

Prevalence of Vision Problems Among School-Entering Children and Association with Socio-Demographic Characteristics: An Iranian Population-Based Cross-Sectional Study

Mehran Alijanzadeh^a, Mark D. Griffiths^b, Mojgan Abbasi^c, Elham Kakavand^c, Ameneh Khaleghi^c, Syedeh Maryam Mirfakhar^c, Fahimeh Karimi^c, Baharh Amini^c, Azar Zolfali^c, Roghayeh Vaydar^c, Hanieh Moradi^c, Ozra Allahverdilo^c, Elahe Jafari^a, and Zainab Alimoradi^{b*}

^aSocial Determinants of Health Research Center, Research Institute for Prevention of Non-Communicable Diseases, Qazvin University of Medical Sciences, Qazvin, Iran; ^bInternational Gaming Research Unit, Psychology Department, Nottingham Trent University, Nottingham, UK; ^cDeputy of Health, Qazvin University of Medical Science, Qazvin, Iran

ABSTRACT

Purpose: Early detection of visual disorders in children and related factors is important to minimize future problems in academic performance and social life. The present study aimed to determine the prevalence of vision problems among school-entering children, and their association with socio-demographic characteristics.

Methods: A population-based cross-sectional study was conducted in Qazvin province between June and November 2023. The research participants were school-entering children and their parents recruited using random quota multi-stage sampling. Data were collected by interviewing parents including demographic characteristics, children's vision status, family history of vision problems, and daily hours of using the internet and/or playing videogames by children. Data were analyzed using multivariate multi-nominal logistic regression.

Results: A total of 5141 parents of school-entering children participated. The prevalence of wearing glasses and suspected visual impairment was 2.2% and 6.7%, respectively. The odds of using eyeglasses among boys was 38% lower than among girls ($p = 0.014$). The odds of using eyeglasses was 3.5 times higher if there was a history of vision disorders in other children in the family ($p < 0.001$) and 90% more likely if there was a history of vision disorders among the parents ($p = 0.002$). The odds of using eyeglasses increased 5% with each unit increase in children's BMI. The odds of suspected vision problems increased by 39% and 3% with each year of age of the child and their mother ($p = 0.001$ and $p = 0.034$ respectively). The odds of suspected visual problems was 90% higher among urban vs. rural children ($p < 0.001$) and 58% higher if there was a history of vision disorders among other children in the family ($p = 0.029$).

Conclusion: The present study identified socio-demographic predictors of having vision disorder among school-entering children based on information provided by their parents. Although vision health screening is carried out as part of the health assessment program for children upon entering school in Iran, high-risk individuals should not to postpone their children's vision examinations until they enter school and should have eye examinations at a younger age.

ARTICLE HISTORY

Received 7 November 2024
Revised 28 February 2025
Accepted 19 March 2025

KEYWORDS

Demographic factors; Iran;
school entering children;
visual impairment

Introduction

Good vision among individuals (including children) is essential for performing daily activities and interacting with the environment (1). Children's vision problems are divided into two groups: (i) eye disorders in which the eye does not focus the incoming light and results in blurred vision, such as myopia, lazy eye, strabismus, and (ii) problems in the structure of the eye such as cataract, glaucoma or retinoblastoma which are no refractive error (2). Childhood vision impairments, affecting 32.5 million children aged under 10 years worldwide, significantly contribute to the global burden of disease (3).

The root of many behavioral-cognitive disorders among children is caused by their vision problems (4, 5). Therefore, parents or legal guardians should screen their child's vision health. As children's vision continues to develop, their vision may change and they may experience problems, especially when they start school (5-7). Some of these conditions may be asymptomatic, and children are often unaware of their vision problems. Therefore, children's vision problems may go undiagnosed by parents or teachers (8). In particular, farsightedness and nearsightedness problems can only be diagnosed through a thorough eye exam (9). Almost 80% of visual impairments are preventable or treatable by early identification (10). Most

importantly, correction of common vision problems is easy and cost-effective, and eye examinations should be included in school health services to enhance learning, social interactions, future education, employment, and socioeconomic benefits (11, 12).

Based on a recent systematic review comprising 769,720 people from 28 different countries (13), the prevalence of visual impairment based on uncorrected visual acuity was 7.26%, presenting visual acuity was 3.82%, best corrected visual acuity was 1.67%, and blindness was 0.17%. Refractive errors were the most common cause of visual impairment (77.20%) among participants of selected studies. The prevalence of amblyopia was 7.60% (95% CI: 0.56%–0.91%) and congenital cataract was 0.60% (95% CI: 0.3%–0.9%) (13). Myopia is the most common visual impairment and it has been estimated that it will affect 50% of the world's population by 2050 (14). Some regional differences exist in the observed prevalence of myopia around the world including early onset of myopia in East Asian cities, with a prevalence of more than 20% in the early primary school years (15).

Vision problems may occur even when the eye appears normal or shows no signs of abnormalities (16). Therefore, early detection of vision disorders is important to minimize future problems related to academic performance and social life (2, 17, 18). Vision screening is mandatory in many European countries and is generally performed among children before starting school at 4–5 years of age (2). In Iran (where the present study was carried out), national screening is mandatory as part of the assessment for children's physical health and academic readiness for entering elementary school. This assessment includes a health assessment of the child's eyes, ears, height and weight, speech, condition of skin and hair, condition of mouth and teeth, measurement of body mass, medical history, blood pressure, mental and nervous condition in medical examinations, vaccination status, and autism disorder.

Based on recent reports, 7% of school-entering children in Qazvin province (Iran) had vision problems based on this pre-school screening program which was twice the national average and repeated for last eight years (19). However, this research was not academic. Considering the higher prevalence vision problems in Qazvin compared to elsewhere in Iran, as well as long-term consequences of vision problems (e.g., academic problems, reduced learning, physical problems such as headaches, long-term fatigue and dizziness), the present study was designed to determine the prevalence of visual disorders among school-entering children's and its relationship with socio-demographic characteristics in the Qazvin province.

Methods

Design and setting: A population-based cross-sectional study was conducted in Qazvin province between June and November 2023. Qazvin province has a population of approximately 1.3 million people and comprises six cities (Qazvin, Abyek, Takestan, Alborz, Boyin Zahra and Avaj). The study was carried out in coordination with school-entering children's physical health and academic readiness assessment at the provincial level. Overall, 20 assessment centers implemented the program across the provinces (in both urban and rural areas). Individuals diagnosed as having suspected vision, hearing, intelligence, and physical movement disorders in these primary centers were referred to one of the specialized centers for further assessments.

Participants: The parents of school-entering children attending for physical health and academic readiness assessment participated in present study. Parents were interviewed after their children had completed their eye examination. The eligibility criteria for the parents included being Iranian, living in Qazvin province, having a school-entering child attending for

physical health and academic readiness assessment, and providing informed consent to participate. The only exclusion criterion was not wanting to participate in the study.

Sample size estimation: According to previous reports regarding prevalence of vision problems among school-entering children in Qazvin province ($\approx 7\%$) (19), considering a 95% confidence interval and 95% test power, the sample size was determined to be 5048 participants. The total number of school-entering children in Qazvin province was 22,795 in the study year. Based on the distribution of the number of school-entering children in the provinces, the sample size proportions were allocated to the six cities as follows: Qazvin (48%), Takestan (9%), Abyek (8%), Avaj (3%), Boyin Zahra (10%), and Alborz (22%).

Sampling procedure: Sampling was conducted using a multi-stage method. First, the sample size was determined as a quota for each city based on the overall number of school-entering children. Then, based on the number of active assessment centers in each city, the sample size related to each center was determined. Finally, among those referred to centers for assessing school-entering children's physical health and academic readiness assessment, eligible parents were randomly selected and invited to participate in the study. For random selection of participants, 20 people were randomly selected (using simple random method) from the list of daily participants in each physical health and academic readiness assessment center. The names of potential participants were then extracted from center's daily registration list. Following this, their names were written down on paper and placed into opaque envelope. twenty envelopes were then randomly picked from each center, and the individuals were then contacted and asked if they would like to participate and be interviewed for the study.

Data collection method: The study data were collected by ten trained individuals interviewing parents. The interviewers all had bachelor degrees in science in public health. Over several sessions, the interviewers acquainted with the objectives of the study and how to ask the questions. To ensure the correctness of asking the questions, the principal investigator directly observed ten interviews of each interviewer. Data were collected in student health assessment centers. In the health assessment centers, each child attended four stations comprising anthropometric measurement, hearing tests, vision tests, and educational readiness checks. For the purpose of data collection in present study, an extra station was added to interview parents.

Measures: The interview had 20 items in four sections: (i) demographic characteristics (13 items including child and parents' age, gender, number of children in the family, birth order of the examined child, parent's educational status, parent's job, rural or urban residency, perceived family economic status, and child having confirmed attention deficit hyperactivity disorder [ADHD]), (ii) family history of vision problems (two items including other children visual problem and parent's visual problem), and (iii) the amount of hours spent using the internet and/or playing videogames (four items including whether the child had used the internet and/or played videogames in the past month, number of hours daily spent on the internet and/or gaming, how many hours does the child spend a day continuously on the internet and/or gaming, and whether the child kept the standard distance from the screen while on the internet or gaming. The questions were prepared based on the study objectives, a review of literature, and experts' opinion. The initial version of the interview schedule was qualitatively reviewed and approved in terms of face validity (by ten parents with a school-entering child) and content (by ten experts in public health, children's health, clinical psychologist, epidemiologist, and health education and promotion).

Children's vision status was assessed using Snellen Chart, and determined as either healthy, using eyeglasses, or suspected vision problems. The Snellen chart was placed on a wall 10 feet

away from the child and the children were asked to cover one eye with their hand without applying pressure to their covered eye. Then the line which they could comfortably read was identified. If they failed to correctly identify at least 50% of the letters on a line, the assessment was stopped. The same procedure was conducted for the other eye. This information was accessed directly from the assessment center's health records.

Ethical considerations: The study protocol was approved by the Medical Research Ethics Committee at Qazvin University of Medical Sciences (IR.QUMS.REC.1401.140). All participants (who were parents of school-entering children) provided written informed consent before data collection for the study began.

Statistical analysis: Data were analyzed using SPSS software version 26. Means and standard deviations (SDs) were used to describe continuous variables, and frequencies and percentages were used to describe categorical data. In order to investigate the relationship between vision status with demographic characteristics, family history of vision problems, number of hours spent online and/or playing videogames in the univariable method, chi-squares and analyses of variance (ANOVAs) were used. In the next step, the multivariable multi-nominal logistic regression method was used using healthy visual status as the reference category for dependent variable (children's vision status). The independent variables that were significant in the univariable analysis ($p < 0.05$) were included in the multivariable analysis.

Results

In present study 5630 individuals were initially recruited. After data screening, 489 surveys were eliminated from data analysis due to incomplete data (8% attrition rate). Therefore, a total of 5,141 parents participated in the study. The mean ages of the children, their fathers, and mothers were 6.18 years (SD=0.59), 38.97 years (SD=6.02) and 34.25 years (SD=5.90), respectively. More than half of the children were boys (52.1%). Almost half of the families had two children (48.7%) and 80% of the children were first or second born in the family. Parents reported that 96.4% of children had used the internet and/or played videogames during the past month, with a mean of 1.56 hours of continuous time spent online and/or playing videogames per day (SD=0.96). The prevalence of using eyeglasses was 2.2% [95%CI: 1.8%, 2.6%] and the prevalence of suspected visual problems was 6.7% [95%CI: 6.1%-7.4%].

Demographic characteristics and their relationship with vision status in the univariable analysis are reported in Table 1. In the univariable analysis, vision problems were significantly higher among girls, older children, children with older-aged parents, children with higher educated parents, children with employed mothers, and children with employed fathers, children living in an urban area, children having poor economic family status, children having other family members with vision problems, children having a history of playing videogames in the past month, and children engaged in daily continuous videogame playing. These variables were included as independent variables in multivariable multi-nominal logistic regression model.

The results of the multivariable logistic regression model (Table 2) showed that the odds of using eyeglasses in boys was 38% lower than in girls ($p=0.014$). The odds of using eyeglasses were 3.5 times higher if there was a history of vision disorders among other children in the family ($p < 0.001$) and 90% more likely if there was a history of vision disorders among the parents ($p=0.002$). The odds of using eyeglasses increased 5% with each unit increase in children's BMI. The odds of suspected vision problems increased by 39% and 3% with each year of age of the child and their mother ($p=0.001$ and $p=0.034$ respectively). The odds of

suspected visual problems was 90% higher among urban vs. rural children ($p<0.001$) and 58% higher if there was a history of vision disorders among other children in the family ($p=0.029$).

Discussion

The present study aimed to determine the prevalence of vision problems among school-entering children attending for physical health and academic readiness assessment and the relationship between vision problems and socio-demographic characteristics. The prevalence of using eyeglasses and suspected visual problems were 2.2% and 6.7%, respectively. Different prevalence rates of children's vision disorders upon entering school have been reported in previous studies. According to World Health Organization reports, approximately 2.2 billion people worldwide have visual impairments. Of these, 19 million are children (under the age of 15 years) (20, 21). William et al. reported that among seven-year-old English children ($n=7825$), 2.3% had obvious strabismus, 3.6% had amblyopia, and 4.8% had hypermetropia (22). In an Iranian study in Bojnurd ($n=6600$), less than 1% of 3-6-year-old children had vision problems (23). In a large-scale study ($n=1173$), regional variations were found in common visual impairments among school-age children in Russia vs. Saudi Arabia. The incidence of visual impairment was lower among children from Saudi Arabia (OR=1.01 in 2018 and OR=0.93) compared to Russian children (OR=1.36 in 2018 vs. OR=1.33 in 2022) (24). In Ethiopia, ($n=816$) the prevalence of vision problems among children was 4.4% (25). In the study of Armenia ($n=5944$), the prevalence of vision problems including myopia, farsightedness, astigmatism, and strabismus among children was 9.7% (26). As reported by Ivleva et al. (2023), lower visual impairment was found in Saudi Arabia (i.e., a country with a successful healthcare system) compared to Russia (a country with the significant number of ophthalmology clinics that are ineffective) (24). These findings indicate that different prevalence rates of vision problems have been reported in previous studies, and that some of these vision problems are very specific. The present study did not have any data on specific vision problems so direct comparison between those here and findings in other studies is difficult to do. Differences in studies might be to different reasons including socio-demographic status, time spent online and/or playing videogames by children in different areas and countries, and the quality of ophthalmological services provided by healthcare systems.

The other aim of present study was to investigate the association between vision problems and participants' socio-demographic characteristics. The results of multivariable analysis showed that the odds of using eyeglasses were higher among female children with higher BMI, a history of vision disorders in their siblings and parents. Also, the odds of suspected vision problem status increased by increase in child and their mothers' age, living in urban (as opposed to rural) areas, and if there was a history of vision disorders among other children in the family. A higher prevalence of vision problems among individuals with history of vision problems in their siblings and parents is consistent with previous studies reporting that visual impairments such as myopia are greatly influenced by genetics (27-30). This consistency between the result of present study with previous studies might be due to the role of genetic factors in the occurrence of visual disorders or social heredity (e.g., if parents or other family members are on screen-based devices a lot of the time, and children mimic what others in their family environment are doing, it may not be surprising if children develop vision problems as a consequence).

Consistent with the present study, Jrbashyan et al. reported greater vision disorders were more prevalent in urban areas (26). Wang et al. reported a higher prevalence of vision problems among female students (compared to male students) from eastern China (31). William et al. reported increased visual problems among children from the lowest occupational social class background were 1.82% more at risk of than children from the highest social class among

seven-year-old English children (n=7825). They concluded that pediatric eye care services may need to consider socioeconomic status to avoid inequities in access to care (22). Consequently, female students and individuals with positive history of visual disorders among their parents and siblings should be considered as an at-risk group for assessment of visual problems at a younger age. Early diagnosis and treatment of these problems in childhood can prevent further damage and vision disorders among these children (23). The consistency between the results of the present study and previous studies can emphasize the point that girls and children with lower socioeconomic levels are among the groups at risk of vision problems and special attention should be paid to their assessment.

In the present study, results of the univariable analysis showed significant association between the amount of time spent online and/or playing videogames with the visual problems of the children upon entering school, but this was not significant in the multivariable analysis. The lack of a significant relationship between the amount of time spent online with vision problems is not consistent with previous studies. Moon et al. (31) reported that the use of smartphones in a dry eye disease group (71%) was more than the control group (50%). In the same study, the duration of daily use of a smartphone and the total duration of daily use of a videogame screen were associated with an increased risk of dry eye disease (32). Lee et al. reported that excessive and continuous videogame playing for 4 hours was associated with impaired visual performance among healthy young people and was associated with eye and physical fatigue, but with adequate rest, physical and visual discomfort returned to baseline levels the following morning during videogames was reduced (33). Consistent with present study, a recent systematic review and meta-analysis comprising 10 cross-sectional studies (n=26,962) with individuals aged 9.5 to 26.0 years, reported that smartphone overuse was not significantly associated with myopia, poor vision, or blurred vision (34). Despite the inconsistency regarding the association between the amount of time using smartphones and playing videogames with visual problems among children, excessive use of smartphones and gaming can cause other negative consequences such as emotional and physical health problems, poor academic performance, and poorer social interactions (35, 36). Therefore, regulating the time spent using smartphones and videogame among children may prevent negative consequences in other areas as well as potential visual problems.

Strengths and limitations

The present population-based cross-sectional study comprised a large sample size using multi-stage random sampling method at the provincial level including both urban and rural populations. This resulted in the inclusion of participants from different socio-demographic characteristics which increased the generalizability of the results. Moreover, the use of multivariable regression models helped in investigating the effect of simultaneous multiple variables and identifying the most important predictors of vision problems among children. However, some limitations should be considered when interpreting the findings including the (i) cross-sectional nature of the study (which meant causal relationships between the study variables could not be determined), (ii) use of parents' self-report (which increased the possibility of social desirability bias in answering questions, as well as the possibility of recall bias in answering questions related items such as the duration of time spent online and playing videogames), (iii) data regarding nutritional variables were not collected in present study. Therefore, given the association of poor nutrition with vision problems, future replications of the present study should collect data on such variables; and (iv) data regarding vision status was collected based solely on examination in the physical health and academic readiness assessment centers which are primary screening centers for assessment of school-entering children. Here, children were screened and diagnosed as either healthy or suspected vision

problems. There was no access to data regarding children's specialist vision assessment or specific types of visual problems.

Clinical implication and future research

The findings of the present study identified predictors of vision problems among children at the time of school entry. According to the results, female children, individuals with a history of vision disorders among their siblings and parents, children living in urban areas, and increased age of children and mother were the strongest predictors of vision problems among children. Therefore, considering these predictors, those in at-risk categories should seek out eye examinations before starting school to identify vision problems. Delay in diagnosing vision problems can have irreversible damage to children that endangers their future sight. Due to the cross-sectional nature of the present study, causal relationships could not be examined. Therefore, prospective studies in Iran are needed prior to school entry to better examine the role of various factors, including pregnancy, childbirth, and early childhood conditions, in the growth and development of children's vision problems. Given that the present study did not have access to children's specific eyesight problems or any diagnoses, integrated systems are needed in future studies to record and access information at different ages of children so that specific information can be accessed and matched with other developmental data and socio-demographic information.

Conclusion

The results of present study showed that vision problems were higher among female children, individuals with a history of vision disorders among their siblings and parents, and among children living in urban (as opposed to rural) areas. Moreover, as the age of the child and mother increased, so did the prevalence of vision problems. Considering that the vision health screening program is conducted as part of the health assessment program for school entry children, at-risk individuals (e.g., girls, those with a family history of vision disorder, those living in a city) should be more carefully screened. In addition, at-risk individuals especially those with a family history of vision problems, which was associated with the highest odds of using glasses, should be advised not to postpone their children's vision examinations until they enter school but to start having eye examinations at a younger age.

Declaration of interest: The authors have no conflict of interest to declare.

Funding: No funding was received.

References

1. Becker P, Montilha RdCI. Occupational performance and quality of life: interrelationships in daily life of visual impaired individuals. *Revista Brasileira de Oftalmologia*. 2015;74:372-7..
2. Ali Q, Heldal I, Helgesen CG, et al. Current challenges supporting school-aged children with vision problems: A rapid review. *Applied Sciences*. 2021;11(20):9673.
3. Eksteen S, Eikelboom RH, Kuper H, Launer S, Swanepoel DW. Prevalence and characteristics of hearing and vision loss in preschool children from low income South African communities: results of a screening program of 10,390 children. *BMC Pediatrics*. 2022;22:1-10.
4. Stein J. Reply to: "The relationship between eye movements and reading difficulties", Blythe, Kirkby & Liversedge. *Brain Sciences*. 2018;8(6):99.
5. Wilhelmsen GB. School starters' vision—An educational approach. *Improving Schools*. 2016;19(2):141-53

6. Johnson C, Majzoub K, Lyons S, Martirosyan K, Tattersall P. Eyes that thrive in school: a program to support vision treatment plans at school. *Journal of School Health*. 2016;86(5):391-6.
7. Sharma A, Congdon N, Patel M, Gilbert C. School-based approaches to the correction of refractive error in children. *Survey of Ophthalmology*. 2012;57(3):272-83.
8. Rao A, Raj N, Padhy D, Sarangi SP. Perspectives and impediment to eye care in caregivers of children with childhood glaucoma. *Indian Journal of Ophthalmology*. 2020;68(5):798-804.
9. Reedy-Cooper A. The eye book: a complete guide to eye disorders and health. *Family Medicine*. 2022;54(5):401-2.
10. World Health Organization. Vision Impairment and blindness; 2017 [Available from: <http://www.who.int/mediacentre/factsheets/fs282/en/>].
11. Davidson S, Quinn GE. The impact of pediatric vision disorders in adulthood. *Pediatrics*. 2011;127(2):334-9.
12. Lv B, Zhou H, Guo X, Liu C, Liu Z, Luo L. The relationship between academic achievement and the emotional well-being of elementary school children in China: The moderating role of parent-school communication. *Frontiers in Psychology*. 2016;7:948.
13. Yekta A, Hooshmand E, Saatchi M, et al. Global prevalence and causes of visual impairment and blindness in children: a systematic review and meta-analysis. *Journal of Current Ophthalmology*. 2022;34(1):1-15.
14. Holden BA, Fricke TR, Wilson DA, et al. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. *Ophthalmology*. 2016;123(5):1036-42.
15. Pan C-W, Dirani M, Cheng C-Y, Wong T-Y, Saw S-M. The age-specific prevalence of myopia in Asia: A meta-analysis. *Optometry and Vision Science*. 2015; 92(3):258-66.
16. Evans BJ. Pickwell's binocular vision anomalies: Elsevier Health Sciences; 2021.
17. Welp A, Woodbury RB, McCoy MA, Teutsch SM. Making eye health a population health imperative: vision for tomorrow. Washington, DC: National Academies Press; 2016.
18. Lipkin PH, Macias MM, Norwood KW, et al. Promoting optimal development: identifying infants and young children with developmental disorders through developmental surveillance and screening. *Pediatrics*. 2020;145(1): e20193449..
19. Ahmadi M. The increase in vision problems in Qazvini children is worrying Iran, Qazvin Province: ISNA, Iranian Students' News Agency; 2022 [Available from: <https://shorturl.at/YAyaI>].
20. Vision Impairment Collaborators. Vision Loss Expert Group of the Global Burden of Disease Study. Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence of avoidable blindness in relation to VISION 2020: the Right to Sight: an analysis for the Global Burden of Disease Study. *Lancet Glob Health*. 2021;9(2):e144-e60.
21. Fricke TR, Tahhan N, Resnikoff S, et al. Global prevalence of presbyopia and vision impairment from uncorrected presbyopia: systematic review, meta-analysis, and modelling. *Ophthalmology*. 2018;125(10):1492-9.
22. Williams C, Northstone K, Howard M, Harvey I, Harrad RA, Sparrow J. Prevalence and risk factors for common vision problems in children: data from the ALSPAC study. *British Journal of Ophthalmology*. 2008;92(7):959-64.
23. Hamidi A, Heravian Shandiz J, Jalalifar S, Boomi Quchan Atigh S, Darvishi A, Lashkardoost H. The prevalence of strabismus and heterophoria in 3-6 years old children in Bojnurd, Iran, in 2016-2017. *Journal of Paramedical Sciences & Rehabilitation*. 2020;9(1):59-67.
24. Ivleva S, Hajimajeed M, Kartashova O, Mikhaylov A. A comparative study of regional variations in common visual impairments among school-age children. *Electronic Journal of General Medicine*. 2023;20(5):em504.

25. Hailu Y, Hiko D, Shaweno T. Prevalence of visual impairment and associated factors among primary schoolchildren in Addis Ababa, Central Ethiopia. *Clinical Ophthalmology*. 2020;767-74.
26. Jrbashyan N, Yeghiazaryan N, Sikder A, et al. Pattern and prevalence of eye disorders and diseases in school-aged children: findings from the Nationwide School Sight Sampling Survey in Armenia. *BMJ Open Ophthalmology*. 2022;7(1):e000899.
27. Wang Y-M, Lu S-Y, Zhang X-J, Chen L-J, Pang C-P, Yam JC. Myopia genetics and heredity. *Children*. 2022;9(3):382.
28. Toualbi L, Toms M, Moosajee M. USH2A-retinopathy: From genetics to therapeutics. *Experimental Eye Research*. 2020;201:108330.
29. Li J, Chen X, Yan Y, Yao K. Molecular genetics of congenital cataracts. *Experimental Eye Research*. 2020;191:107872.
30. Lenassi E, Clayton-Smith J, Douzgou S, et al. Clinical utility of genetic testing in 201 preschool children with inherited eye disorders. *Genetics in Medicine*. 2020;22(4):745-51.
31. Wang J, Ying G-s, Fu X, et al. Prevalence of myopia and vision impairment in school students in Eastern China. *BMC Ophthalmology*. 2020;20:1-10..
32. Moon JH, Lee MY, Moon NJ. Association between video display terminal use and dry eye disease in school children. *J Pediatr Ophthalmol Strabismus*. 2014;51(2):87-92.
33. Lee JW, Cho HG, Moon BY, Kim SY, Yu DS. Effects of prolonged continuous computer gaming on physical and ocular symptoms and binocular vision functions in young healthy individuals. *PeerJ*. 2019;7:e7050.
34. Wang J, Li M, Zhu D, Cao Y. Smartphone overuse and visual impairment in children and young adults: systematic review and meta-analysis. *Journal of Medical Internet Research*. 2020;22(12):e21923.
35. Busch PA, McCarthy S. Antecedents and consequences of problematic smartphone use: a systematic literature review of an emerging research area. *Computers in Human Behavior*. 2021;114:106414.
36. Aziz N, Nordin MJ, Abdulkadir SJ, Salih MMM. Digital addiction: systematic review of computer game addiction impact on adolescent physical health. *Electronics*. 2021;10(9):996.

Table 1. Distribution of demographic characteristics and their association with vision status						
Variables		Total (N=5141)	Vision status - N (%)			Statistical results
			Healthy vision 4686 (91.1)	Using eyeglass 112 (2.2)	Suspecte d vision problems 345 (6.7)	
Continuous variables		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	F (d):
Age (year)		6.18 (0.59)	6.18 (0.59)	6.19 (0.59)	6.28 (0.56)	4.98 (0.007)
Father's age (year)		38.97 (6.02)	38.90 (6.04)	40.28 (5.62)	39.46 (5.83)	4.10 (0.017)
Mother's age (year)		34.25 (5.90)	34.14 (5.85)	35.88 (5.85)	35.24 (5.82)	9.95 (<0.001)
BMI (kg/m ²)		19.28 (3.69)	19.24 (3.64)	19.99 (4.07)	19.61 (4.16)	3.81 (0.22)
Categorical variables		N(%)	N(%)	N(%)	N(%)	χ^2 (p)
Gender	Boy	2676 (52.1)	2455 (91.7)	45 (1.7)	176 (6.6)	6.72 (p=0.035)
	Girl	2465 (47.9)	2229 (90.4)	67 (2.7)	169 (6.9)	
Number of children	1	1114 (21.7)	1003 (90.0)	27 (2.4)	84 (7.5)	9.26 (p=0.32)
	2	2505 (48.7)	2281 (91.1)	57 (2.3)	167 (6.7)	
	3	1098 (21.4)	1019 (92.8)	21 (1.9)	58 (5.3)	
	4	282 (5.5)	252 (89.4)	4 (1.4)	26 (9.2)	
	5 ≤	142 (2.8)	129 (90.8)	3 (2.1)	10 (7.0)	
Birth order of child	1	2015 (39.2)	1829 (90.8)	49 (2.4)	137 (6.8)	6.72 (p=0.57)
	2	2095 (40.8)	1907 (91.0)	40 (1.9)	148 (7.1)	
	3	768 (14.9)	710 (92.4)	19 (2.5)	39 (5.1)	
	4	172 (3.3)	156 (90.7)	2 (1.2)	14 (8.1)	
	5 ≤	91 (1.8)	82 (90.1)	2 (2.2)	7 (7.7)	
Educational status of father	Elementary	1207 (23.5)	1107 (91.7)	24 (2.0)	76 (6.3)	18.64 (p=0.005)
	Guidance	1276 (24.8)	1185 (92.9)	27 (2.1)	64 (5.0)	
	High school	1585 (30.8)	1445 (91.2)	35 (2.2)	105 (6.6)	
	Academic	1073 (20.9)	947 (88.3)	26 (2.4)	100 (9.3)	
Educational status of mother	Elementary	1154 (22.4)	1064 (92.2)	28 (2.4)	62 (5.4)	24.80 (p<0.001)
	Guidance	1188 (23.1)	1093 (92.0)	24 (2.0)	71 (6.0)	
	High school	1708 (33.2)	1572 (92.0)	30 (1.8)	106 (6.2)	
	Academic	1091 (21.2)	955 (87.5)	30 (2.7)	106 (9.7)	
Fathers' job	Employed	4980 (96.9)	4536 (91.1)	103 (2.1)	341 (6.8)	13.84 (p=0.008)
	Retired	61 (1.2)	56 (91.8)	4 (6.6)	1 (1.6)	
	Unemployed	100 (1.9)	92 (92.0)	5 (5.0)	3 (3.0)	
Mothers' job	Housewife	4576 (89)	4191 (91.6)	100 (2.2)	285 (6.2)	15.50 (p<0.001)
	Employed	565 (11)	493 (87.3)	12 (2.1)	60 (10.6)	
Residency	Urban	4003 (77.9)	3607 (90.1)	93 (2.3)	303 (7.6)	23.60 (p<0.001)
	Rural	1138 (22.1)	1077 (94.6)	19 (1.7)	42 (3.7)	
Perceived family economic status	Weak	592 (11.5)	523 (88.3)	21 (3.5)	48 (8.1)	10.53 (p=0.032)
	Fair	3688 (70.7)	3333 (91.7)	73 (2)	227 (6.2)	
	Good	916 (17.8)	828 (90.4)	18 (2)	70 (7.6)	
Other children with vision problems	Yes	305 (5.9)	253 (83)	22 (7.2)	30 (9.8)	44.81 (p<0.001)
	No	4836 (94.1)	4431 (91.6)	90 (1.9)	315 (6.5)	
Parents Visual Problem	Yes	1261 (24.5)	1117 (88.6)	47 (3.7)	97 (7.7)	21.97 (p<0.001)
	No	3880 (75.5)	3567 (91.9)	65 (1.7)	248 (6.4)	
Confirmed ADHD	Yes	59 (1.1)	42 (88.1)	3 (5.1)	4 (6.8)	2.37 (p=0.31)
	No	5082 (98.9)	4632 (91.1)	109 (2.1)	341 (6.7)	
	Yes	4957 (96.4)	4528 (91.3)	107 (2.2)	322 (6.5)	10.62 (p=0.005)

Time spent online and/or gaming during past month	No	184 (3.6)	156 (84.8)	5 (2.7)	23 (12.5)	
Continuous hours of time spent online and/or gaming daily	No gaming	184 (3.6)	156 (84.8)	5 (2.7)	23 (12.5)	20.15 ($p=0.01$)
	Less than 1 hour	3025 (58.8)	2069 (91.5)	69 (2.3)	187 (6.2)	
	1-2 hours	1400 (27.2)	1285 (91.8)	30 (2.1)	85 (6.1)	
	2-3 hours	333 (6.5)	297 (89.2)	4 (1.2)	32 (9.6)	
	More than 3 hours	199 (3.9)	177 (88.9)	4 (2)	18 (9)	
Standard distance from screen	Yes	4562 (88.7)	4167 (91.3)	98 (2.1)	297 (6.5)	2.83 ($p=0.24$)
	No	579 (11.3)	517 (89.3)	14 (2.4)	48 (8.3)	
Daily hours spent online and/or gaming	Less than 1 hour	1748 (34)	1583 (90.6)	37 (2.1)	128 (7.3)	8.53 ($p=0.20$)
	1-2 hours	2088 (40.6)	1908 (91.4)	38 (1.8)	142 (6.8)	
	2-3 hours	830 (16.1)	765 (92.2)	21 (2.5)	44 (5.3)	
	More than 3 hours	475 (9.2)	428 (90.1)	16 (3.4)	31 (6.5)	

Table 2. Results of multivariable multi-nominal logistic regression analysis				
		OR	95% CI for OR	Sig.
Healthy vision status	Reference group			
Wearing eyeglasses	[Gender=boy vs. girl]	0.62	0.42; 0.91	0.014
	BMI	1.05	1.01; 1.10	0.026
	Other children with vision problem [Yes vs. No]	3.53	2.12; 5.88	<0.001
	Parents with vision problem [Yes vs. No]	1.90	1.27; 2.84	0.002
Suspected vision problems	Age of child	1.39	1.14; 1.68	0.001
	Age of mother	1.03	1.00; 1.06	0.034
	Residency [urban vs. rural]	1.90	1.34; 2.71	<0.001
	Other children with vision problems [Yes vs. No]	1.58	1.05; 2.37	0.029
Model summary	Goodness of fit: χ^2 (p)= 10044.60 (0.90) Model fitting information: χ^2 (p)= 166.69 (<0.001) Pseudo R-square based on Nagelkerke: 0.063			
NB. All significant variables in univariable analysis was entered in multivariable model and only significant predictors are reported in this table.				