

<https://doi.org/10.54500/2790-1203-2023-4-119-42-48>

UDC: 617.7; 613.95/96; 616-036.22

IRSTI: 76.29.56; 76.33.31; 76.33.43

Original article

## The Prevalence of Refractive Errors and Risk Factors for the Formation of Myopia in Schoolchildren in the City of Astana

[Zeynet Akhmedyanova](#)<sup>1</sup>, [Adeliya Assykbayeva](#)<sup>2</sup>, [Elvira Kadraliyeva](#)<sup>3</sup>, [Aigerim Tuletova](#)<sup>4</sup>,  
[Ainagul Mukazhanova](#)<sup>5</sup>, [Kanat Akhmetov](#)<sup>6</sup>

<sup>1</sup> Head of the Department of Eye Diseases, Astana Medical University, Astana, Kazakhstan.

E-mail: [ahmedyanova.z@amu.kz](mailto:ahmedyanova.z@amu.kz)

<sup>2</sup> Ophthalmologist of the branch of the Kazakh Research Institute of Eye Diseases, Astana, Kazakhstan.

E-mail: [adelasykbaeva@gmail.com](mailto:adelasykbaeva@gmail.com)

<sup>3</sup> Associate Professor of the Department of Eye Diseases, Astana Medical University, Astana, Kazakhstan. E-mail:

[kadralievaei@inbox.ru](mailto:kadralievaei@inbox.ru)

<sup>4</sup> Chief freelance pediatric ophthalmologist of the Republic of Kazakhstan, Director of the Branch of the Kazakh Research Institute of Eye Diseases, Astana, Kazakhstan. E-mail: [a.tuletova@eyeinst.kz](mailto:a.tuletova@eyeinst.kz)

<sup>5</sup> Ophthalmologist of the Branch of the Kazakh Research Institute of Eye Diseases, Astana, Kazakhstan.

E-mail: [ainagul.e@gmail.com](mailto:ainagul.e@gmail.com)

<sup>6</sup> Associate Professor of the Department of Surgical Diseases with a course in Cardio-Oracic Surgery and MFS, Astana Medical University, Astana, Kazakhstan. E-mail: [kana\\_82\\_akhmetov@mail.ru](mailto:kana_82_akhmetov@mail.ru)

### Abstract

Both genetic and environmental factors play a role in the increased prevalence of myopia. Multiple cross-sectional and longitudinal studies report an association between education and myopia.

**The purpose of this study** is to study the structure and prevalence of refractive errors, as well as risk factors for the formation of myopia in schoolchildren in Astana.

**Methods.** The cross-sectional study involved 200 students (400 eyes) in urban secondary schools. We studied autorefractometry, subjective refraction using the "fogging" method and proposed a questionnaire in two age groups: 4<sup>th</sup> grade – 9 -10 years old (n=100), 9<sup>th</sup> grade - 15-16 years old (n=100). The questionnaire covered major risk factors such as parental myopia, screen time, outdoor time, working at close range, sports, daily routine, and subjective visual complaints. The association of risk factors with myopia was examined.

**Results.** The overall prevalence of refractive errors was 46.75% (95% confidence interval (CI) 40; 53.5); myopia 36.75% (95% CI 27.5; 46); hyperopia 10% (95% CI 12.5–7.5) and astigmatism 18.75% (95% CI 11.5; 26). In the senior class group (9<sup>th</sup> grade), the percentage of myopia was higher (27.5% and 46%), while outdoor activity more than 2 hours a day (60.1% and 48%) and sports (65% and 48%) were associated with a lower incidence of myopia in the younger group (4<sup>th</sup> grade).

**Conclusions.** The most common refractive error among schoolchildren in Astana is myopia. Measures to prevent the formation and progression of myopia, including increased time spent outdoors and playing sports, should guide public health interventions for this population.

**Keywords:** refraction, myopia, hypermetropia, childhood myopia.

Corresponding author: Adeliya Assykbayeva, first-year master student of Astana Medical University, doctor Ophthalmologist Kazakh Research Institute of Eye Diseases branch Astana, Astana, Kazakhstan.

Postal code: Z05P6B4

Address: Kazakhstan, Astana, Kabanbay Batyr Ave. 49.

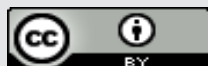
Phone: +77753575771

E-mail: [adelasykbaeva@gmail.com](mailto:adelasykbaeva@gmail.com)

2023; 4(119): 42-48

Received: 27-10-2023

Accepted: 08-12-2023



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## Introduction

The prevalence of myopia has increased rapidly in recent decades; however, this varies by geographic location and origin. Currently, 30% or more of the population in Europe and the US suffer from myopia. In Singapore, South Korea, and other developed countries in East and Southeast Asia, levels are higher, especially among young people [1-4].

A 2004 cross-sectional study in Almaty, Kazakhstan found a 21% prevalence of refractive errors in schoolchildren, while myopia was confirmed in 14%, hyperopia in 3%, astigmatism in 1%, and accommodation disturbances in 3% of the study population [5]. Due to its high prevalence, myopia has become important in epidemiological studies.

## Materials and methods

We conducted a school-based, cross-sectional, cross-sectional study in Astana conducted from January to March 2023.

This cross-sectional school-based study was conducted according to the Refractive Error Study in Children (RESC) protocol. This protocol was developed to standardize the methodology used to obtain data on the prevalence of refractive errors in children [10].

The research was conducted between January and March 2023. Two age groups were studied, including the 4th and 9th grades of two schools, which were randomly selected from 84 schools in Astana. The exclusion category included children who had a history of any eye surgeries (including intraocular, refractive, traumatic and strabismus), any inflammatory or infectious eye diseases, keratoconus, heterotropia, and congenital cataracts. Schoolchildren receiving orthokeratology therapy were excluded because their uncorrected visual acuity and refractive data could not be obtained.

**Questionnaire.** We also asked the children's parents to complete an online form that included

## Results

In the current cross-sectional study of the 200 subjects analyzed, 49.5% (n = 99) were boys and 50.5% (n = 101) were girls. The average age of the participants

Complications of refractive error are the leading cause of moderate to severe visual impairment worldwide and the second most common cause of preventable blindness [1-3]. Children with early onset myopia are at particular risk of complications as progression over time can lead to severe myopia and myopic macular degeneration [4].

Considering the heterogeneity and small amount of data on the prevalence of refractive errors in children in Kazakhstan [5-9], **the purpose of this work** is to study risk factors for the formation of myopia and the prevalence of refractive errors in schoolchildren in the city of Astana.

demographic information, parental history of myopia, and participant behavioral factors. Demographic information included age, gender, and school grades. Behavioral factors included the average duration of daily use of gadgets (computer, mobile phone, tablet, games, etc.), walking in the fresh air, estimated in hours per day. We were also interested in students' sports activity, subjective vision complaints, and adherence to daily and sleep patterns.

**Examination protocol.** The medical examination was carried out by an ophthalmologist as part of a planned medical commission. All children underwent the following standard procedures: determination of distance visual acuity, autorefractometry, subjective determination of refraction by the "fogging" method, ophthalmoscopy. We used an RC-5000 (Tomey, Tokyo, Japan) for autorefraction in an average of three dimensions. The Sivtsev-Golovin table was used for visual acuity, a Heine mini 3000 portable ophthalmoscope was used for ophthalmoscopy.

was 12.4±3.02 (range 9 to 16) years. There were no significant differences in gender between groups. The distribution by class is shown in Table 1.

Table 1 - Prevalence of refractive errors among schoolchildren in Astana

Age	n (%)	Emmetropia, %	Ametropia, %	p
4 <sup>th</sup> grade	100 (50%)	46.5%	53.5%	<0.01
9 <sup>th</sup> grade	200 (100)	53.25%	46.75%	
Total	100 (50%)	60%	40%	

Table 1 shows the prevalence of refractive errors among all children examined. The prevalence of refractive error among all children was 46.75% (95% CI 40; 53.5)

and increased with age and grade from 40% (95% CI) in 4th grade to 53.5% (95% CI) in 9<sup>th</sup> grade.

Table 2 - Structure of identified refractive errors in children depending on age

Age group (Grade)	Myopia, %	p	Hypermetropia, %	p	Astigmatism, %	p
4 <sup>th</sup> grade	27.5	0.01	12.5	0.03	11.5	0.03
9 <sup>th</sup> grade	46		7.5		26	
Total	36.75		10		18.75	

The overall prevalence of myopia was 36.75% (95% CI 27.5; 46). Among all participants with myopia, 67.3% had low myopia, 27.3% had moderate myopia, and 5.4% had high myopia. The prevalence of farsightedness was 10%. Low degree hyperopia was found in 95%,

and moderate hyperopia in 5% of all participants with farsightedness, as can be seen from Table 2 and Table 3.

Table 3 - Structure of identified refractive errors according to the official classification

Classification by degree	Myopia, % total (4 <sup>th</sup> and 9 <sup>th</sup> grades)	Hypermetropia, % total (4 <sup>th</sup> and 9 <sup>th</sup> grades)	Astigmatism, % total (4 <sup>th</sup> and 9 <sup>th</sup> grades)
Weak	67.3 (27.9 / 39.4)	95 (60 / 35)	82.6 (24 / 58.6)
Average	27.3 (8.3 / 19)	5 (2.5 / 2.5)	17.4 (6.7 / 10.7)
High	5.4 (1.4 / 4)	-	-

The detected astigmatism was predominantly of the complex myopic type (34.7%, 69%), and simple hyperopia was represented in the least degrees (4.4%, 4%), Table 4.

The probability of developing myopia was higher in children in 9<sup>th</sup> grade compared to 4<sup>th</sup> grade (27.5%,

46%). We also observed a sharp increase in moderate myopia in the 9<sup>th</sup> grade group (8.3%, 19%) compared to 4<sup>th</sup> grade children. As well as an increase in indicators of mild astigmatism (24%, 58.6%). The risk of developing high myopia increased significantly among 9<sup>th</sup> grade students (1.4%, 4%).

Table 4 - Identified astigmatism according to the official classification

Type of asigmatism	4 <sup>th</sup> grade (%)	9 <sup>th</sup> grade (%)
Simple Hyperopic Astigmatism	4.4 %	4%
Complex Hyperopic Astigmatism	13 %	6 %
Simple Myopic Astigmatism	30.6 %	8 %
Complex Myopic Astigmatism	34.7 %	69 %
Mixed Astigmatism	17.3 %	13 %
Total 75 eyes (out of 400)	23 eyes	52 eyes

Farsightedness among 9<sup>th</sup> grade students (2.6%) was almost 2 times less common compared to 4<sup>th</sup> grade students (60%, 35%).

The response rate to questionnaires filled out by parents about behavioral risk factors and the role of

parental myopia was 56.3% (113 people). As can be seen from Tables 5 and 6, a clear correlation between parental and child myopia is not found, perhaps this is due to the population's insufficient knowledge of medical terminology, and as a result, an incorrect answer.

Table 5 - Risk factors, results of a survey of parents of 4<sup>th</sup> grade children

Risk factors, 4 <sup>th</sup> grade	Risk factors, 4 <sup>th</sup> grade		
	No	one parent has	both parents have
Myopia in parents	40.8%	49.5%	9.7%
Amount of time spent walking (hours/day)	no walking	1-2 hours	more than 2 hours
	28.2%	60.1%	11.7%
Gadget viewing time (hours/day)	1 hour	2-3 hours	more than 3 hours
	13.6%	34%	52.4%
Sports activities		yes	no
		65%	35%
Amount of time at school (hours/day)	4 hours	5-6 hours	more than 6 hours
	13.6%	80.6%	5.8%
Working time "close" (reading, writing, needlework, etc.) h/day	1 hour	2-3 hours	more than 3 hours
	46.6%	51.5%	1.9%
Sleep time (hours/day)	8 hours	7-8 hours	less than 7 hours
	65%	34%	1%
Subjective visual impairment	yes	no	Don't know
	37.9%	35%	27.1%

The amount of time spent per day on various activities in the older age group prevails, which confirms the connection of this factor with the formation of myopia. Myopic children spent significantly more time looking at screens than nonmyopic children (52.4%, 82%). Close work, including needlework, for more than 3 hours a day increased the probability of myopia (1.9%, 62%).

The prevalence of myopia among schoolchildren who spent about 2 hours a day in the fresh air is lower (60.1%, 48%), while among students who ignore walks the rates of myopia are higher (28.2%, 32%). Playing sports also had a positive effect on children's vision

(65%, 48%). In the older age group, there is a tendency to decrease sleep hours per day (65%, 25%). This may be explained by the influence of parental control in the younger age group. In multivariate adjusted regression analysis, higher grade was a significant positive predictor of myopia. Being outdoors for more than 2 hours per day and doing sports were protective against myopia in these multivariate adjusted analyses.

Table 6 - Risk factors, results of a survey of parents of 9<sup>th</sup> grade children

Risk factors, 9 <sup>th</sup> grade			
Myopia in parents	No	one parent has	both parents have
	52%	38.5%	9.5%
Amount of time spent walking (hours/day)	no walking	1–2 hours	more than 2 hours
	32%	48%	20%
Gadget viewing time (hours/day)	1 hour	2-3 hours	more than 3 hours
	7%	11%	82%
Sports activities		yes	no
		48%	52%
Amount of time at school (hours/day)	4 hours	5-6 hours	more than 6 hours
	2%	44%	54%
Working time "close" (reading, writing, needlework, etc.) h/day	1 hour	2–3 hours	more than 3 hours
	2%	36%	62%
Sleep time (hours/day)	8 hours	7–8 hours	less than 7 hours
	25%	45%	30%
Subjective visual impairment	yes	no	Don't know

## Discussion

This study was conducted to study the prevalence of refractive errors among schoolchildren in Astana. Based on the results of the work, we expectedly confirmed an increase in the prevalence of refractive errors in schoolchildren, which amounted to 36.75% (95% CI 27.5; 46), which indicates an upward trend compared to the previous study in 2022 with a prevalence of 28% in the same age group [10,28].

We believe that this is due to the constant increase in academic workload, which leads to an increase in time spent reading and studying, with a simultaneous decrease in time spent outdoors [11-16]. Differences in examination methods or inconsistencies in the definition and cutoff values for myopia [17-19] may also explain conflicting results from studies elsewhere. As expected, our results showed an increase in the prevalence and severity of myopia in the senior grades: from 27.5% of myopic students in 4<sup>th</sup> grade to 46% in 9<sup>th</sup> grade.

Our results are consistent with similar studies in children, confirming an increase in the prevalence of

## Conclusions

Our study showed that about a third of Astana schoolchildren have refractive errors, with myopia being the most common. Compared with previous local studies in this age group, the prevalence of myopia among children has increased over the past 10 years. The prevalence of myopia at older school age was revealed. We also found that time spent outdoors, and close visual stimulation may be associated with a decreased probability of developing myopia; however, the effects we identified require further study in the population of Kazakhstan.

## References

1. Hashemi H., Fotouhi A., Khabazkhoob M., Pakzad R. et al. Global and regional estimates of prevalence of refractive errors: Systematic review and meta-analysis. *Journal of current ophthalmology*. 2017; 30(1): 3-22. [[Crossref](#)]
2. Flaxman S., Bourne R., Zheng Y., Ackland P. et al. Global causes of blindness and distance vision impairment 1990-2020: a systematic review and meta-analysis. *The Lancet. Global health*. 2017; 5(12): e1221-e1234. [[Crossref](#)]
3. Lou L., Yao C., Ye J., Perez V. et al. Global Patterns in Health Burden of Uncorrected Refractive Error. *Investigative ophthalmology & visual science*. 2016; 57(14): 6271-6277. [[Crossref](#)]
4. Fricke T., Jong M., Resnikoff S., Sankaridurg P. et al. Global prevalence of visual impairment associated with myopic macular degeneration and temporal trends from 2000 through 2050: systematic review, meta-analysis and modelling. *The British journal of ophthalmology*. 2018; 102(7): 855-862. [[Crossref](#)]

myopic refraction and a decrease in the incidence of hyperopia with age, especially in the second decade of life [20-25].

In our study, we tried to study all the putative risk factors for the development of myopia in schoolchildren. We identified an association between an increase in the prevalence of myopia and age (grade). As well as a decrease in myopic refraction in children attending sports clubs. A shift in refraction towards hypermetropia was observed in children spending more than 2 hours a day in the fresh air.

These results highlight the importance of environmental factors for myopia and support the need for a balance between workload and physical activity. Spending more time outdoors has been shown to reduce the probability of myopia, and these are simple measures that can be implemented in public schools and at home [26-28].

**Author contributions.** Conceptualization – Z.A.; Methodology – Z.A., A.A.; Verification, Formal Analysis – E.K., A.T., K.A., A.M.; Writing (Original Draft Preparation) – A.A.; Writing (Review and Editing) – A.A.; Z.A.

**Conflict of interest.** No conflict of interest has been declared. This material has not been previously submitted for publication in other publications and is not under consideration by other publishers.

**Financing.** During this work, there was no funding from outside organizations and medical representatives.

5. Искакбаева Д. Изучение частоты близорукости у школьников города Алматы и разработка методов ее лечения: автореф... дисс. канд. мед. наук. – Алматы.: 2004. – С. 29. Электронный ресурс. Режим доступа: <https://www.dissercat.com/content/razrabotka-metodov-prognoza-i-lecheniya-progressiruyushchei-miopii-u-detei>

Iskakbaeva D. Izuchenie chastoty blizorukosti u shkol'nikov goroda Алматы i razrabotka metodov ee lecheniya (Study of the frequency of myopia among schoolchildren in Алматы and the development of methods for its treatment) [in Russian]. avtoref... diss. kand. med. nauk., Алматы, 2004; 29 p. Jelektronnyj resurs. Rezhim dostupa: <https://www.dissercat.com/content/razrabotka-metodov-prognoza-i-lecheniya-progressiruyushchei-miopii-u-detei>

5. Аубакирова А.Ж., Токсанбаева Г.К., Аужанова Р.М. Эффективность профилактики и лечения близорукости у детей в условиях школы // Казахстанский офтальмологический журнал. – 2009. -№1. – С. 12–14. [[Google Scholar](#)]

Aubakirova A.Zh., Toksanbaeva G.K., Auzhanova R.M. Jefferktivnost' profilaktiki i lechenija blizorukosti u detej v uslovijah shkoly (Efficiency of prevention and treatment of myopia in children in school settings) [in Russian]. Kazahstanskij oftal'mologicheskij zhurnal. 2009; 1: 12–14. [[Google Scholar](#)]

6. Ботабекова Т.К., Алдашева Н.А., Абдуллина В.Р., Степанова И.С. и др. Разработка комплексной программы профилактики и лечения аномалий рефракции у детей школьного возраста // РМЖ. Клиническая офтальмология. – 2021. – Т. 21. – №3. – С. 135-142. [[Google Scholar](#)]

Botabekova T.K., Aldasheva N.A., Abdullina V.R., Stepanova I.S. i dr. Razrabotka kompleksnoj programmy profilaktiki i lechenija anomalij refrakcii u detej shkol'nogo vozrasta (Development of a comprehensive program for the prevention and treatment of refractive errors in school-age children) [in Russian]. RMZh. Klinicheskaja oftal'mologija, 2021; 21(3): 135-142. [[Google Scholar](#)]

6. Аубакирова А.Ж., Кенжебаева К.С., Искакбаева Ж.С., Ботабекова Т.К. Клинико-статистическая характеристика миопии у школьников г. Алматы и особенности ее лечения // Офтальмологический журнал. - 2001. - №4. - С. 8-10.

Aubakirova A.Zh., Kenzhebaeva K.S., Iskakbaeva Zh.S., Botabekova T.K. Kliniko-statisticheskaja harakteristika miopii u shkol'nikov g. Алматы i osobennosti ee lechenija (Clinical and statistical characteristics of myopia in schoolchildren. and features of its treatment in Алматы) [in Russian]. Oftal'mologicheskij zhurnal. 2001; 4: 8-10.

7. Кенжебаева К.С. Клинико-патогенетические аспекты близорукости у детей и методы ее коррекции: автореф... дисс. док мед. наук. – Алматы.: 2008. – С. 36.

Kenzhebaeva K.S. Kliniko-patogeneticheskie aspekty blizorukosti u detej i metody ee korrekcii (Clinical and pathogenetic aspects of myopia in children and methods of its correction) [in Russian]: avtoref... diss. dok. med. nauk., Алматы, 2008: 36 p.

8. Mukazhanova A., Aldasheva N., Vinnikov D., Bakhytbek R. et al. Prevalence of refractive errors and risk factors for myopia among schoolchildren of Алматы, Kazakhstan: A cross-sectional study. PLOS ONE. 2022; 17(6): e0269474. [[Crossref](#)]

9. Wang S., Guo Y., He M., Chen Y. et al. Incidence of and Factors Associated with Myopia and High Myopia in Chinese Children, Based on Refraction Without Cycloplegia. JAMA Ophthalmology. 2018; 136(9): 1017-1024. [[Crossref](#)]

10. Yam J., Tang S., Pang C., Chen L.J. et al. High prevalence of myopia in children and their parents in Hong Kong Chinese Population: The Hong Kong Children Eye Study Acta Ophthalmologica. 2020; 98(5): e639-e648. [[Crossref](#)]

11. Plotnikov D., Williams C., Guggenheim J., Davies N.M. et al. Effect of Education on Myopia: Evidence from the United Kingdom ROSLA 1972 Reform Investigative. Ophthalmology & Visual Science. 2020; 61(11): 7. [[Crossref](#)]

12. Harrington S., Stack J., O'dwyer V. Risk factors associated with myopia in schoolchildren in Ireland. The British journal of ophthalmology. 2019; 103(12): 1803-1809. [[Crossref](#)]

13. Morgan I., French A., Rose K., Guo X. et al. The epidemics of myopia: Aetiology and prevention. Progress in retinal and eye research. 2018; 62: 134-149. [[Crossref](#)]

14. Tsai T., Liu Y., Ma I.H., Su C.C. et al. Evolution of the Prevalence of Myopia among Taiwanese Schoolchildren: A Review of Survey Data from 1983 through 2017. Ophthalmology. 2021; 128(2): 290-301. [[Crossref](#)]

15. Kang M., Jan C., Li S., Yusufu M. et al. Prevalence and risk factors of pseudomyopia in a Chinese children population: the Anyang Childhood Eye Study. The British journal of ophthalmology. 2021; 105(9): 1216-1221. [[Crossref](#)]

16. Adyanthaya B., SIndian A. A comparison between retinoscopy and autorefraction in acceptance of subjective correction in school age children. Journal of Clinical and Experimental Ophthalmology. 2020; 6(3): 418-421. [[Crossref](#)]

17. Saxena R., Vashist P., Tandon R., Pandey R.M., Bhardawaj A., et al. Incidence and progression of myopia and associated factors in urban school children in Delhi: The North India Myopia Study (NIM Study). PloS one, 2017; 12(12): e0189774. [[Crossref](#)]

18. Проскурина О.В., Маркова Е.Ю., Бржеский В.В., Ефимова Е.Л. и др. Распространенность миопии у школьников некоторых регионов России // Офтальмология. – 2018. – Т. 15. - №3. 348–353. [[Crossref](#)]

Proskurina O.V., Markova E.Ju., Brzheskij V.V., Efimova E.L. i dr. Rasprostranennost' miopii u shkol'nikov nekotoryh regionov Rossii (Prevalence of myopia among schoolchildren in some regions of Russia) [in Russian]. Oftal'mologija. 2018; 15(3): 348–353. [[Crossref](#)]

19. Tideman J., Polling J., Hofman A., Jaddoe V. et al. Environmental factors explain socioeconomic prevalence differences in myopia in 6-year-old children. British Journal of Ophthalmology. 2018; 102(2): 243-247. [[Crossref](#)]

20. Bhandary S., Dhakal R., Sanghavi V., Verkicharlai P. Verkicharla Ambient light level varies with different locations and environmental conditions: Potential to impact myopia. PloS one. 2021; 16(7): e0254027. [[Crossref](#)]

21. Jones-Jordan L.A., Sinnott L.T., Chu R.H., Cotter S.A. et al. Myopia Progression as a Function of Sex, Age, and Ethnicity. Investigative Ophthalmology & Visual Science. 2021; 62(10): 36. [[Crossref](#)]

22. Flitcroft D., He M., Jonas J.B., Jong M. et al. MI - Defining and Classifying Myopia: A Proposed Set of Standards for Clinical and Epidemiologic Studies. Investigative ophthalmology & visual science. 2019; 60(3): M20-M30. [[Crossref](#)]

23. Chen M., Wu A., Zhang L., Wang K. The increasing prevalence of myopia and high myopia among high school students in Fenghua city, eastern China: a 15-year population-based survey. BMC ophthalmology. 2018; 18(1): 158. [[Crossref](#)]

24. Jiang Y., Tian B. Understanding Modifiable Risk Factors for the Development of Myopia. Ophthalmology. 2019; 126(2): 221-222. [[Crossref](#)]

25. Ku P, Steptoe A., Lai Y.J., Hu H.Y. et al. The Associations between Near Visual Activity and Incident Myopia in Children: A Nation-wide 4-Year Follow-up Study. *Ophthalmology*. 2019; 126(2): 214-220. [Crossref]
26. Lei Y, Chen X, Cheng M., Li B., et al. Comparisons of objective and subjective refraction with and without cycloplegia using binocular wavefront optometer with autorefraction and retinoscopy in school-age children. *Graefes Archive for Clinical and Experimental Ophthalmology*, 2023; 261(5): 1465-1472. [Crossref]
27. Tomaz S., Hinkley T., Jones R.A., Watson E.D. et al. Screen Time and Sleep of Rural and Urban South African Preschool Children *International journal of environmental research and public health*. 2020; 17(15): 1-12. [Crossref]
28. Auffret É., Gomart G., Bourcier T., Gaucher D. et al. Digital eye strain. Symptoms, prevalence, pathophysiology, and management. *Journal francais d'ophtalmologie*. 2021; 44(10): 1605-1610. [Crossref]

### Астана қаласының мектеп оқушыларында сыну ақауларының таралуы және миопияның пайда болуының қауіп-қатер факторлары

[Ахмедьянова З.У.](#)<sup>1</sup>, [Асықбаева А.Б.](#)<sup>2</sup>, [Кадралиева Е.И.](#)<sup>3</sup>, [Түлетова А.С.](#)<sup>4</sup>,  
[Мұқажанова А.С.](#)<sup>5</sup>, [Ахметов К.К.](#)<sup>6</sup>

<sup>1</sup> Көз аурулары кафедрасының меңгерушісі, Астана медицина университеті, Астана, Қазақстан.

E-mail: ahmedyanova.z@amu.kz

<sup>2</sup> Қазақ көз аурулары ғылыми-зерттеу институты филиалының офтальмологы, Астана, Қазақстан.

E-mail: adelasykbaeva@gmail.com

<sup>3</sup> Көз аурулары кафедрасының доценті, Астана медицина университеті, Астана, Қазақстан.

E-mail: kadralievaei@inbox.ru

<sup>4</sup> Қазақстан Республикасының бас штаттан тыс балалар офтальмологы, Қазақ көз аурулары ғылыми-зерттеу институты филиалының директоры, Астана, Қазақстан. E-mail: a.tuletova@eyeinst.kz

<sup>5</sup> Қазақ көз аурулары ғылыми-зерттеу институты филиалының офтальмологы, Астана, Қазақстан.

E-mail: ainagul.e@gmail.com

<sup>6</sup> Кардиоторакальды хирургия және жақ-бет хирургиясы курсы бар хирургиялық аурулар кафедрасының доценті, Астана медицина университеті, Астана, Қазақстан. E-mail: kana\_82\_akhmetov@mail.ru

#### Түйіндіме

Миопияның таралуының жоғарылауында генетикалық және қоршаған орта факторлары рөл атқарады. Қазақстан Республикасының, оның ішінде Астана қаласында балалар популяциясында сыну ақауларының таралуы туралы ақпараттың тапшы және біркелкі емес.

**Зерттеудің мақсаты:** сыну ақауларының құрылымы мен таралуын, сондай-ақ Астана қаласындағы мектеп оқушыларында миопияның пайда болуының қауіп-қатер факторларын зерттеу.

**Әдістері.** Көлденең зерттеуге Астана қалалық орта мектептердің 200 оқушысы (400 көз) қатысты. Біз «тұмандау» әдісі арқылы авторефракцияны, субъективті рефракцияны зерттеп, екі жас тобына сауалнама ұсындық: 4 сынып – 9-10 жас (n=100), 9 сынып – 15-16 жас (n=100). Сауалнама ата-аналық миопия, экран уақыты, ашық уақыт, жақын қашықтықта жұмыс істеу, спорт, күнделікті тәртіп және субъективті визуалды шағымдар сияқты негізгі қауіп-қатер факторларын қамтыды. Қауіп-қатер факторларының миопиямен байланысы зерттелді.

**Нәтижелері.** Сыну қателерінің жалпы таралуы 46,75% (95% сенімділік аралығы (СА) 40; 53,5); миопия 36,75% (95% СА 27,5; 46); гиперметропия 10% (95% СА 12,5–7,5) және астигматизм 18,75% (95% СА 11,5; 26). Жоғары сынып (9 сынып) тобында (46%) миопияның пайызы кіші (4 сынып) тобына (27,5%) қарағанда жоғары, ал ашық ауада жұмыс істеу күніне 2 сағаттан астам (60,1% және 48%) және спорттық іс-әрекеттер (65% және 48%) кіші топтағы (4 сынып) миопияның төмен жиілігімен байланысты болды.

**Қорытынды.** Миопия Астана қаласындағы мектеп оқушыларының арасында жиі кездеседі. Миопияның пайда болуы мен өршуіне жол бермеу шаралары, оның ішінде ашық ауада және спортпен шұғылдану уақытын ұлғайту осы тұрғындардың денсаулығын сақтау шараларын басшылыққа алуы керек.

**Түйін сөздер:** рефракция, миопия, гиперметропия, балалық миопия.

### Распространенность аномалий рефракции и факторы риска формирования миопии у школьников города Астана

[Ахмедьянова З.У.](#)<sup>1</sup>, [Асықбаева А.Б.](#)<sup>2</sup>, [Кадралиева Е.И.](#)<sup>3</sup>, [Түлетова А.С.](#)<sup>4</sup>,  
[Мұқажанова А.С.](#)<sup>5</sup>, [Ахметов К.К.](#)<sup>6</sup>

<sup>1</sup> Заведующая кафедрой глазных болезней, Медицинский университет Астана, Астана, Казахстан.

E-mail: ahmedyanova.z@amu.kz

<sup>2</sup> Врач офтальмолог филиала Казахского научно-исследовательского института глазных болезней, Астана, Казахстан. E-mail: adelasykbaeva@gmail.com

<sup>3</sup> Доцент кафедры глазных болезней, Медицинский университет Астана, Астана, Казахстан.

E-mail: kadralievaei@inbox.ru

<sup>4</sup> Главный внештатный детский офтальмолог Республики Казахстан, Директор филиала Казахского научно-исследовательского института глазных болезней, Астана, Казахстан. E-mail: a.tuletova@eyeinst.kz

<sup>5</sup> Врач офтальмолог филиала Казахского научно-исследовательского института глазных болезней, Астана, Казахстан. E-mail: ainagul.e@gmail.com

<sup>6</sup> Доцент кафедры хирургических болезней с курсом кардиоторакальной хирургии и челюстно-лицевой хирургии, Медицинский университет Астана, Астана, Казахстан. E-mail: kana\_82\_akhmetov@mail.ru

## Резюме

Генетические и экологические факторы играют роль в увеличении распространенности миопии. Данные о распространенности аномалий рефракции у детского населения Республики Казахстан, в том числе города Астана весьма ограничены.

**Цель исследования:** изучить структуру и распространенность аномалий рефракции, а также факторов риска формирования миопии у школьников города Астаны.

**Методы.** В поперечном исследовании участвовали 200 учащихся (400 глаз) средних городских школ. Мы исследовали авторефракцию, субъективную рефракцию методом "затуманивания" и предложили опросник в двух возрастных группах: 4 класс – 9-10 лет (n=100), 9 класс- 15-16 лет (n=100). Анкета охватывала основные факторы риска, такие как близорукость у родителей, время, проводимое за экраном, время на открытом воздухе, работа на близком расстоянии, занятия спортом, режим дня, субъективные жалобы на зрение. Была рассмотрена связь факторов риска с близорукостью.

**Результаты.** Общая распространенность аномалий рефракции составила 46,75% (95% ДИ 40; 53,5); миопия 36,75% (95% ДИ 27,5; 46); дальновзоркость 10% (95% ДИ 12,5–7,5) и астигматизм 18,75% (95% ДИ 11,5; 26). В группе старшего класса (9 класс) процент близорукости был выше (46%) чем в группе младшего (4) класса (27,5%), в то время как активность на открытом воздухе более 2 часов в день (60,1% и 48%) и занятия спортом (65% и 48%) ассоциировались с более низкой частотой миопии в младшей группе (4 класс).

**Выводы.** Наиболее распространенной аномалией рефракции у школьников города Астана является миопия. Меры по профилактике формирования и прогрессировании близорукости, в том числе увеличение времени пребывания на открытом воздухе, занятия спортом должны определять меры общественного здравоохранения для этой группы населения.

**Ключевые слова:** рефракция, миопия, гиперметропия, детская близорукость.