	b. Second year of primary school	d do		
	c. Third year of primary school			
	d. Fourth year of primary schoo			
	$\Gamma^{*}_{01}$ $\Gamma^{*}_{1}$ $1$ $1$		led	
	f. Sixth year of primary school	. (AE	fron	_
4. The child currently has a total of siblings (related by blood,	this child is not counted).	BES	htt	
5.Your education:		ing,	<b>p</b> ://	
	b. Middle school	Alt	bmj	
	c. High school/Technical second	ary	school	
	d. Junior college/Bachelor's deg	<b>J</b>	n.b	
		, and	<u> </u>	
6.Your work Status:			n n n n n n n n n n n n n n n n n n n	
	b. Unemployed	nila	on	
	c. Self-employed	r teo	ل un	
	d. Housewives	chn	le 7,	
	e. Others	olog	2025	
7.In the past year, your monthly per capita household income was	a.<2000	similar technologies.	25 at	
(including income in kind and rental income, etc.): yuan	b.2000-5000		t Agei	
	c.5000-10000		2	
	d.10000-20000		ce Bi	
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4 5 6	8.Are you nearsighted?	a Nearsighted	
7 8 9	9. Is your child nearsighted?	a. Nearsighted	
10 11 12 13 14 15		b. Not nearsighted a. Nearsighted b. Not nearsighted b. Not nearsighted b. Not nearsighted c. Not nea	
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Part II Knowledge of myopia		on 21		
1. Myopia is the result of overdevelopment of the eyeball, which is essentially a shortening of t	the system	March a.Correct	b.Wrong	c.Unclear
axis.	elater	. a. Contect	0. W10115	C.Ulicicai
2. The complications of high myopia are mainly fundus lesions, such as: retinal detach	ាយផ្លាំដី ព		b.Wrong	c.Unclear
retinochoroidal atrophy, macular haemorrhage, macular fissure, etc.	superi	a.Correct	D. WIONg	C.Ulicicai
<b>3.</b> Low-density atropine drops are effective in slowing the development of myopia.	eur (A d data	a.Correct	b.Wrong	c.Unclear
4. Mydriasis is a routine form of eye examination and treatment.	ABES) a minii		b.Wrong	c.Unclear
5. To give your eyes adequate rest, get up and move around every 20 minutes when working	ig and	a.Correct	b.Wrong	c.Unclear
studying, and stand in front of a window and look 20 feet (6m) away for at least 20 seconds.	train		0. wrong	
6. During home Internet classes, you should ensure that the room is well-lit and adjust the brig	,htness	b b b c Correct	h Wrong	c.Unclear
of your child's electronic devices appropriately, not too bright or too dark.	nd sin	a.Correct	b.Wrong	C.Ulicicai
7. Outdoor exercise is also crucial to myopia prevention and control, but it does not matter w	hether	.م بر a.Correct	b.Wrong	c.Unclear
the child is under daylight or not, he/she should be allowed to do more outdoor activities. (Wro	<sup>118</sup> 5 :	1e 7,	U. WIONg	C.Ulicicai
8. Children should not read at home in too much or too little light. Make sure that indoor lighting	ng and	a.Correct	b.Wrong	c.Unclear
eye protection lamps are on at the same time.	S S	t Ag	0. 11 10115	
9. Wearing frame glasses is one of the best ways to control myopia; moreover, there are other of	ptions,	- A I	b.Wrong	c.Unclear
such as Keratoscope, as well as reducing close reading & learning and increasing outdoor activ	ities.		0. 11 10115	C.Ulicicai
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10. If you need to do screen reading the harmful blue light to the eyes	ing for a long time, you should wear anti-blue light gla as much as possible.		a.Correct	b.Wrong	c.Unclear
		ecessary, and	a.Correct	b.Wrong	c.Unclear
12. A simple computerized opto (Wrong)	ometry can accurately obtain the diopters of child	with myo	a.Correct	b.Wrong	c.Unclear
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		ру сорундні, пісіаанд			
Part III Attitude te	o myopia				
1. I believe that glasses should only be worn when necessary to correct vision. (N)	a.Strongly agree	-	Meutral Chseigner	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	nent Superi	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		in the second se	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	mj.com/	d.Disagree	e.Strongly disagree
6. I am concerned that my child's myopia may impact their future life and studies.	a.Strongly agree	lection	7,	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.N <del>u</del> utral	d.Disagree	e.Strongly disagree
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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 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41	necessary, but not necessarily all day. (N) G To use related to be and data milling. A training, and similar technologies.
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Part IV Practice o		ר for		
1. Do you take your child to engage in outdoor activities for more than	a.Yes	March Ensei uses r	b.No	
2 hours a day as much as possible? (P)				
2. Do you supervise your child to do eye exercises? (P)	a.Yes	025. Inem lated	b.No	
<b>3.</b> 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	Downl lent Su I to tex	b.No	
4. How often you take your child to a specialised facility for an optical	a.Never	load peri t an		
eye examination each year:	b.Once a year	led f ieur d da		
	c.Twice a year	fron (AE		
	d. More than twice a year	nini		
Your daily meal preparation:		ng,		
5. If it contains eggs, meat, fish or animal liver?	a.Never prepare	Altr		
	b.1~2 times a week on av	grage		
	c.3~4 times a week on av	<b>e</b> ag <mark>g</mark>		
	d.5 or more times a week	<b>ğ</b> n aye	rage	
6. If it contains dairy or soya products?	a.Never prepare	sim		
	b.1~2 times a week on av	5 ~		
	c.3~4 times a week on av			
	d.5 or more times a week	en ave	rage	
7. If it contains fresh fruits and vegetables?	a.Never prepare	202ť logi		
	b.1~2 times a week on av			
	c.3~4 times a week on av			
	d.5 or more times a week	- Ö		
8. Supervise your child's reading and writing posture. (P)	5	C. Bib	d.	e. Extremely
	Positive Positive	Neut <del>r</del> al	Negative	Negative

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d. Negative	
Negative	e. Extremely
	-
4	Negative
	e. Extremely
Negative	Negative