Research Square

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Distribution characteristics of myopia among children and adolescents in Yunnan Province, China: a retrospective analysis

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Abstract

Background

Myopia is a leading cause of visual impairment among children and adolescents worldwide. Large-scale data on refractive status distribution from southwestern China—particularly from plateau and multi-ethnic regions such as Yunnan Province—remain limited. This study aimed to analyze the distribution characteristics of refractive status and myopia among outpatient individuals under 18 years of age in Yunnan, based on non-cycloplegic refraction, and to provide data support for regional myopia prevention and control strategies.

Methods

A retrospective, single-center, cross-sectional analysis was conducted on spherical equivalent (SE) data from outpatient individuals under 18 years who visited Kunming Stars Ophthalmology Hospital between January 2021 and June 2026. Refractive status was categorized into four groups using the first non-cycloplegic comprehensive refraction: pre-myopia (SE + 1.00 to 0.00 D), initial myopia (SE − 1.00 to 0.00 D), low-to-moderate myopia (SE − 6.00 to − 1.00 D), and high myopia (SE < − 6.00 D). Age, gender, regional distribution, and clinical visit characteristics were analyzed using the chi-square test and one-way analysis of variance.

Results

Among 60,650 valid records, 55,853 (92.1%) had refractive abnormalities, including pre-myopia (16,638 cases; 27.4% of total, 29.8% of abnormalities), initial myopia (13,287; 21.9% of total, 23.8% of abnormalities), low-to-moderate myopia (25,093; 41.4% of total, 44.9% of abnormalities), and high myopia (835; 1.4% of total, 1.5% of abnormalities). Mean age increased from 8.2 years in pre-myopia to 13.0 years in high myopia ($P < 0.001$). Males predominated in pre-myopia (52.9%), whereas females surpassed males from initial myopia onward (51.8% in initial myopia, 51.3% in low-to-moderate myopia); the gender ratio in high myopia was nearly equal (50.1% vs. 49.9%). Cases concentrated in Yunnan Province, with Kunming contributing 17,966 records (29.6% of all data). The proportion of high myopia increased with age, reaching 6.1% among senior high school students. Follow-up rates rose with myopia severity, from 14.8% in pre-myopia to 26.5% in high myopia.

Conclusions

Low-to-moderate myopia is the predominant refractive abnormality among outpatient children and adolescents in Yunnan Province, with degree worsening by age. Preschool and lower primary school stages represent critical windows for prevention. Regular refractive screening and personalized control systems should be established. These findings are based on a single-center outpatient sample with non-cycloplegic refraction and may not represent general population prevalence.

Background

Myopia is one of the most common refractive errors worldwide and an important public health problem causing visual impairment. In recent years, the prevalence of myopia has been increasing globally, especially in East Asia. It is predicted that by 2050, the global prevalence of myopia will reach 49.8%, and the prevalence of high myopia will

reach 9.8% [1]. The prevalence of myopia among children and adolescents in China remains high. Data released by the National Health Commission in 2023 showed that the overall myopia rate among children and adolescents in China was 51.9%, including 35.6% in primary school, 71.1% in junior high school, and 80.5% in senior high school. Myopia not only affects visual quality, but high myopia can also lead to serious complications such as retinopathy, glaucoma, and macular degeneration, imposing a heavy disease burden on individuals and society [2, 3].

The onset and development of myopia is a process involving multiple factors, including genetic factors, environmental factors, and behavioral habits [4]. Studies have shown that myopia is closely related to prolonged near work, insufficient outdoor activity time, and accelerated urbanization [5]. In addition, the progression of myopia has obvious age characteristics, and school age is a high-risk stage for the onset and progression of myopia [6]. Early identification of people at risk of myopia and timely intervention are of great significance for delaying the progression of myopia and reducing the incidence of high myopia.

Yunnan Province is located in the southwest of China and has unique geographical and socioeconomic characteristics. However, there are few reports of large-sample studies on the distribution characteristics of myopia among children and adolescents in Yunnan Province. This study retrospectively analyzed the SE data of 60,650 patients under 18 years of age who visited hospitals in Yunnan Province and surrounding areas, to explore the age, gender, regional distribution, and clinical visit characteristics of myopia, and to provide data support for formulating regional myopia prevention and control strategies.

Methods

Study design and participants

This was a retrospective, single-center, cross-sectional observational study conducted at Kunming Stars Ophthalmology Hospital, Kunming, Yunnan Province, China. The inclusion criteria were: (1) age < 18 years; (2) completion of initial comprehensive refraction (measurement of binocular spherical degree); and (3) complete medical record data. The exclusion criteria were: (1) age ≥ 18 years; (2) missing spherical data or unreliable measurement results; and (3) complication with corneal lesions, cataracts, retinal detachment, or other ocular diseases that seriously affect refractive measurement.

We retrospectively analyzed spherical data from patients who visited Kunming Stars Ophthalmology Hospital from January 2021 to June 2026 and met the above criteria, totaling 60,650 cases, including 55,853 cases of refractive abnormalities (including pre-myopia).

Classification of refractive status

According to the spherical equivalent (SE), the refractive status of the participants was divided into four categories: (1) pre-myopia: SE + 1.00 to 0.00 D, indicating a stage of depleted hyperopic reserve that does not yet meet the diagnostic criteria for myopia but represents a high-risk stage for impending myopia, thus included in the unified analysis; (2) initial myopia: SE -1.00 to 0.00 D, indicating the early trend of myopia with relatively low diopter; (3) low-to-moderate myopia: SE -6.00 to -1.00 D, representing the main group of myopia; and (4) high myopia: SE < -6.00 D, indicating severe myopia with a significantly increased risk of complications [7, 8]. SE was taken as the average of the spherical degrees of the right and left eyes from the first comprehensive refraction.

Data collection

Data collected included gender, age, visit type (initial/return visit), spherical degree, and visit region. Each patient underwent unified examinations, including binocular uncorrected and corrected visual acuity, intraocular pressure, refractive status, ocular B-ultrasound, fundus photography, and axial length measurement. Patients were divided into six age groups: infant (0–3 years), preschool (4–6 years), lower primary (7–9 years), upper primary (10–12 years), junior high (13–15 years), and senior high (16–17 years). Regional distribution was analyzed by province and prefecture-level city.

Statistical analysis

SPSS 26.0 statistical software (IBM Corp., Armonk, NY, USA) was used for data analysis. Categorical data were expressed as n (%) and compared using the chi-square test. Measurement data were expressed as mean ± standard deviation (SD) and compared using one-way analysis of variance (ANOVA). A two-sided $P < 0.05$ was considered statistically significant.

Use of artificial intelligence tools

No artificial intelligence tools or large language models were used in the writing, analysis, or generation of any content in this manuscript.

Results

Characteristics of the study population

A total of 60,650 valid SE data points from individuals under 18 years of age were included. Among them, 16,638 (27.4% of all valid data) were in the pre-myopia group, 13,287 (21.9%) in the initial myopia group, 25,093 (41.4%) in the low-to-moderate myopia group, and 835 (1.4%) in the high myopia group, totaling 55,853 cases (92.1%). The remaining 4,797 cases (7.9%) with SE > + 1.00 D were classified as hyperopia or other refractive statuses and were not included in the statistics of the four refractive abnormality groups (Fig. 1). Among the 55,853 participants with refractive abnormalities, males accounted for 27,832 cases (49.8%) and females 28,021 cases (50.2%), showing a basically balanced gender ratio. The overall mean age was 10.8 years (median 10.0 years), with a mean SE of -1.36 D. There were 46,215 initial visits (82.7%) and 9,638 return visits (17.3%) (Table 1).

Table 1
Characteristics of the four refrlicative abnormality groups

Classification	SE (D)	Number	Proportion (%)a	Mean age (years)	Median age (years)	Mean SE (D)	Male:Female (%)	Initial:Return visit (%)
Pre-myopia	+ 1.00 to 0.00	16,638	27.4	8.2	8.0	+ 0.46	52.9:47.1	85.2:14.8
Initial myopia	-1.00 to 0.00	13,287	21.9	11.0	11.0	-0.65	48.2:51.8	82.2:17.8
Low-to-moderate myopia	-6.00 to -1.00	25,093	41.4	12.2	12.0	-2.32	48.7:51.3	81.7:18.3
High myopia	< -6.00	835	1.4	13.0	14.0	-8.22	50.1:49.9	73.5:26.5
Total	—	55,853	92.1	10.8	10.0	-1.36	49.8:50.2	82.7:17.3

a Proportions are calculated from the total of 60,650 valid SE records. An additional 4,797 cases (7.9%) with SE > + 1.00 D were classified as hyperopia/other and were not included in the four refractive abnormality groups. Among the 55,853 refractive abnormality cases, the corresponding proportions were 29.8% (pre-myopia), 23.8% (initial myopia), 44.9% (low-to-moderate myopia), and 1.5% (high myopia). SE, spherical equivalent.

Age distribution

From pre-myopia to high myopia, the mean age increased gradually from 8.2 years to 13.0 years, showing a significant age-increasing pattern ($F = 2{,}415.36$, $P < 0.001$). In the pre-myopia group, 48.7% were concentrated in the lower primary stage (7–9 years), 24.2% were preschool children (4–6 years), and 19.3% were in the upper primary stage (10–12 years). In the initial myopia group, 40.1% were in the upper primary stage, 28.9% in the lower primary stage, and 22.5% in junior high school. In the low-to-moderate myopia group, 36.3% were in the upper primary stage, 33.7% in junior high school, and 12.2% in senior high school. In the high myopia group, 34.1% were in junior high school and 30.7% in senior high school, and the proportion increased with age. The infant stage (0–3 years) was dominated by pre-myopia (83.4%), and the preschool stage (4–6 years) was still dominated by pre-myopia (85.4%). In the lower primary stage (7–9 years), pre-myopia accounted for 50.0%; in the upper primary stage (10–12 years), low-to-moderate myopia accounted for 51.2%; in junior high school, low-to-moderate myopia accounted for 66.7%; and in senior high school, low-to-moderate myopia accounted for 73.3% (Table 2, Fig. 2).

Table 2
Age distribution of participants by refractive status group [n (%)]

Classification	Infant (0–3)	Preschool (4–6)	Lower primary (7–9)	Upper primary (10–12)	Junior high (13–15)	Senior high (16–17)	Total
Pre-myopia	246 (83.4)	4,019 (85.4)	8,099 (50.0)	3,211 (18.1)	950 (7.5)	113 (2.7)	16,638
Initial myopia	17 (5.8)	370 (7.9)	3,842 (23.7)	5,324 (29.9)	2,988 (23.6)	746 (17.9)	13,287
Low-to-moderate myopia	23 (7.8)	273 (5.8)	4,171 (25.7)	9,105 (51.2)	8,459 (66.7)	3,062 (73.3)	25,093
High myopia	9 (3.0)	45 (1.0)	102 (0.6)	138 (0.8)	285 (2.2)	256 (6.1)	835
Total	295	4,707	16,214	17,778	12,682	4,177	55,853

Percentages in parentheses represent the proportion of each refractive status group within the corresponding age group.

Gender distribution

Among the participants with refractive abnormalities, males accounted for 49.8% and females 50.2%, showing a basically balanced gender ratio. However, there were significant differences in gender distribution among the different refractive status groups ($\chi^2 = 67.82$, $P < 0.001$). Pre-myopia was the only group with more males than females, with 8,796 males (52.9%) and 7,842 females (47.1%). From the initial myopia stage onward, females surpassed males, with 6,883 females (51.8%) and 6,404 males (48.2%). In low-to-moderate myopia, the proportion of females remained higher, with 12,879 females (51.3%) and 12,214 males (48.7%). It is worth noting that the gender ratio in high myopia under 18 years of age was almost equal, with 418 males (50.1%) and 417 females (49.9%), which was in sharp contrast to the female predominance (57.2%) reported in all-age high myopia, suggesting that high myopia in adult females may be more related to acquired factors (Table 1, Fig. 3).

Regional distribution

The regional distribution showed that cases were mainly from Yunnan Province, with a total of 25,085 cases (44.9% of all included cases), followed by Guizhou Province (325 cases), Sichuan Province (195 cases), Hunan Province (90 cases), and Fujian Province (82 cases) (Fig. 4A). In Yunnan Province, Kunming City contributed the most, with a total of 17,966 cases (71.6% of the cases in Yunnan, 29.6% of all data), followed by Qujing City (2,247 cases), Honghe Prefecture (1,862 cases), Dali Prefecture (1,140 cases), Zhaotong City (834 cases), and Yuxi City (801 cases) (Fig. 4B). The composition of refractive status groups in each region was consistent with the overall trend, with low-to-moderate myopia as the main type (Table 3).

Table 3
Distribution of refractive status groups in the ten major cities

City	Pre-myopia	Initial myopia	Low-to-moderate myopia	High myopia	Total
Kunming	4,934	4,201	7,440	173	17,966
Qujing	515	408	942	80	2,247
Honghe	416	374	804	41	1,862
Dali	291	236	450	25	1,140
Zhaotong	177	140	347	34	834
Yuxi	211	164	300	15	801
Chuxiong	183	141	299	17	717
Pu'er	140	129	358	9	694
Baoshan	103	86	250	9	519
Lijiang	136	102	181	10	479

Top 10 cities by case number in Yunnan Province. Totals represent all cases from each city in the database.

Clinical visit characteristics

Among the participants with refractive abnormalities, there were 46,215 initial visits (82.7%) and 9,638 return visits (17.3%). The follow-up rate increased with the severity of myopia: the lowest in pre-myopia (14.8%, 2,456/16,638), 17.8% in initial myopia (2,364/13,287), 18.3% in low-to-moderate myopia (4,597/25,093), and the highest in high myopia (26.5%, 221/835), with statistically significant differences between groups ($\chi^2 = 145.67$, $P < 0.001$). The mean SE of high myopia patients was − 8.22 D (median − 7.38 D), ranging from − 25.00 to -6.12 D, suggesting that patients with deeper diopters have better follow-up compliance, but also indicating that the follow-up management of mild patients needs to be strengthened.

Spherical equivalent distribution

The mean SE of the four groups was + 0.46 D (pre-myopia), -0.65 D (initial myopia), -2.32 D (low-to-moderate myopia), and − 8.22 D (high myopia), showing a significant stepwise decreasing trend ($F = 18,547.32$, $P < 0.001$). The median SE of low-to-moderate myopia was − 2.00 D, indicating that this group was mainly composed of mild myopia. The SE range of high myopia was wide (-25.00 to -6.12 D), suggesting great heterogeneity within this group and the need for more refined hierarchical management (Fig. 5).

Discussion

Myopia is one of the most common refractive errors worldwide, and its prevalence has been increasing in Asia in recent years. Holden et al. [1] predicted that by 2050, the global prevalence of myopia would be close to 50%, with East Asia becoming the most severely affected area. The situation of myopia among children and adolescents in China is severe, with the overall prevalence exceeding 50%. As an important province in southwest China, Yunnan has a unique plateau geographical environment, multi-ethnic population characteristics, and an obvious urban–rural medical gradient. However, there is a lack of systematic reports on large-sample data regarding the distribution characteristics of myopia among children and adolescents in this region. This study retrospectively

analyzed the SE data of 60,650 patients under 18 years of age, revealing several important characteristics of myopia distribution in this region, which are discussed below in the context of these regional particularities.

This study found that low-to-moderate myopia was the largest group among children and adolescents under 18 years of age, accounting for 41.4% of all valid data (25,093 cases; 44.9% of the refractive abnormality cohort), which is generally consistent with the results of national epidemiological surveys. Pre-myopia accounted for 27.4% (16,638 cases). Although this group has not yet reached the diagnostic criteria for myopia, their hyperopic reserve is being depleted, making them a high-risk population for the onset of myopia. Studies have shown that pre-myopia is the golden window for intervention, and behavioral interventions can reduce the 2-year cumulative incidence of myopia from 27.8% to 13.3% [9]. In this study, the mean age of pre-myopia patients was only 8.2 years, with 48.7% concentrated in the lower primary school stage (7–9 years) and 24.2% in the preschool stage (4–6 years), indicating that the preschool and lower primary school stages are critical periods for myopia prevention and control.

It is worth noting that Yunnan is located on a plateau with significantly higher ultraviolet (UV) radiation intensity than plain areas. Theoretically, high-intensity natural light can promote retinal dopamine release and inhibit excessive axial elongation [10], providing a natural “light protection advantage”. However, the data from this study show that Kunming City, a high UV exposure area, had as many as 17,966 myopia cases, accounting for nearly 30% of the cases in the database, and the burden of myopia remains heavy. This suggests that the modern near-work academic load may completely offset the protective effect of plateau light [11]. In addition, strong UV radiation without protection may cause lens opacity or retinal photochemical damage [12]. Therefore, myopia prevention strategies in Yunnan should not be blindly optimistic about the “plateau advantage”. While encouraging outdoor activities, it is necessary to emphasize wearing UV-protective hats or glasses to balance protection and prevention.

The age-increasing pattern is one of the most significant findings of this study. From pre-myopia to high myopia, the mean age gradually increased from 8.2 to 13.0 years, reflecting the natural pattern of myopia onset and progression with age. The infant stage (0–3 years) was dominated by pre-myopia (83.4%), and the preschool stage (4–6 years) was still dominated by pre-myopia (85.4%). During these stages, the hyperopic reserve still exists, making them a focus for early intervention. As school age increases, low-to-moderate myopia gradually becomes the dominant type, accounting for 51.2% in upper primary school (10–12 years), 66.7% in junior high school, and 73.3% in senior high school. This trend is consistent with the reported patterns of myopia progression in domestic and international studies [6, 13]. It is worth noting that high myopia accounted for only 1.5% (835 cases) of the refractive abnormality cohort, but its proportion increased with age, reaching 2.2% in junior high school and 6.1% in senior high school, suggesting that adolescence is a high-risk stage for the development of high myopia and requires focused attention.

The changing trend of gender distribution is noteworthy and may also reflect the heterogeneity of refractive phenotypes under the multi-ethnic genetic background of Yunnan. This study found that pre-myopia was the only group with more males than females (52.9% vs. 47.1%). From the initial myopia stage onward, females surpassed males (51.8%), and females accounted for 51.3% in low-to-moderate myopia. This gender crossover phenomenon is consistent with previous reports of a higher prevalence of myopia in females [14]. Faghihi et al. [15] showed that the prevalence of myopia in Iranian schoolchildren was significantly higher in females than in males, which was attributed to earlier female puberty and longer near-work time. However, the gender ratio in high myopia under 18 years of age was almost equal (50.1% vs. 49.9%), which was significantly different from the female predominance

(57.2%) reported in all-age high myopia, suggesting that high myopia in adult females may be more related to acquired factors, such as long-term near work and hormonal changes [16].

As a multi-ethnic region, Yunnan provides a natural setting for studying genetic factors. Epidemiological evidence shows that the myopia rate in Han children is generally higher than that in ethnic minorities such as the Dai and Hani, which is closely related to the fact that the traditional farming lifestyle of the latter retains more outdoor exposure time. Molecular epidemiological studies have also found that the susceptible SNP loci for refractive errors (such as GJD2 and TGF-β) in the Hani population of Mojiang show unique distribution frequencies [17, 18]. However, with the acceleration of urbanization, the traditional lifestyles of ethnic minorities are changing, and the myopia growth rate in some ethnic groups (such as the Naxi) has exceeded that of the Han population. In this study, Kunming City concentrated 71.6% of the myopia patients in the province, indirectly reflecting the association between urbanization and myopia risk [19]. This warns us that prevention and control strategies need to be "tailored to each ethnicity": for genetically susceptible Han and mixed-ethnicity populations, early axial length monitoring should be strengthened; for ethnic minority areas with currently low myopia rates, the focus should be on maintaining their traditional outdoor activity habits to prevent the "loss of advantage".

In terms of regional distribution, the patients included in this study were concentrated in Yunnan Province, with Kunming City contributing the most cases (17,966 cases, 29.6% of all data). This may be related to the relative concentration of medical resources in Kunming as the provincial capital, and also indirectly reflects the "gradient drop" and structural contradictions in the distribution of eye health resources in Yunnan. The composition of refractive status groups in various prefectures and cities within Yunnan Province was consistent with the overall trend, with low-to-moderate myopia as the main type. Studies have shown that the degree of urbanization is positively correlated with the risk of myopia onset and progression [19]. As the most urbanized area in Yunnan, the fact that Kunming has the largest number of myopia patients confirms this association. In addition, secondhand smoke exposure (SHS) is significantly associated with a negative shift in SE and axial elongation [20] and is also an intervenable environmental risk factor. Although provincial tertiary hospitals have strong technical capabilities, primary health centers, especially township health centers, generally lack qualified optometrists and standardized examination equipment, resulting in a large number of myopic children in rural areas remaining in a state of "unscreened and uncorrected", lacking effective referral and affordable glasses mechanisms. In the future, it will be necessary to rely on the "county–township–village" three-tier network, incorporate cycloplegic refraction and axial length measurement into the basic public health service package, and provide supporting glasses subsidy policies for remote areas, so as to truly reach the "last mile" of myopia prevention and control.

The differential distribution of clinical visit characteristics also has important clinical significance. The follow-up rate increased with the severity of myopia (from 14.8% to 26.5%), indicating that patients with higher diopters have better follow-up compliance. However, the follow-up rates in pre-myopia and initial myopia were relatively low (14.8% and 17.8%), indicating that the follow-up management of mild patients needs to be strengthened. Studies have shown that active clinical intervention is of key significance in establishing screening and personalized prevention and control strategies during childhood and adolescence [21]. In particular, for patients with pre-myopia and initial myopia, regular follow-up and health education should be strengthened.

The management of high myopia requires special attention. In this study, the mean SE of high myopia patients was − 8.22 D, with a range of -25.00 to -6.12 D, and previous studies have reported approximately two-thirds bilateral involvement in nonsyndromic high myopia [22]. The risk of complications from high myopia is significantly increased, including retinopathy, glaucoma, and macular degeneration [2, 3, 23]. In addition, in progressive high

myopia, the daily choroidal thinning rate is significantly accelerated, suggesting that dynamic changes in the choroid can be used as a monitoring indicator for progression [24]. Therefore, for high myopia patients, a long-term follow-up system should be established, with regular fundus examination and axial length monitoring.

This study has several limitations. First, it is a retrospective, single-center study, and the data are derived from outpatients, which cannot fully represent the population prevalence. Second, the data are mainly from Yunnan Province, so the generalizability is limited. Third, biometric indicators such as axial length and corneal curvature were not included in the analysis, making it impossible to comprehensively evaluate the biological characteristics of myopia. Future population-based multicenter prospective studies are needed to further validate the findings of this study, combined with biological parameters such as axial length and choroidal thickness. At the same time, genome-wide association studies (GWAS) and artificial intelligence prediction models should be combined to deeply analyze the mechanism of myopia onset and development in the special environment of Yunnan, especially to explore the heterogeneity of refractive phenotypes under the multi-ethnic genetic background.

Conclusions

Low-to-moderate myopia is the main type of refractive abnormality among children and adolescents under 18 years of age in Yunnan Province, and the degree of myopia worsens with age. Preschool and lower primary school stages are the golden windows for myopia prevention and intervention. Regular refractive screening should be carried out to establish a personalized prevention and control system. At the same time, the follow-up management of patients with pre-myopia and initial myopia should be strengthened to improve the follow-up compliance of mild patients, so as to delay the progression of myopia to the greatest extent and reduce the incidence of high myopia.

Abbreviations

ANOVA
analysis of variance
D
diopter
GWAS
genome-wide association study
SD
standard deviation
SE
spherical equivalent
SHS
secondhand smoke
SNP
single nucleotide polymorphism
UV
ultraviolet

Declarations

Ethics approval and consent to participate

This retrospective study followed the Helsinki Declaration(2013 revision) and was approved by the Ethics Committee of the Affiliated Hospital of Yunnan University, China(NO.2024064). The requirement for written informed consent was waived by the Ethics Committee due to the retrospective nature of the study, and all patient data were anonymized before analysis.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

MH was responsible for the conception and design of the study and provided administrative support. All authors contributed to the provision of study materials or patients and the collection and assembly of data. QYZ and JRL performed the data analysis and interpretation. All authors participated in manuscript writing and read and approved the final manuscript.

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Availability of data and materials

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Figures

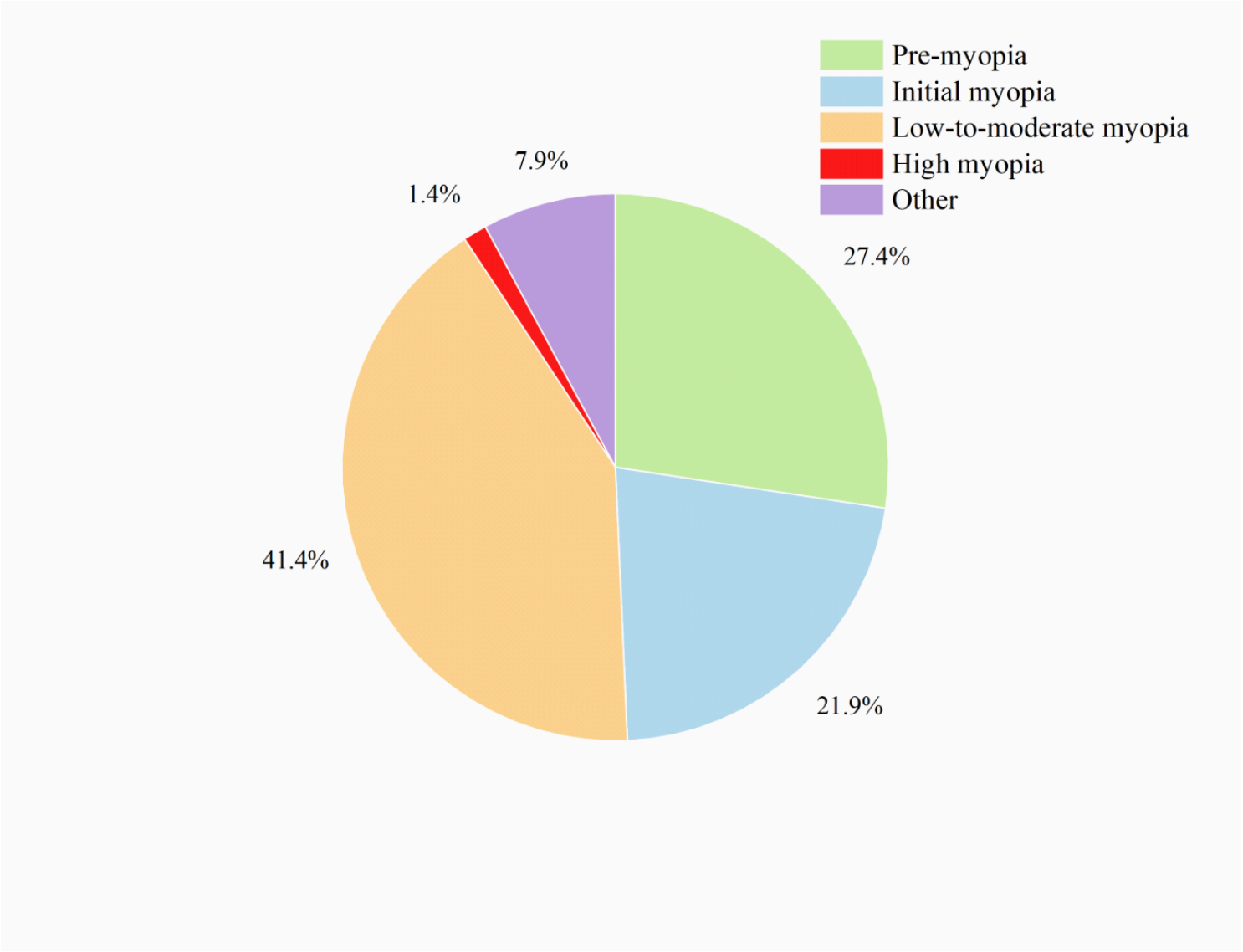


Figure 1

Proportions of the four refractive abnormality groups. The pie chart shows the proportions of pre-myopia, initial myopia, low-to-moderate myopia, and high myopia among the 55,853 participants with refractive abnormalities.

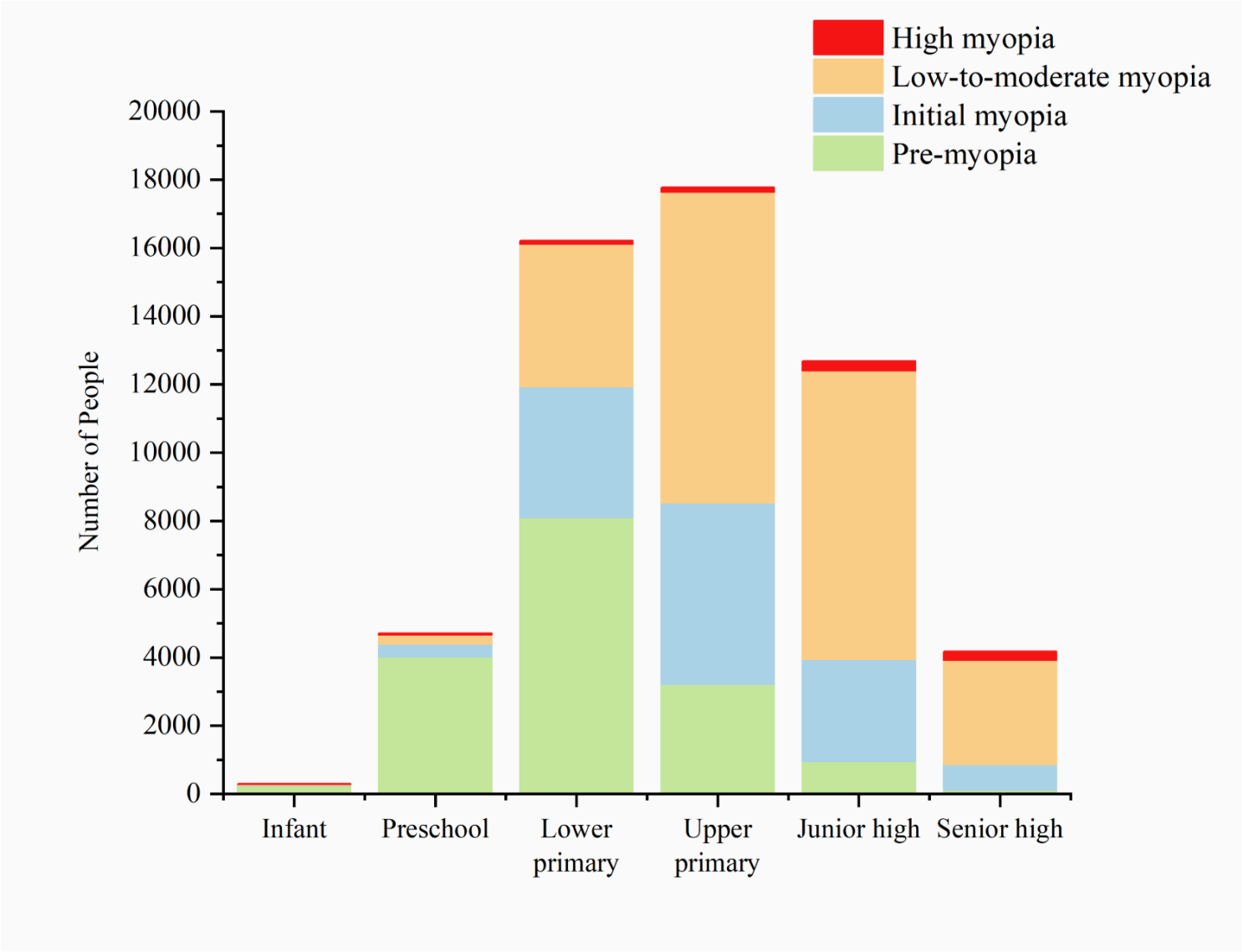


Figure 2

Distribution of participants by age group and refractive status. Stacked bar chart showing the composition of refractive status groups within each age group.

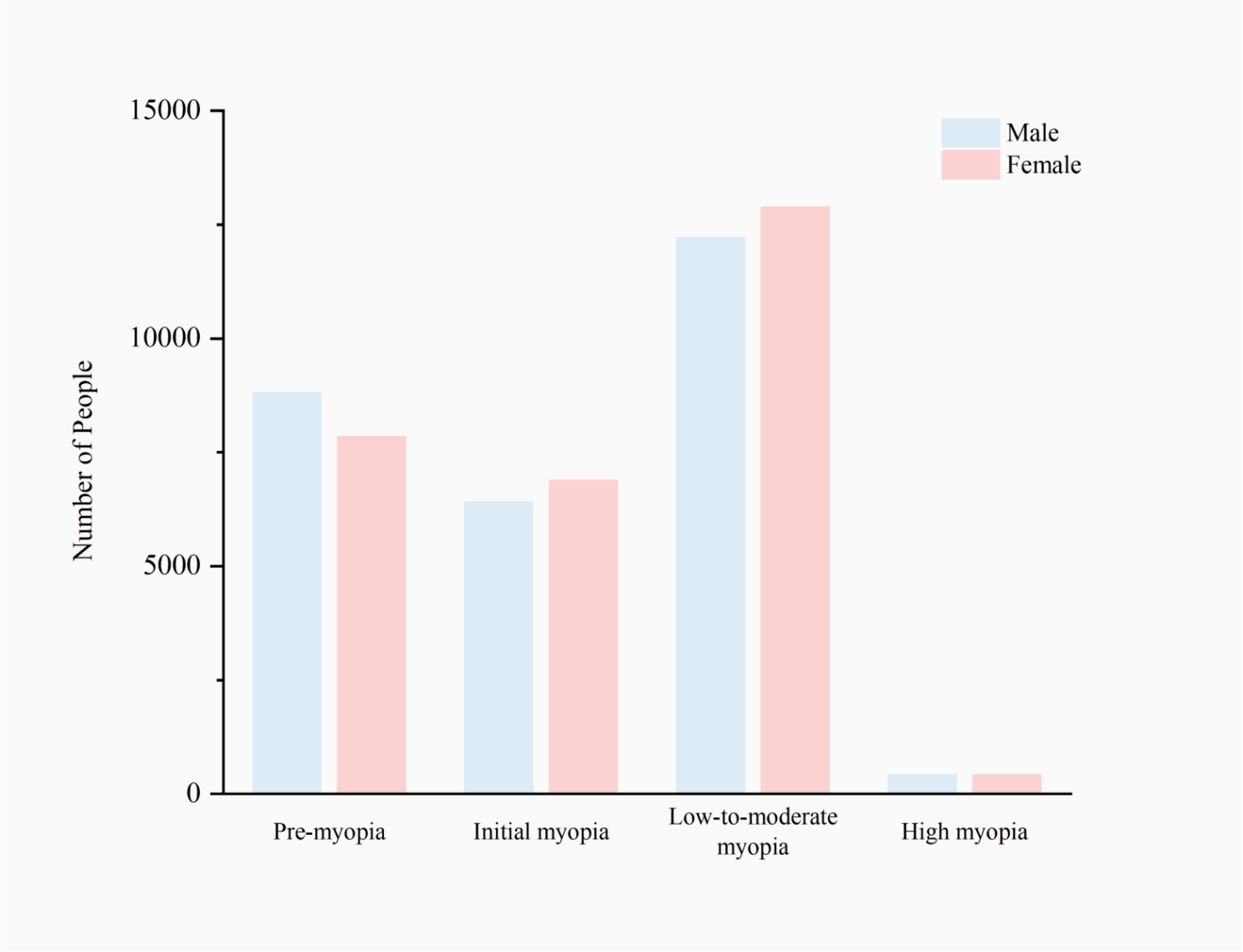


Figure 3

Gender distribution by refractive status group. Bar chart comparing the proportions of males and females in each refractive status group.

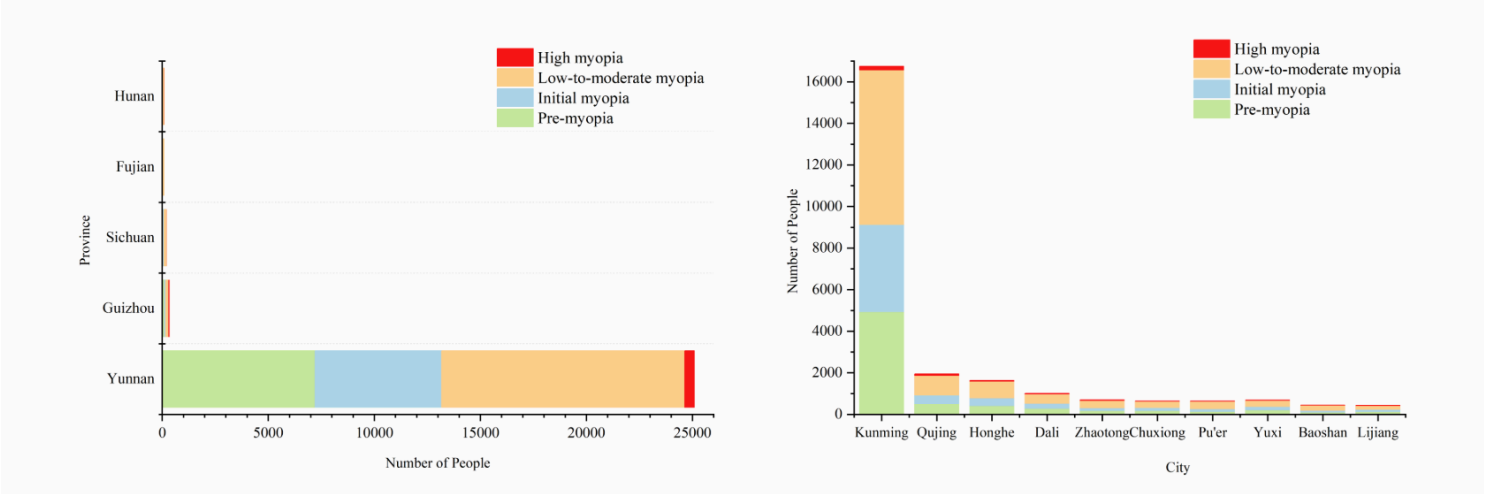


Figure 4

Regional distribution of participants by refractive status. (A) Distribution by province (top 5 provinces outside Yunnan). (B) Distribution by major city in Yunnan Province (top 10 cities).

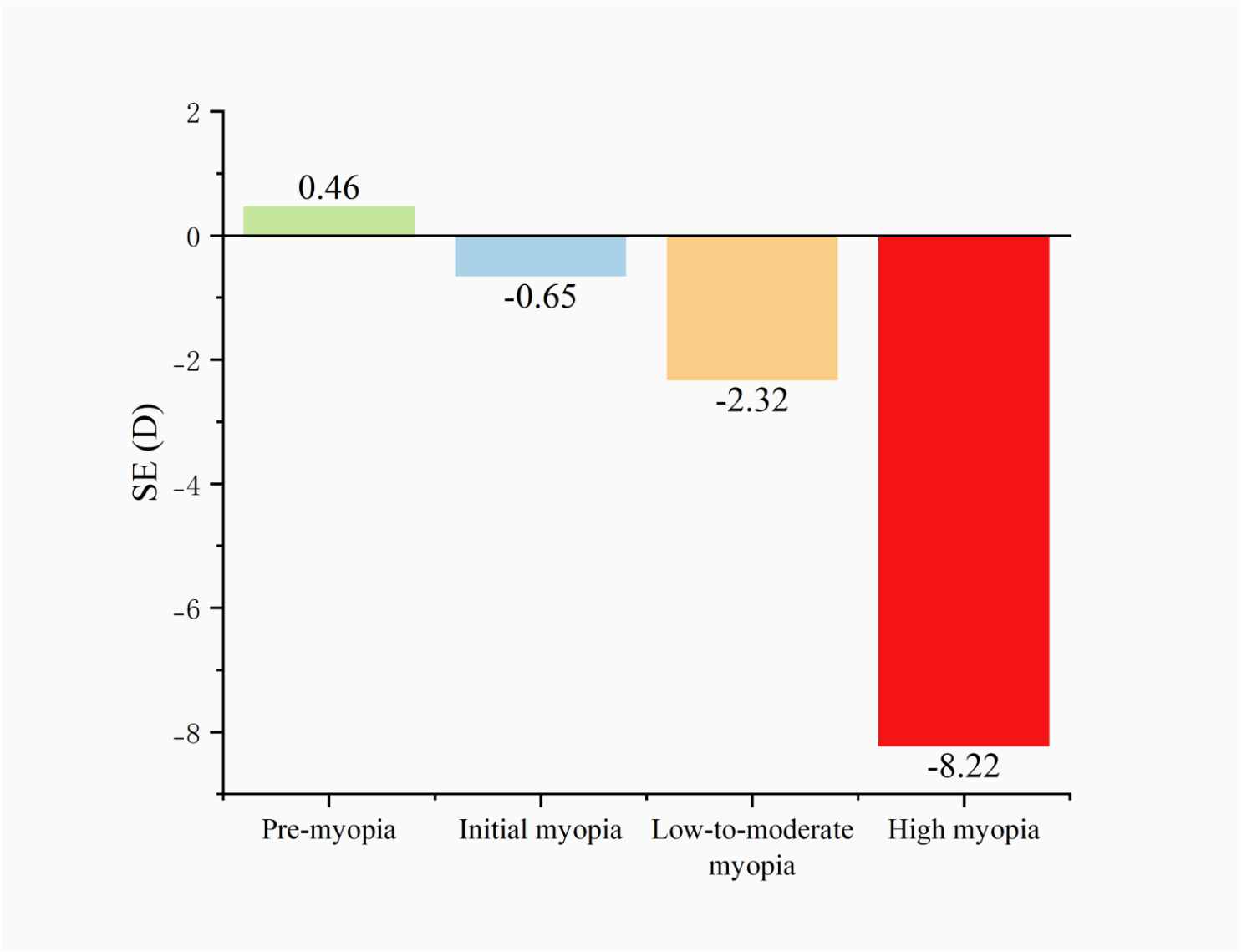


Figure 5

Mean spherical equivalent by refractive status group. Bar chart showing the mean spherical equivalent of each refractive status group. Error bars represent the data range within each group.