

**Risk Factors for Developing Myopia Among 6-18 Years Old Schoolchildren in Yerevan and  
Gegharkunik marz**

**(A cross-sectional study)**

Master of Public Health Integrating Experience Project

Utilizing Professional Publication Framework

by

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## ***1. Introduction***

### ***1.1 Background/Literature Review***

The number of people who are blind increases worldwide, despite growing number of blindness prevention programs (1, 2). Currently, about 314 million people are visually impaired; and 45 million of them are blind. By 2020, the number of blind people worldwide is projected to be 76 million, if effective, major interventions are not implemented. About 85% of all visual impairment and 80% of blindness could be prevented or cured (3, 4).

The four main leading causes of avoidable blindness worldwide are: cataract, uncorrected refractive errors (RE), glaucoma, and age-related macular degeneration (5). The World Health Organization (WHO) estimates that 153 million people worldwide live with visual impairment due to uncorrected refractive errors, excluding presbyopia (3,5). Uncorrected RE can negatively influence school performance, reduce employability and productivity, and generally impair quality of life (5). There are about 1.4 million blind children in the world; almost three-quarters of them live in developing countries. Uncorrected refractive errors (myopia, hyperopia, and astigmatism) are the main cause of vision impairment among 5-15 years old in many countries (7-13).

One of the simplest, cost effective ways to correct refractive errors include provision of appropriate spectacles. Contact lenses and refractive surgery are also used to correct refractive errors (1, 3, 6). There is a need for obtaining epidemiological information on refractive errors among school-age children to develop appropriate programs aimed at preventing avoidable blindness caused by refractive errors (8).

The public health and economic impact of myopia, the most common eye disease in the world, is enormous. Over the past few decades the prevalence of myopia has increased in some populations leading to growing concern among the public and scientific community (14).

Myopia is a significant problem not only because of its high prevalence, but also because of its big contribution in visual morbidity and the risk for vision-threatening conditions (myopic macular degeneration, cataract, glaucoma, peripheral retinal changes, retinal holes and tears, retinal detachment). Uncorrected myopia is an obstacle to seeing distant objects clearly and particularly among schoolchildren to see the blackboard, which can be a limiting factor in school performance and occupational choices (15). Thus, myopia is a condition with social, educational, and economic consequences (14).

### ***1.1.1 Risk factors for myopia development among children***

Research suggests that the risk factors for myopia development among children include heredity, near work, school achievement, outdoor activity, gender, history of prematurity and others (16 - 21).

**Heredity.** Majority of the studies report that genetic factors are of major importance in myopia/hyperopia and astigmatism appears to be dominantly inherited (16 - 19). Children with myopia are more likely to have parents with myopia (16). The prevalence of myopia in children with two parents with myopia is 30% to 40%, decreasing to 20% to 25% in children with one parent with myopia and less than 10% in children with no parents with myopia (17). Having one (OR=3.31; 95% confidence interval [CI]=1.32-8.30) or two parents with myopia (OR=7.29; 95%

[CI]=2.84-18.7) significantly increases the odds of being myope. Children with highly myopic parents tend to have an earlier onset of myopia with an OR of 2.61 (18).

**Near Work.** Many studies in different countries found strong association between doing near work and having myopia (20 - 23). Near-work activities include reading, writing, computer use and playing video games (23). Children with higher myopia usually read more, spend more time on homework and using computer, and take more classes than those with lower myopia or nonmyopes (20 - 22).

**Lack of outdoor activity.** Outdoor activities have been recognized as a protective factor for myopia (24,25). Children who spend more time outdoors or are engaged in more sports (indoor and outdoor) are less likely to be myopic (24, 25).

**School achievement.** Level of education is often used as a surrogate for near work with more myopia among the more educated (23).

**Prematurity.** Studies show that child's growth parameters (birth weight, birth height, gestation age) are associated with refractive errors (26, 27). However, one study indicates that the eye refraction is correlated with age at eye examination and not gestational age or birth weight (28).

**Gender.** The prevalence of refractive errors appears to be much higher among girls (29 - 31).

**Living in urban areas.** Several studies reported about a higher prevalence of myopia in urban population than in rural (32 - 36). Prevalence of uncorrected refractive error, especially myopia, is significantly higher in 6 to 15 years old school children living urban areas compared to children from rural schools (32 - 34). One study showed that myopia prevalence was lowest in the outer suburban region (6.9%) and highest in the inner city region (17.8%) (35). Another study suggested that the prevalence of refractive errors were significantly higher among students living in a heavy traffic residential area compared to those from mixed, industrial, and low traffic areas (36).

### ***1.2 Situation in Armenia***

In 1999, Garo Meghriyan Institute for Preventive Ophthalmology (Meghriyan Institute), Center for Health Services Research and Development, American University of Armenia conducted a situation analysis to assess the regional ophthalmologic services. This study suggested that blindness in Armenia reflects the country's overall health care delivery problems: low utilization of services, due to poor financial and geographic access. In 2000, Meghriyan Institute's Summer Camps Visual Impairment Project screened 3,307 school children in 11 camps within 3 regions of Armenia (Hankavan, Tsakhkadzor, Gyumri). The screening results indicated that 11% of children had refractive errors (37). Recently conducted Eye screening Program at Social Care Center for Children of Achapnyak Community revealed that the prevalence of refractive errors among socially vulnerable school children was approximately 20% (38). There are no population based studies about RE among school children in Armenia.

**The research questions of the study are:**

- What is the prevalence of RE among 6-18 years old school children living in Yerevan and Gegharkunik marz?
- What are the risk factors for development of myopia among 6-18 years old school children living in Yerevan and Gegharkunik marz?
- Is living in Yerevan vs. Gegharqunik towns an independent risk factor for myopia development after controlling for other known risk factors?

## ***2.Methods***

### ***2.1 Study Design***

To address the mentioned research questions, the study used analytical cross sectional study design, to collect information on the prevalence of RE and known risk factors for myopia development. The study measured a snapshot of the population to estimate the relationship between an outcome of interest and population variables at one particular point in time.

### ***2.2 Study Population***

The *target population* of this study was 6-18 years old school children living in Yerevan and five main towns of Gegharkunik marz.

### ***2.3 Sample Size***

According to the Summer Camps Visual Impairment Project the prevalence of refraction errors among school age children was 11% (37). This result will be taken as the estimate of myopia prevalence among children from rural areas. Recently conducted Eye screening Program at Social Care Center for Children of Achapnyak Community revealed that the refractive error

prevalence among children in Yerevan was approximately 20% (38). This number will be used as the estimate of myopia prevalence among children from urban areas. Assumptions included 95% confidence interval ( $\alpha=0.05$ ) and 80% power. The response rate of a similar study was approximately 97% (39), but taking into consideration that 6-12 years old children can participate to the study only in the case of having parent's consent, the response rate was considered 90%. This sample size was calculated using the formula for two equal groups finding difference in proportions.

$$\Delta = p_a - p_0 = 0.09$$

Significance level,  $\alpha = 0.05$  (two-sided) and power  $(1 - \beta) = 0.80$

$$n = \frac{[Z_{\alpha/2} \sqrt{2(p\bar{q})} + Z_{\beta} \sqrt{p_1 * q_1 + p_2 * q_2}]^2}{\Delta^2} =$$

$$\frac{[1.96 \sqrt{2 * 0.155 * 0.845} + 0.84 \sqrt{0.11 * 0.89 + 0.2 * 0.8}]^2}{(0.09)^2} =$$

$$\frac{[1.96 \sqrt{0.26195} + 0.84 \sqrt{0.0979 + 0.16}]^2}{0.0081} = \frac{[1.003148602 + 0.426584387]^2}{0.0081} = \frac{[1.42973299]^2}{0.0081} =$$

$$\frac{2.044136423}{0.0081} \approx 252$$

Taking into account design effect of cluster sampling and multiplying the result by the coefficient of 2 and response rate of 80%, final sample size was 630 for each area (Yerevan and Gegharkunik).

## 2.4 Sampling Design

The study used multi-stage random sampling. Children from Gegharkunik marz were from five main towns (Sevan, Gavar, Martuni, Vardenis and Chambarak); children from Yerevan were



from five randomly selected communities. From 12 communities in Yerevan Kentron, Davitashen, Nubarashen, Ajapnyak, and Arabkir communities were chosen for the study through simple random sampling. To obtain the number of children from each community or town, the sample size for Yerevan and Gegharkunik marz (630) was divided by five. To have all school ages equally represented in the samples 42 children were randomly selected from each age group (primary 1-4 grades, middle 5-9 grades, and high 10-12 grades). The number of children was about 20 in each class; therefore, two classes were randomly selected from each age group in each community and town.

### ***2.5 Study dependent and independent variables***

The dependent variable (outcome) of the study was the presence/absence of myopia confirmed by an ophthalmologist. The independent variables were age, gender, heredity status (parents with myopia), near work activity, outdoor activity, place of residence, birth weight, birth height and gestation age.

Children's near work was assessed by asking how many hours per week the child spent in near work activities outside the school (reading, writing, computer, and TV). These activities were analyzed separately and as a composite variable called "near work" which was the sum of the durations of all near work activities. In addition, near work was weighted by dioptric equivalent (1 to 4) of an assumed working distance for the activities. The purpose of this weighting was to quantify the exposure to near work not only in terms of time, but also accommodative effort required during each activity (17). The physical activity and outdoor activity were also assessed based on the time children spent on each activity per week.

To analyze the data SPSS 19.0 statistical package was used. The student investigator conducted double entry and data cleaning to minimize possible errors.

## ***2.6 Study instrument***

The study developed structured questionnaire, which consisted of three parts: first part was designed for mothers or guardians (self administered), the second part for children (interviewer administered) and the third part for ophthalmologist's clinical examination. The first part of the questionnaire included questions regarding the child birth weight, birth height and gestation age. It also covered information about family history in terms of vision problems, whether the child was allergic to medication and the history of having any eye injury. It was developed based on the risk factors mentioned in the literature. The questions about allergy to medication and eye injury were included for using as inclusion and exclusion criteria for performing cycloplegia. The questionnaire for children contained questions about demographics, near work, outdoor and physical activity. The questions for this questionnaire were based on the questionnaire used in a similar study in Australia. The third part of the questionnaire contained the results of visual acuity testing and information about refractive errors. It was adapted from the Summer Camps Visual Impairment Project (37).

## ***2.7 Eye screening procedure***

The ophthalmologic examinations were carried out after completing the interviews. Vision acuity test was performed by Sivtsev chart among children to identify the presence of refractive errors. Pupil Delation (cycloplegia) was administered for those who do not have eye injuries, eye surgery and allergy. This procedure was performed by dropping small amount of Mydoptic

(2.5%) solution on each eye, which prepared the patient for eye fundus examination. Eye fundus examination was performed by ophthalmoscopes.

## ***2.8 Ethical Considerations***

The Institutional Review Board/Committee on Human Research (IRB) within the College of Health Sciences at the American University of Armenia approved the study. All ethical norms, including confidentiality and voluntary based participation were assured throughout the project. All participants received an identification number (ID) and their names did not appear on the questionnaires. The results of the study remained confidential and were used for research purposes only. All documents are kept in the archive of the Research Center of Health Sciences of American University of Armenia, where only members of the research team have access.

## ***3. Analysis***

### ***3.1 Descriptive Statistics***

The total number of participants was 1,092 children: 563 (51.6%) of them were from Yerevan and 525 (48.4%) from Gegharqunik marz. Among the participants 505 (46.2%) were male and 579 (53.8%) were female. The response rate of the study was 86.7%. The mean age of children was 13 years old (ranging from 6- to 19 years old). The age is divided into three main categories based on the child's grade in school. Children 6-10 years old from primary school 321 (31.2%), 11-15 years old from middle school - 312 ( 28.5%) and 16-19 years old from high school - 450 (40.9%) (Table 1).

Among the 525 participants from Yerevan 52.1% were girls and among 525 participants from Gegharkunik 54.9% were girls. The mean age of children was 13 years old (ranging from 6- to 19 years old). A total of 29.6% of study participants was  $\leq 10$  years old, 28.8% was  $> 10$  to  $\leq 15$  years old and 41.6% was  $> 15$  years old (Table 1).

**Refractive errors.** All children underwent ophthalmological examination. Majority of children (72.1%) had normal vision and 27.9% less than normal. In the overall sample, 196 (17.9%) children had myopia, from them 157 (14.4%) children low degree of myopia, 20 (1.8%) children middle degree of myopia, 2 (0.2%) children high degree of myopia, and 17 (1.6%) children undefined myopia. Thirty-seven (3.4%) children had hyperopia, from them 29 (2.7%) children had low degree of hyperopia, 3(0.3%) children middle degree of hyperopia, 2 (0.2%) children high degree of hyperopia, and 3 (0.3%) undefined hyperopia. Thirty-five (3.2%) children had astigmatism: 28 (2.6%) children had myopic astigmatism, 5 (0.5%) hyperopic astigmatism, and 2 (0.2%) mixed astigmatism. Accommodative spasm was present among 104 (9.5%) children. The rates of refractive errors in Yerevan were approximately two times higher (31.6%) compared to Gegharqunik marz (16.8%). The prevalence of myopia was also higher in Yerevan - 22.8% vs. 12.7% in Gegharqunik marz. The prevalence of hyperopia was almost the same: 3.5% for Yerevan and 3.2% for Gegharqunik marz. The prevalence of astigmatism was over five times higher in Yerevan (5.3%) than in Gegharqunik (0.9%). The differences in prevalence of myopia and astigmatism between the two regions were statistically significant.

**Eye Diseases.** The main eye diseases among 103 (9.4%) children were conjunctivitis 7.1%, blepharoconjunctivitis 1.2% and blepharitis 0.5%. Other diseases such as (dry eye syndrome, demodekosis, and episcleritis) together were 0.6%.

Thirty-eight children (3.5%) had different types of strabismus. The main type of the strabismus was cooperated convergent strabismus 27 (2.5%). Amblyopia was present among 18 (1.6%) children. Thirteen children (1.2%) had eye trauma in the past and six children (0.5%) underwent eye operation.

**Near Work.** Children's survey suggested that children spent on average 53.3 hours per week on near work. Among the near work activities children spent the most time on watching TV (on average 15.1 hours per week), preparing for school 14.1 hours p/w, working on computers 8.5 hours p/w, reading for pleasure 5.2 hours p/w, using mobile phones for games and internet 2.0 hours p/w, playing chess 1.9 hours p/w, video games 1.8 hours p/w and playing on musical instruments 0.8 hours p/w.

The rate of children spending more than 60 minutes on continuous reading was 15.1% in Yerevan and 21.6% in Gegharqunik marz.

**Near Work in Diopter-Hours.** The situation changed when the results were assessed by using diopter-hours. Taking into account the assumed distance for each near work activity, children spent the most time on doing homework 42.3 dpt/h, working on computer took 17.0 dpt/h, reading for pleasure 15.6 dpt/h, watching TV 15.1 dpt/h, painting 6.7 dpt/h, mobile phones 4.0

dpt/h, playing chess 3.8 dpt/h, playing video games 3.5 dpt/h, playing on musical instruments 1.7 dpt/h.

### **School performance.**

Percent of children reporting “Good” and “Excellent” grades at school was higher in Yerevan (74.9%) than in Gegharqunik marz (65.4%) (Table 1). Children from Yerevan were more involved in additional studies requiring near work (39.2%) compared to the children from Gegharkunik (21.6%). Both differences were statistically significant.

**Physical / Outdoor Activity.** The time spent on physical activity per week was approximately 4.5 times less compared to the time spent on near work. Children’s survey suggested that children spent on average 11.9 (ranging from 0 to 77.5 hours) per week on physical and outdoor activity. Among physical activities children spent the most time on playing in the yard (on average 5 hours per week), physical activity at home and at school each 1.9 hours p/w, playing football 1.2 hours p/w, on dancing 0.61 hours p/w, swimming and basketball each 0.2 hours p/w. On average children spent 6.5 hours per week on outdoor activities.

Gegharkunik children were more involved in outdoor activities (37.8%) compared to those from Yerevan (20.5%). This difference was also statistically significant.

**Parental visual problems.** Parents’ response rate to parental questionnaire was approximately 90%. Among 9.1% of children (myopia 5.4%, hyperopia 1.9%, astigmatism 0.5% and other visual problems 1.2%) only mothers had visual problem; among 6.6% (myopia 3.4%, hyperopia

1.2%, astigmatism 0.5% and other visual problems 1.5%) only fathers had visual problems; and among 4.4% both mothers and fathers had visual problems.

The rates of parental myopia (at least one myopic parent) were similar: 10.7% among children from Yerevan and 9.8% from Gegharqunik marz.

### ***3.2 Simple Logistic Regression***

Table 2 presents the results of simple logistic regression analyses for associations between myopia and independent variables with estimated crude odds ratios (OR), confidence intervals (CIs), and p-values. The estimated crude OR of the association between having myopia and living in Yerevan was 2.02 (95% CI: 1.46-2.79,  $p < 0.001$ ) meaning that the odds of having myopia among children living in Yerevan was approximately 2 times higher compared to children living in Gegharqunik marz. The estimated crude OR of the association between myopia and gender was 1.69 (95% CI: 1.23-2.33,  $p = 0.001$ ) suggesting that girls were 1.69 times more likely to have myopia than boys.

Compared to the children from first age category ( $\leq 10$  years old) the children from second age category ( $> 10$  years old  $\leq 15$ ) had 2.08 times higher odds of developing myopia (95% CI: 1.32-3.27,  $p = 0.002$ ) and the third age category had 2.48 times higher odds (95% CI: 1.63-3.76,  $p < 0.001$ ).

For children who read continuously 31-60 minutes and more than 60 minutes the crude odds of developing myopia was 1.97 (95% CI: 1.36-2.87,  $p < 0.001$ ) and 2.67 (95% CI: 1.81-3.93,

p<0.001) times higher (respectively) compared to children who read continuously less than 30 minutes.

Children who took additional studies requiring near work had 2.13 (95% CI: 1.55-2.93, p<0.001) times higher odds of developing myopia compared to those who did not take any additional studies. The crude OR of the association between school performance and myopia was 1.67 (95% CI: 1.14-2.45, p=0.009) times higher for the children who reported “good” performance at school and 1.90 (95% CI: 1.16-3.11, p=0.010) times higher among children who reported “excellent” performance, compared to those with “satisfactory” performance.

The estimated crude odds ratio between myopia and doing physical activity more than 18 hours in a week was 0.51 (95% CI: 0.33-0.80, p=0.003) compared to those with less than 18 hours of physical activity. The estimated crude odds ratio between myopia and doing outdoor activity more than 7 hours in a week was 0.50 (95% CI: 0.35-0.72, p<0.001) compared to those who did less than 7 hours.

The estimated crude OR of having at least one myopic parent was 2.88 (95% CI: 1.85-4.50, p<0.001) compared to those who did not have myopic parents.

Near work (composite), socio-economic statuses, child prematurity at birth were not significantly associated with myopia.



### ***3.3 Testing for Confounding***

Table 2 presents the results of the simple logistic regression between myopia and residence area and other independent variables. Gender, age, continuous reading, school achievement, additional studies, physical activity, outdoor activity, parental myopia were statistically significantly associated with myopia. Continuous reading, school achievement, additional studies, physical activity, outdoor activity were statistically significantly associated with residence area. This analysis concluded that age, continuous reading, school achievement, additional studies, physical activity, and outdoor activity were confounders of the relationship between myopia and residence area.

### ***3.4 Multivariate Logistic Regression***

For adjusted analyses, all variables with p-values less than 0.15 and all potential confounders known from the unadjusted analysis (age, gender, and region) were included into multiple logistic regression model. Interaction terms were tested for the potential genetic factor (at least one myopic parent) and the environmental factors (continuous reading, additional studies), and no statistical significant interactions were found. In multivariate logistic regression model, some factors lost their statistical significance: physical activity, outdoor activity, continuous reading up to 60 minutes. Additional studies and “good” grade at school obtained border-line statistical significance. Factors that maintained their high statistical significance independently associated with myopia were: region, gender, age, continuous reading more than 60 minutes, “excellent” school grade, and at least one myopic parent (Tables 3).

The odds ratio of having myopia is 2.14 times higher in Gegharqunik marz compared to Yerevan (OR=2.13: CI=95%: 1.48-3.06: p<0.001). Among girls the odds ratio of having myopia is 1.49 times higher compared to boys (OR=1.49: CI=95%: 1.03-2.16: p=0.032). Compared to the children from first age category ( $\leq 10$  years old) for the children from second age category ( $>10$  years old  $\leq 15$ ) the estimated crude odds ratio for myopia is 2.08 times higher (95% CI: 1.32-3.27: p=0.002) and for the third age category the crude odds ratio is 2.48 times higher (95% CI: 1.63-3.76: p<0.001). The odds of developing myopia is 1.79 (95% CI: 1.18-2.7: p=0.006) times higher among children who read continuously more than 60 minutes, compared to those who read continuously less than 60 minutes. The crude OR of the association between school grade and myopia is 1.52 (95% CI: 0.98-2.33: p=0.059) times higher for the children who have “good” grade at school, and 1.99 (95% CI: 1.11-3.56: p=0.021) times higher among children who have “excellent” grade, compared to the children whose grade at school is “satisfactory”. The estimated crude OR of having at least one myopic parent is 2.97 (95% CI: 1.85-4.50: p<0.0001) meaning that children who have one or more myopic parents are approximately 3 times more likely to develop myopia, compared to the children who do not have any myopic parent.

#### **4. Discussion**

The research questions for the current cross-sectional study was to identify the prevalence differences of myopia in Gegharqunik marz and Yerevan, investigate risk factors for developing myopia among school children, and evaluate modifiable environmental risk factors to prevent and reduce myopia. The study identified several risk factors associated with the development of myopia among school children.

**Yerevan-Gegharqunik Marz differences.** The prevalence rates of myopia are significantly higher among the students in Yerevan compared with Gegharqunik marz. Children in Yerevan are approximately two times more likely to be myopic than in Gegharqunik marz. The multivariate analysis indicates that aside from the environmental, demographic and genetic risk factors identified for myopia, there remain unknown determinants for myopia that differ between Yerevan and Gegharqunik marz. Some studies show that differences in more urban versus less urban areas and adult educational attainment are associated with myopia, which may explain some of these differences. Further study is required to understand these factors.

**Gender differences.** The study found gender differences for developing myopia. This finding is similar to other studies, showing that girls are more likely to develop myopia than boys. After controlling for school achievement, additional studies and continuous reading, where girls are different than boys, there were still independent unknown differences between girls and boys for the odds of having myopia.

**Continuous reading.** Myopic children were found to spend more time on continuous reading than non-myopic children, although the study found no statistically significant association between near work scores and myopia. The findings suggest that the number of hours of general near work plays little role in the development of myopia but the length of time of focused *continuous* close work does.

**School Achievement.** Children who perform better at school tend to be more myopic. Our finding is consistent with previous studies (40). School achievement may be a result of focused

higher cumulative hours spent on very near work, thus contributing to risk of myopia. Some studies have also found that results from IQ tests are associated with risk of myopia, but this remains controversial (41).

**Near Work.** There are many studies which find near work as a risk factor for myopia, but also others studies that find no association. This factor's association with myopia remains controversial. This study found no association between near work and myopia, though some characteristic components of near work such as additional studies, continuous reading, and school achievement were found to be associated with myopia. This contradiction may be in part due to inaccuracies in self-assessment of the time spent on near work activities reported by children or by the way that near work is defined.

**Prematurity.** The study did not find any association between low birth weight and preterm with myopia. There are several studies that have controversial findings for these associations. Some studies found a positive association between low birth weight and myopia when they conducted an eye examination within the first year after birth. However, no study was found that examined the association of prematurity with myopia at a later age.

**Socio-economic status.** Socio-economic status had no association with myopia. One study found a U-shaped association between socio-economic status and myopia, where those in the lowest and the highest status were at greatest risk of myopia (42). Other studies found a positive association between socio-economic status and myopia, while several other studies found no

association. Differences in findings may be due to socio-economic status measurement biases and/or cultural differences.

**Outdoor activity.** Some previous studies found a protective association for increased outdoor activity with myopia for children. This study found no association.

**Parental Myopia.** One of the findings of the study was the identification of a potential hereditary factor for myopia development. Consistent with other studies, children with myopia are more likely to have myopic parents. This study found that having at least one myopic parent is associated with a three-fold increased odds of being myopic. Previous studies suggest that there may be interaction between hereditary factors and environmental factors. However, after testing for interactions between environmental factors and having at least one myopic parent, no interaction was found.

## **5. Conclusion**

The main risk factors described in the literature were relevant for children 6-18 years old living in Yerevan and Gegharqunik marz. The study revealed that the number of hours of general near work plays a little role in the development of myopia but the length of time of focused continuous reading does. The findings show that both genetic and environmental factor have their independent roles in developing myopia. The following recommendations derived from the study findings:

- Increase the awareness of myopic parents about the elevated risk of myopia in their children and the need for regular eye screenings for its timely detection and correction

- Increase awareness of parents, children, and teachers about the benefits of taking breaks to look at distant objects during prolonged continuous near work
- Conduct further studies to investigate the role of living in rural areas and other risk factors not investigated in this study.

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*Tables*

**Table 1. Socio-demographic, health and learning behavior characteristics of study participants**

		Yerevan (%)	Gegharkunik marz (%)	Total (%)
Participants		42.8	51.8	100
Gender				
	<i>Male</i>	47.9	45.1	46.6
	<i>Female</i>	52.1	54.9	53.4
Age*				
	<i>≤10 years old</i>	31.6	27.6	29.6
	<i>&gt;10 and ≤15 years old</i>	29.9	27.6	28.8
	<i>&gt; 15 years old</i>	38.1	44.8	41.6
Parental myopia ( <i>at least one myopic parent</i> )		10.7	9.8	10.3
Refractive errors				
	<i>Overall</i>	31.6	15.9	21.5
	<i>Myopia</i>	22.8	11.8	17.9
	<i>Hyperopia</i>	3.5	3.2	3.4
	<i>Astigmatism</i>	5.3	0.95	3.2
Socio-economic status				
	<i>Rather less than average</i>	7.1	8.6	7.9
	<i>Slightly less than average</i>	9.3	13.3	11.4
	<i>Average</i>	59.8	61.3	60.6
	<i>Slightly more than average</i>	19.6	13.7	16.6
	<i>Rather more than average</i>	4.2	3.1	3.6
Continuous reading*				
	<i>≤60 minutes</i>	84.9	78.4	81.8
	<i>&gt;60 minutes</i>	15.1	21.6	18.2
Grade*				
	<i>Satisfactory</i>	25.1	34.6	30.2
	<i>Good</i>	56.7	52.5	54.7
	<i>Excellent</i>	18.2	12.9	15.2
Additional studies*				
	<i>Yes</i>	39.2	21.6	31.2
	<i>No</i>	60.8	78.4	68.8
Outdoor activity*				
	<i>Yes</i>	20.5	37.8	33.4
	<i>No</i>	79.5	62.2	66.6

**Table 2. The likelihood of having myopia according to risk factors: The results of unadjusted logistic regression**

		P-value	Unadjusted OR (95% CI)
Region			
	<i>Gegharkunik</i>		1.00
	<i>Yerevan</i>	0.001	2.02 (1.46; 2.79)
Gender			
	<i>Boys</i>		1.00
	<i>Girls</i>	0.001	1.69 (1.23; 2.33)
Age			
	$\leq 10$ years old		1.00
	$> 10$ and $\leq 15$ years old	0.002	2.08 (1.32; 3.27)
	$> 15$ years old	0.001	2.48 (1.63; 3.76)
Continuous reading			
	<i>0-30 min</i>		1.00
	<i>31-60 min</i>	<0.001	1.97 (1.36; 2.87)
	<i>&gt;60 min</i>	<0.001	2.67 (1.81; 3.93)
Additional studies			
	<i>No</i>		1.00
	<i>Yes</i>	<0.001	2.13 (1.55; 2.93)
School Achievement			
	<i>Satisfactory</i>		1.00
	<i>Good</i>	0.009	1.67 (1.14; 2.45)
	<i>Excellent</i>	0.010	1.90 (1.16; 3.11)
Physical Activity			
	$< 6$ hours per week		1.00
	$\geq 6$ hours $< 18$ hours per week	0.195	0.80 (0.57; 1.12)
	$\geq 18$ hours per week	0.001	0.45 (1.16; 3.11)
Outdoor activity			
	<i>No outdoor activity</i>		1.00
	$> 0$ h and $< 7$ hours per week	0.139	0.75 (0.52; 1.09)
	$\geq 7$ hours per week	<0.001	0.45 (1.16; 3.11)
Parental myopia			
	<i>No</i>		1.00
	<i>At least one parent</i>	<0.001	2.88 (1.85; 4.50)

**Table 3. The likelihood of having myopia according to risk factors: The results of adjusted logistic regression**

		P-value	Adjusted OR (95% CI)
Region	<i>Gegharkunik</i>		1.00
	<i>Yerevan</i>	< 0.001	2.13 (1.48; 3.06)
Gender	<i>Boys</i>		1.00
	<i>Girls</i>	0.025	1.52 (1.05; 2.18)
Age	<i>≤10 years old</i>		1.00
	<i>&gt; 10 years old</i>	< 0.001	2.36 (1.47; 3.81)
Continuous reading	<i>≤ 60 min</i>		1.00
	<i>&gt;60 min</i>	0.006	1.79 (1.19; 2.70)
Additional studies	<i>No</i>		1.00
	<i>Yes</i>	0.064	1.42 (0.98; 2.06)
School Achievement	<i>Satisfactory</i>		1.00
	<i>Good</i>	0.063	1.50 (0.98; 2.31)
	<i>Excellent</i>	0.024	1.95 (1.09; 3.46)
Parental myopia	<i>No</i>		1.00
	<i>At least one parent</i>	<0.001	2.95 (1.84; 4.72)

## Appendix 1. Mather/ Guardian Consent

**American University Of Armenia  
Institutional Review Board # 1/Committee On Human Research  
College Of Health Sciences Subcommittee For Student Theses**

*MOTHER/GUARDIAN CONSENT*

**Title of Research Project:** Investigation of Risk Factors for Refractive Errors (myopia, hyperopia, astigmatism) Development among schoolchildren in Yerevan and Gegharkunik marz

- 1. Who is doing the study:** My name is Greta Harutyunyan. I am a graduate student in Public Health at the American University of Armenia and a medical student in Yerevan State Medical University. The College of Health Sciences at the American University of Armenia conducts research on the risk factors for refractive errors.
- 2. Purpose:** The purpose of the study is to investigate the risk factors for refractive errors (myopia, hypermetropia, astigmatism) development in Yerevan and Gegharkunik marz, asking some questions to the children and their mothers and screening children's eye vision.
- 3. Why you are invited to participate:** Your child is being asked to participate in this study as we are targeting schoolchildren. Your child's participation in this study is very important and the information given by your child and you will be useful and valuable for this study.
- 4. Procedures:** During the study you will be asked several questions about your child (for example, birth weight), and we will ask several questions about your child about major risk factors for refractive errors (myopia, hyperopia, astigmatism) development. Then, eye-examination will be performed to detect refractive error if it exists.
- 5. Risks:** Participation to this study assumes minimal risk, as, in case of necessity, the procedure of eye dilatation (cycloplegia) may be performed. The information about whether the child has allergy to any medication will be obtained from the questionnaire answered by mothers (guardians).
- 6. Benefit:** The benefit from this study is that your child will get free eye-examination and medical advice (if needed).The ophthalmologist will provide written information about your child's vision status. In addition, your child's participation in this study will help to better understand the risk factors for refractive errors and make recommendations for prevention of the problem.

**7. Voluntary nature of the study:**

Your and your child's participation in this study is completely voluntary. You and your child can refuse to answer any of the questions or refuse to participate in this study without any consequences for you and your child.

**8. Confidentiality and Anonymity:**

Your and your child's participation is confidential. Your and his/her name and any characteristics that may identify your child or you will not appear on the questionnaire or in the results report of the study.

**9. Alternatives to participation:** Your child is free to decline participation at any time even after interview.

**10. Right to withdraw at any time:** Your child may withdraw from the study at any time and any data collected from you will be destroyed should you withdraw after interview.

**11.** Before we start, you should have had all your questions regarding participation in this study answered. If you have more questions about this study you can contact Dr. Varduhi Petrosyan, the Associate Dean of the College of Health Sciences at AUA calling 010-512592. If you feel you have not been treated fairly or think you have been hurt by joining this study, please contact Dr. Hripsime Martirosyan, AUA Human Subjects Administrator at 010-512561. If you consent to participate, we can start.

If you agree, please answer to the questions in the questionnaire and seal the envelope and send with your child to school; we will take it from the child.

**Հայաստանի ամերիկյան համալսարան  
Հանրային Առողջապահության մագիստրատուրա  
Դիպլոմային աշխատանք**

**Ծնողների բանավոր համաձայնագիր**

**Հետազոտության անվանումը՝** Ռեֆրակցիոն սխալների (կարճատեսություն, հեռատեսություն, աստիգմատիզմ) զարգացման ռիսկի գործոնների հայտնաբերումը Երևանի և Գեղարքունիք մարզի դպրոցահասակ երեխաների շրջանում

1. ԵսԳրետաՀարությունյաննեմ,  
Հայաստանի ամերիկյան համալսարանի Հանրային առողջապահության մագիստրատուրայի (ՀԱՄ) և Երևանի Պետական Բժշկական Համալսարանի (ԵՊԲՀ) վերջին կուրսի ուսանողուհի եմ: Հայաստանի ամերիկյան համալսարանի Առողջապահական գիտությունների ֆակուլտետը իրականացնում է հետազոտություն տեսողական խնդիրների (կարճատեսություն, հեռատեսություն, աստիգմատիզմ) զարգացման ռիսկի գործոնների վերաբերյալ:
2. Ակնկալում ենք Ձեր երեխայի մասնակցությունը այս հետազոտությանը, քանի որ ուսումնասիրությունը ընդգրկում է դպրոցահասակ երեխաներին: Ձեր և Ձեր երեխայի մասնակցությունը շատ կարևոր է, և նրա մասին տվյալները կլինեն օգտակար ու արժեքավոր:
3. Հետազոտության ընթացքում Ձեզ կտրվեն մի քանի հարցեր Ձեր երեխայի մասին, ինչպես նաև կտրվեն հարցեր Ձեր երեխային կարճատեսության կամ հեռատեսության կարևորագույն ռիսկի գործոնների վերաբերյալ: Այնուհետև, կիրականացվի երեխայի տեսողության սրության ստուգում և, ըստ անհրաժեշտության, աչքի մանրակրկիտ զննում:
4. Այս հետազոտության մասնակցությունը ենթադրում է նվազագույն ռիսկ, քանի որ միայն անհրաժեշտության դեպքում որոշ երեխաներ կանցնեն աչքի բքի լայնացման փուլը: Այդ ընթացքում երեխայի աչքի մեջ կկաթեցվի աչքի կաթիլ: Վերջինս իրականացվում է, եթե երեխան ունի տեսողական խնդիր և այն անհրաժեշտ է ավելի ճիշտ ախտորոշել: Ակնաբույժը կտրամադրի գրավոր ինֆորմացիա երեխայի տեսողության վերաբերյալ: Մինևույն ժամանակ Ձեր երեխան կշահի ստանալով անվճար աչքի մանրակրկիտ զննում և հարկեղծ դեպքում անբժշկական խորհրդատվություն: Ինչպես նաև Ձեր երեխայի մասնակցությունը այս ուսումնասիրությանը կօգնի ավելի լավ

հասկանալ վատ տեսնելու պատճառները դպրոցահասակ երեխաների մոտ և մշակել անհրաժեշտ կանխարգելիչ միջոցառումներ:

5. Ձեր և Ձեր երեխայի մասնակցությունը այս հետազոտությանը լիովին կամավոր է: Դուք կարող եք հրաժարվել մասնակցությունից հետազոտության ցանկացած պահի: Ձեր երեխան կարող է չպատասխանել ցանկացած հարցի: Հետազոտությունից հրաժարվելը ոչ մի բացասական հետևանք չի կարող ունենալ ոչ Ձեր, ոչ էլ Ձեր երեխայի համար:
6. Ձեր երեխայի վերաբերյալ տվյալները հասանելի կլինեն միայն հետազոտողներին: Այդ տվյալները կմնան գաղտնի և կօգտագործվեն միայն ընդհանրացված ձևով հետազոտության վերջնական վերլուծության համար:
7. Հետազոտության հետևյալ ավաճ հետազոտողների համար կարող եք գանգահարել Հայաստանի ամերիկյան համալսարանի Հանրային առողջապահության մագիստրատուրայի փոխդեկան՝ Վարդուհի Պետրոսյանին – 010-512592, իսկ եթե կարծում եք, որ հետազոտության ընթացքում Ձեր երեխային լավ չեն վերաբերվել և/կամ հետազոտությունը նրան վնաս է հասցրել կարող եք գանգահարել Հայաստանի ամերիկյան համալսարանի Էթիկայի հանձնաժողովի ադմինիստրատոր՝ Հոփսիմե Մարտիրոսյանին, հետևյալ հեռախոսահամարով՝ 010-512561:

**Եթե համաձայն եք, խնդրում ենք պատասխանել կցված հարցաշարի հարցերին, այն դեպքում տրամադրված ծրարի մեջ և փակել: Խնդրեք Ձեր երեխային ծրարը փոխանցել մեզ դպրոցում:**



## Appendix 2. Child Consent

**American University of Armenia  
Institutional Review Board # 1/Committee on Human Research  
College Of Health Sciences Subcommittee for Student Theses**

### CHILD CONSENT

(12-16 years old)

**Title of Research Project:** Investigation of Risk Factors for Refractive Errors (myopia, hyperopia, astigmatism) Development among schoolchildren in Yerevan and Gegharkunik marz

1. **Who is doing the study:** My name is Greta Harutyunyan. I am a graduate student in Public Health at the American University of Armenia and a medical student in Yerevan State Medical University. The College of Health Sciences at the American University of Armenia conducts research on the risk factors for visual problems (myopia, hypermetropia, astigmatism).
2. **Purpose:** The purpose of the study is to investigate the risk factors for (myopia, hypermetropia, astigmatism) development in Yerevan and Gegharkunik marz, asking some questions to the children and their mothers and screening children's eye vision.
3. **Why you are invited to participate:** You are being asked to participate in this study as we are targeting the schoolchildren. Your participation in this study is very important and the information given by you will be useful and valuable for this study.
4. **Procedures:** During the study we will ask questions about major risk factors for visual problems (myopia, hyperopia, astigmatism) development. Then, eye-examination will be performed to detect refractive error if it exists.
5. **Risks:** Participation to this study assumes minimal risk. The information about your allergy to any medication will be obtained from your mother.

**Benefit:** The benefit from this study is that you will get free eye-examination and medical advice (if needed). Your participation in this study will help better understand the risk factors for refractive errors and make recommendations for prevention of the problem.

6. **Voluntary nature of the study:** Your participation in this study is completely voluntary. You can refuse to answer any of the questions or refuse to participate without any consequences for.

7. **Confidentiality and Anonymity:** Your participation is confidential and anonymous. Your name and any characteristics that identify you child will not be associated with your interview or with the results of this study.
8. **Alternatives to participation:** You are free to decline participation at any time even after interview.
9. **Right to withdraw at any time:** You may withdraw from the study at any time and any data collected from you will be destroyed should you withdraw after interview.
10. Before we start, you should have had all your questions regarding participation in this study answered. If you have more questions about this study you can contact Dr. Varduhi Petrosyan, the Associate Dean of the College of Health Sciences at AUA calling 010-512592. If you feel you have not been treated fairly or think you have been hurt by joining this study, please contact Dr. Hripsime Martirosyan, AUA Human Subjects Administrator at 010-512561. If you consent to participate, we can start.

**Հայաստանի ամերիկյան համալսարան  
Հանրային Առողջապահության մագիստրատուրա  
Դիպլոմային աշխատանք**

**Երեխաների բանավոր համաձայնագիր  
(12-18 տարեկան)**

**Հետազոտության անվանումը՝** Ռեֆրակցիոն սխալների (կարճատեսություն, հեռատեսություն, աստիգմատիզմ) զարգացման ռիսկի գործոնների հայտնաբերումը Երևանի և Գեղարքունիք մարզի դպրոցահասակ երեխաների շրջանում

1. ԵսԳրետաՀարությունյաննեմ,  
Հայաստանի ամերիկյան համալսարանի Հանրային առողջապահության մագիստրատուրայի (ՀԱՄ) և Երևանի Պետական Բժշկական Համալսարանի (ԵՊԲՀ) վերջին կուրսի ուսանողուհի եմ:  
Հայաստանի ամերիկյան համալսարանի Առողջապահան գիտությունների ֆակուլտետի րականացնում է հետազոտություն տեսողական խնդիրների (կարճատեսություն, հեռատեսություն, աստիգմատիզմ) զարգացման ռիսկի գործոնների վերաբերյալ:
2. Ակնկալում եմ Ձեր մասնակցությունը այս հետազոտությանը, քանի որ ուսումնասիրությունը ընդգրկում է դպրոցահասակ երեխաներին: Ձեր մասնակցությունը շատ կարևոր է, և Ձեր մասին տվյալները կլինեն օգտակար ու արժեքավոր:
3. Հետազոտության ընթացքում Ձեզ կտրվեն մի քանի հարցեր կարճատեսության կամ հեռատեսության կարևորագույն ռիսկի գործոնների վերաբերյալ: Այնուհետև, կիրականացվի տեսողության սրության ստուգում և, ըստ անհրաժեշտության, աչքի մանրակրկիտ զննում:
4. Եթե Ձեզ մոտ հայտնաբերվի տեսողության խնդիր, պետք կլինի դեղամիջոց կաթեցնել աչքի մեջ աչքի բքի լայնացման համար: Վերջինս իրականացվում է տեսողական խնդրի ճիշտ ախտորոշման համար: Այդ ընթացքում Դուք չեք ունենա որևէ ցավային զգացողություն: Եթե Դուք ունեք դեղորայքի նկատմամբ ալերգիա, ապա Ձեզ մոտ աչքի մանրակրկիտ զննում չենք կատարի: Մասնակցելով այս ուսումնասիրությանը՝ դուք կշահեք ստանալով անվճար աչքի մանրակրկիտ զննում և հարկեղաձեռնում անբժշկական խորհրդատվություն: Ինչպես նաև Ձեր մասնակցությունը այս ուսումնասիրությանը կօգնի ավելի լավ հասկանալ վատ տեսնելու պատճառները դպրոցահասակ երեխաների մոտ և մշակել անհրաժեշտ կանխարգելիչ միջոցառումներ:

5. Ձեր մասնակցությունը այս հետազոտությանը լիովին կամավոր է: Դուք կարող եք հրաժարվել մասնակցությունից հետազոտության ցանկացած պահի: Կարող եք չպատասխանել ցանկացած հարցի: Հետազոտությունից հրաժարվելը ոչ մի բացասական հետևանք չի կարող ունենալ Ձեզ համար:
6. Մենք Ձեզ կտրամադրենք տվյալներ Ձեր տեսողության վերաբերյալ, անհրաժեշտության դեպքում նաև բժշկական խորհրդատվություն: Ձեր վերաբերյալ տվյալները կմնան գաղտնի և կօգտագործվեն միայն ընդհանրացված ձևով հետազոտության վերջնական վերլուծության համար:
7. Հետազոտության հետևյալ ավաժ հետազոտողներին համար կարող եք զանգահարել Հայաստանի ամերիկյան համալսարանի Հանրային առողջապահության մագիստրատուրայի փոխդեկան՝ Վարդուհի Պետրոսյանին – 010-512592, եթե կարծում եք, որ հետազոտության ընթացքում Ձեզ լավ չեն վերաբերվել և/կամ հետազոտությունը Ձեզ վնաս է հասցրել կարող եք զանգահարել Հայաստանի ամերիկյան համալսարանի Էթիկայի հանձնաժողովի ադմինիստրատոր՝ Հռիփսիմե Մարտիրոսյանին, հետևյալ հեռախոսահամարով՝ 010-512561:

### **Appendix 3. Child Assent**

**American University of Armenia  
Institutional Review Board # 1/Committee on Human Research  
College Of Health Sciences Subcommittee for Student Theses**

**Child Assent  
(6-12 years old)**

**Title of Research Project:** Investigation of Risk Factors for Refractive Errors (myopia, hyperopia, astigmatism) Development among schoolchildren in Yerevan and Gegharkunik marz

“Hi! My name is Greta Harutyunyan. I am graduate student in American University of Armenia and Yerevan State Medical University. We are going to examine your eyes in order to take care of your vision. This will help you to avoid any problems with eyes in older ages. Before starting the examination we would like to ask you some questions concerning your life and health. We want to be sure that everything is okay with your eyes. To detect this, we may drop some eye drops which will give us opportunity to identify whether you have any visual problem. You will not feel any pain during this procedure. Your participation in this study is completely voluntary. You can refuse to answer any of the questions or refuse to participate. If you have any questions do not hesitate to ask us. If you do not mind, let’s start the interview”.

**Հայաստանի Ամերիկյան Համալսարան  
Հանրային Առողջապահության մագիստրատուրա  
Դիպլոմային աշխատանք**

**Անչափահասների բանավոր համաձայնագիր  
(6-12 տարեկան)**

**Հետազոտության անվանումը՝** Ռեֆրակցիոն սխալների (կարճատեսություն, հեռատեսություն, աստիգմատիզմ) զարգացման ռիսկի գործոնների հայտնաբերումը Երևանի և Գեղարքունիկ մարզի դպրոցահասակ երեխաների շրջանում:

Ողջույն, ես Գրետա Հարությունյանն եմ: Հայաստանի ամերիկյան համալսարանի Հանրային առողջապահության մագիստրատուրայի (ՀԱՄ) և Երևանի Պետական Բժշկական Համալսարանի (ԵՊԲՀ) վերջին կուրսի ուսանողուհի եմ: Մենք կզննենք քո աչքերը՝ քո տեսողության համար հոգ տանելու նպատակով: Սա կօգնի հետագայում տեսողական խնդիրներից խուսափելու համար: Հետազոտությունը սկսելուց առաջ քեզ կտրվեն հարցեր քո կյանքի և առողջության մասին: Մենք ցանկանում ենք համոզվել, որ քեզ մոտ տեսողական որևէ խնդիր չկա: Վերջինս պարզելու համար, անհրաժեշտության դեպքում աչքի մեջ կկաթեցվեն աչքի կաթիլներ: Նրանք միանգամայն անցավ են:

Քո մասնակցությունը այս հետազոտությանը լիովին կամավոր է: Դու կարող ես հրաժարվել մասնակցությունից հետազոտության ցանկացած պահի: Կարող ես չպատասխանել ցանկացած հարցի: « Եթե քեզ մոտ հարցեր ծագեն, ապա մի խուսափիր հարցնել: Եթե դեմ չես, սկսենք հարցազրույցը»:

## Appendix 4. Questionnaire for children

### Risk Factors for Developing Myopia among 6-18 Years Old Schoolchildren in Yerevan and Gegharkunik marz

Identification Number: \_\_\_ \_\_\_ \_\_\_

Date: \_\_\_ \_\_\_ / \_\_\_ \_\_\_ / \_\_\_ \_\_\_ (dd/mm/yy)

Residency area  1. Yerevan

2. Gegharkunik marz

Interview Start Time \_\_\_\_\_

#### Demographic Information

1. Birth date: \_\_\_ \_\_\_ / \_\_\_ \_\_\_ / \_\_\_ \_\_\_ (dd/mm/yy)

2. Gender:  1. Male  2. Female

3. Weight: \_\_\_\_\_ kilos (*Record the body weight to the nearest 0.1 kg*)

4. Height: \_\_\_\_\_ cm (*Record the height to the nearest millimeter*)

#### Near Work

5. For how long do you **continuously** read without taking a break?

1. 0-15 minutes

2. 16-30 minutes

3. 31-45 minutes

4. 46-60 minutes

5. More than 60 minutes

6. Do you have any additional classes besides school hours that require near work?

1. Yes Please specify \_\_\_\_\_

2. No (skip the 7 question)

7. How many hours per week do you spend on additional classes?

- 1. Less than one hour
- 2. 1-2 hours
- 3. 2-3 hours
- 4. More than 3 hours

**8. How many *hours per day* you spend doing the following activities**

		On a school weekdays				On weekends			
		Not at all	< 1 hour	1-2 hours	≥3 hours	Not at all	< 1 hour	1-2 hours	≥3 hours
8-1.	Reading								
8-2.	Watching TV/video/DVDs								
8-3.	Playing video games (Playstation)								
8-4.	Drawing, painting and/or writing								
8-5.	School homework								
8-6.	Playing musical instruments								
8-7.	Using computer or playing computer games								
8-8.	Playing cell-phone games								
8-9.	Playing chess, cards or board games								
8-10.	Other _____								



**Physical and Outdoor Activity**

9. Please tick the activities you do *during the school term* and the number of *hours per week* you spend doing the activity. Include activities done **at school** and **at home**.

DURING THE 7 DAYS OF THE

WEEK

		Yes	No	Number of hours per week spent in this activity	Where is this done?	
					Outdoors	Indoors
9-1.	Dancing, gymnastics	<input type="checkbox"/>	<input type="checkbox"/>	_____ hrs per week	<input type="checkbox"/>	<input type="checkbox"/>
9-2.	Swimming	<input type="checkbox"/>	<input type="checkbox"/>	_____ hrs per week	<input type="checkbox"/>	<input type="checkbox"/>
9-3.	Football	<input type="checkbox"/>	<input type="checkbox"/>	_____ hrs per week	<input type="checkbox"/>	<input type="checkbox"/>
9-4.	Basketball	<input type="checkbox"/>	<input type="checkbox"/>	_____ hrs per week	<input type="checkbox"/>	<input type="checkbox"/>
9-5.	Physical activity classes at school	<input type="checkbox"/>	<input type="checkbox"/>	_____ hrs per week	<input type="checkbox"/>	<input type="checkbox"/>
9-6.	Physical activity at home	<input type="checkbox"/>	<input type="checkbox"/>	_____ hrs per week	<input type="checkbox"/>	<input type="checkbox"/>
9-7.	Other, please describe below _____	<input type="checkbox"/>	<input type="checkbox"/>	_____ hrs per week	<input type="checkbox"/>	<input type="checkbox"/>

**10. What is your school achievement?**

- 1. Excellent
- 2. Good
- 3. Satisfactory

## Detailed Eye Screening

### 11. Visual Acuity

1. Normal (1.0) (If 1.0, go to q. 13)

2. Worse than normal

*Vis.*    *OD* \_\_\_\_\_ *OS* \_\_\_\_\_ *OU* \_\_\_\_\_

### 12. Visual Acuity with the best possible correction:

*OD* \_\_\_\_\_ *OS* \_\_\_\_\_ *OU* \_\_\_\_\_

### 13. Have you ever visited an ophthalmologist?

1. Yes             2. No (go to 15<sup>th</sup> question)

### 14. Did the ophthalmologist prescribe eye glasses?

1. Yes             2. No (go to 16<sup>th</sup> question)

### 15. Do you wear glasses?

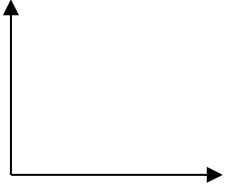
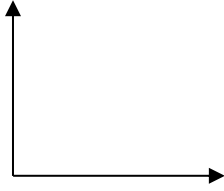
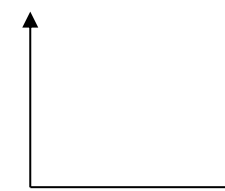
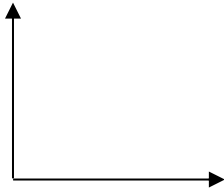
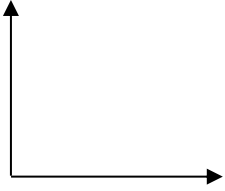
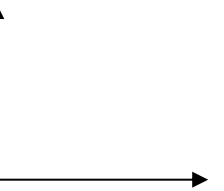
1. Yes             2. No

### 16. Refraction without cycloplegia.

1. Emetropy (go to 18<sup>th</sup> question)

2. Refraction disorder

17. Refraction after cycloplegia

OD	OS
<p>17.1 Myopia</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.5 – 6.0 3. <input type="checkbox"/> &gt;6.0</p> <p>4. <input type="checkbox"/> No</p> 	<p>17.11 Myopia</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.5 – 6.0 3. <input type="checkbox"/> &gt;6.0</p> <p>4. <input type="checkbox"/> No</p> 
<p>17.2 Hyperopia</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.25 – 6.0 3. <input type="checkbox"/> &gt; 6.0</p> <p>4. <input type="checkbox"/> No</p> 	<p>17.22 Hyperopia</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.25 – 6.0 3. <input type="checkbox"/> &gt; 6.0</p> <p>4. <input type="checkbox"/> No</p> 
<p>17.3 Astigmatism type</p> <p><input type="checkbox"/> 1. Simple</p> <p><input type="checkbox"/> 2. Mixed</p> <p><input type="checkbox"/> 3. Complicated</p> <p>17.4 Astigmatism</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.5 – 6.0 3. <input type="checkbox"/> &gt; 6.0</p> <p>4. <input type="checkbox"/> No</p> <p>17.5 Degree</p> 	<p>17.33 Astigmatism type</p> <p><input type="checkbox"/> 1. Simple</p> <p><input type="checkbox"/> 2. Mixed</p> <p><input type="checkbox"/> 3. Complicated</p> <p>17.44 Astigmatism</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.5 – 6.0 3. <input type="checkbox"/> &gt; 6.0</p> <p>4. <input type="checkbox"/> No</p> <p>17.55 Degree</p> 

**18. Eye position (If no strabismus, go to q. 21):**

1. Normal  2. Exsophthalm  3. Enophthalm  4. Strabismus

**19. Type of Strabismus** \_\_\_\_\_

**20. Strabismus angle:**

1.  $5^{\circ}$   2.  $10^{\circ}$   3.  $15^{\circ}$   4.  $20^{\circ}$   5.  $25^{\circ}$   6.  $> 25^{\circ}$

**21. Diplopia:**

1. Yes  2. No

**22. Eye Movements:**

1. Restricted  2. Full  3. Nystagmus

### **Status Oculorum**

**23. External part of the eye:**

1. Normal  
 2. Pathology  OD  OS

(Specify \_\_\_\_\_)

**24. Optical environment:**

1. Normal  
 2. Pathology  OD  OS

(Specify \_\_\_\_\_)

**25. Fundus:**

1. Normal

2. Pathology  OD  OS

(Specify \_\_\_\_\_)

**26. Intraocular Pressure Measurement with palpation method:**

1. Normotony  2. Hypertony  3. Hypotony

**27. Diagnosis:**

1. Healthy (the end of interview)  
 2. Eye pathology or refraction disorder

**28. Clinical diagnosis:**

1.  Refraction disorder \_\_\_\_\_
2.  Eye pathology \_\_\_\_\_
3.  Strabismus \_\_\_\_\_
4.  Other \_\_\_\_\_

**29. Recommendation:**

1.  Treatment in specialized eye department/clinic
2.  Treatment in outpatient clinic
3.  Glasses
4.  To be under the regular control of ophthalmologist

**Signature of Ophthalmologist:** \_\_\_\_\_

**Կարճատեսության զարգացման ռիսկի գործոնների հայտնաբերումը Երևանի և Գեղարքունիք մարզի 6-18 տարեկան դպրոցահասակ երեխաների շրջանում**

**(երեխաների հարցաշար)**

Տարբերակման համար: \_\_\_ \_\_\_ \_\_\_  
(օր/ամիս/տարի)

Ամսաթիվ: \_\_\_ \_\_\_ / \_\_\_ \_\_\_ / \_\_\_ \_\_\_

Բնակության վայր  1. Երևան

2. Գեղարքունիք մարզ

Հարցազրույցի սկիզբը \_\_\_\_\_

**Դեմոգրաֆիկ տվյալներ**

1. Ծննդյան ամսաթիվ: \_\_\_ \_\_\_ / \_\_\_ \_\_\_ / \_\_\_ \_\_\_ (օր/ամիս/տարի)

2. Սեռը:  1. Արական  2. Իգական

3. Քաշը: \_\_\_\_\_ կգ (*գրանցել 100գ-ի ճշգրտությամբ*)

4. Հասակը: \_\_\_\_\_ սմ (*գրանցել 5մմ ճշգրտությամբ*)

**Մոտիկ աշխատանք**

5. Որքա՞ն ժամանակ եք տրամադրում ընթերցանությանը առանց ընդմիջման:

1. 0-15 րոպե

2. 16-30 րոպե

3. 31-45 րոպե

4. 46-60 րոպե

5. 60 րոպեից ավել

6. Դպրոցից դուրս հաճախու՞մ եք լրացուցիչ պարապմունքների, որոնք պահանջում են մոտիկ աշխատանք:

- 1.  Այո Խնդրում եմք նշել \_\_\_\_\_
- 2.  Ոչ (բաց թողնել 7րդ հարցը)

7. Շաբաթական քանի՞ ժամ եք տրամադրում դպրոցից դուրս այդ լրացուցիչ պարապմունքներին:

- 1. մեկ ժամից քիչ
- 2. 1-2 ժամ
- 3. 2-3 ժամ
- 4. 3 և ավելի

8. Օրական քանի՞ ժամ եք ծախսում հետևյալ գործողությունների վրա:

		Դպրոցի օրերին				Դպրոցից ազատ օրերին			
		Չի զբաղվում	< 1 ժամ	1-2 ժամ	≥ 3 ժամ	Չի զբաղվում	< 1 ժամ	1-2 ժամ	≥ 3 ժամ
8-1.	Կարդալ								
8-2.	Հեռուստացույց դիտել								
8-3.	Վիդեո խաղեր խաղալ								
8-4.	Նկարչություն								
8-5.	Տնային հանձնարարություն								
8-6.	Որևէ երաժշտական գործիքնվագել								
8-7.	Համակարգիչ կամ համակարգչային խաղեր								
8-8.	Բջջային հեռախոսով խաղեր խաղալ								
8-9.	Շախմատ խաղալ, խաղաքարտեր կամ սետլան ի խաղեր								
8-10.	Այլ _____								

9. Խնդրում ենք նշել շարքական քանի՞ ժամ եք ծախսում նշված գործողության վրա:

		Այո	Ոչ	Շարքական ծախսված ժամաքանակը տվյալ գործողության վրա	Որտեղ է արվում	
					Փակ տարածքում	Բաց տարածքում
9-1.	Պար, գիմնաստիկա	<input type="checkbox"/>	<input type="checkbox"/>	_____ ժամ	<input type="checkbox"/>	<input type="checkbox"/>
9-2.	Լող	<input type="checkbox"/>	<input type="checkbox"/>	_____ ժամ	<input type="checkbox"/>	<input type="checkbox"/>
9-3.	Ֆուտբոլ	<input type="checkbox"/>	<input type="checkbox"/>	_____ ժամ	<input type="checkbox"/>	<input type="checkbox"/>
9-4.	Բասկետբոլ	<input type="checkbox"/>	<input type="checkbox"/>	_____ ժամ	<input type="checkbox"/>	<input type="checkbox"/>
9-5.	Դպրոցում ֆիզկուլտուրայի դասեր	<input type="checkbox"/>	<input type="checkbox"/>	_____ ժամ	<input type="checkbox"/>	<input type="checkbox"/>
9-6.	Տանը ֆիզիկական ակտիվություն	<input type="checkbox"/>	<input type="checkbox"/>	_____ ժամ	<input type="checkbox"/>	<input type="checkbox"/>
9-7.	Այլ, նշել _____	<input type="checkbox"/>	<input type="checkbox"/>	_____ ժամ	<input type="checkbox"/>	<input type="checkbox"/>

10. Ինչպիսին է ձեր առաջադիմությունը դպրոցում:

- 1. գերազանց
- 2 լավ
- 3. բավարար



## Աչքի զննման հարցաթերթիկ

Տարբերակման համարը \_\_\_\_\_ Ամսաթիվ: \_\_\_ / \_\_\_ / \_\_\_ (օր/ամիս/տարի)

### Ռեֆրակցիա

11. Տեսողության սրություն:

1. Նորմալ (1.0) (100% տեսողության դեպքում, անցնել շ#13- ին)

2. Նորմայից վատ

Vis. OD \_\_\_\_\_ OS \_\_\_\_\_ OU \_\_\_\_\_

12. Տեսողությունը ամենալավ հնարավոր կորեկցիայի դեպքում`

OD \_\_\_\_\_ OS \_\_\_\_\_ OU \_\_\_\_\_

13. Երբևէ՞ ակնաբույժի դիմել եք:

1. Այո  2. Ոչ (անցնել շ#15- ին)

14. Ակնաբուժը նշանակե՞լ է ակնոց:

1. Այո  2. Ոչ (անցնել շ#16- ին)

15. Դուք ակնոց կրու՞մ եք:


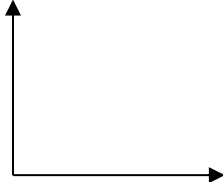
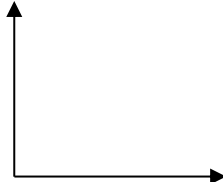
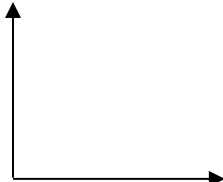


1. Այո  2. Ոչ

16. Ռեֆրակցիան առանց ցիկլոպլեգիայի:

1. Էմետրոպիա (անցնել շ#18)

2. Ռեֆրակցիոն խանգարում

17. Ուեֆրակցիան ցիկլոպլեգիայից հետո:

OD	OS
<p>17.1 Կարճատեսություն</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.5 – 6.0 3. <input type="checkbox"/> &gt;6.0                      4. <input type="checkbox"/> Չկա</p> 	<p>17.11 Կարճատեսություն</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.5 – 6.0 3. <input type="checkbox"/> &gt;6.0                      4. <input type="checkbox"/> Չկա</p> 
<p>17.2 Հեռատեսություն</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.25 – 6.0 3. <input type="checkbox"/> &gt; 6.0                      4. <input type="checkbox"/> Չկա</p> 	<p>17.22 Հեռատեսություն</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.25 – 6.0 3. <input type="checkbox"/> &gt; 6.0                      4. <input type="checkbox"/> Չկա</p> 
<p>17.3 Աստիգմատիզմի տեսակը`</p> <p><input type="checkbox"/> 1. Հասարակ <input type="checkbox"/> 2. Բարդ <input type="checkbox"/> 3. Խառը</p> <p>17.4 Աստիգմատիզմ</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.5 – 6.0 3. <input type="checkbox"/> &gt; 6.0                      4. <input type="checkbox"/> Չկա</p> <p>17.5 Աստիճանը</p> 	<p>17.33 Աստիգմատիզմի տեսակը`</p> <p><input type="checkbox"/> 1. Հասարակ <input type="checkbox"/> 2. Բարդ <input type="checkbox"/> 3. Խառը</p> <p>17.44 Աստիգմատիզմ</p> <p>1. <input type="checkbox"/> 0.5 – 3.0 2. <input type="checkbox"/> 3.5 – 6.0 3. <input type="checkbox"/> &gt; 6.0                      4. <input type="checkbox"/> Չկա</p> <p>17.6 Աստիճանը</p> 

18. Աչքի դիրքը (Եթե չկա շլություն անցեք Յ # 21)

1.Նորմալ 2.Էքզոֆթալմ 3. Էնօֆթալմ 4. Շլություն

19. Շլության տեսակը (*Նշեք*) \_\_\_\_\_

20. Շլության անկյունը (*Առաջնորդվեք Հիրշբերգի մեթոդով*)

1.5° 2. 10° 3.15° 4.20° 5.25° 6.> 25°

21. Երկտեսություն՝ 1.Այո 2.Ոչ

22. Աչքի շարժումները

1. Սահմանափակված 2.Լրիվ ծավալով 3.Նիստագմ

### Status Oculorum

23. Աչքի առաջային հատվածը:

1. Նորմալ է  
2. Առկա է պաթոլոգիա  OD  OS

(նշել \_\_\_\_\_)

24. Օպտիկական միջավայրերը:

1. Թափանցիկ  
2. Պղտորում  OD  OS

(նշել \_\_\_\_\_)

25. Ակնահատակ

1. Նորմալ է  
2. Առկա է պաթոլոգիա  OD  OS

(նշել \_\_\_\_\_)

26. Ներակնային ճնշման մոտավոր չափում *պալպատոր* եղանակով՝

1. Նորմոտոնիա       2. Հիպերտոնիա       3. Հիպոտոնիա

27. Եզրակացություն

- Առողջ է (*ավարտել հարցազրույցը*)
- Առկա է աչքի հիվանդություն կամ ռեֆրակցիոն խանգարում

28. Ախտորոշումը

- Ռեֆրակցիոն խանգարում՝ \_\_\_\_\_
- Աչքի հիվանդություն՝ \_\_\_\_\_
- Շլություն՝ \_\_\_\_\_
- Այլ՝ \_\_\_\_\_

29. Խորհուրդներ (*Նշեք համապատասխան կետերը*)

- Ստացիոնար բուժում
- Ամբուլատոր բուժում
- Ակնոցի կրում
- Ակնաբույժի հսկողություն

Ակնաբույժի ստորագրությունը՝ \_\_\_\_\_

**Appendix 5. Questionnaire for mothers/guardians**

**Risk Factors for Developing Myopia Among 6-18 Years Old Schoolchildren in Yerevan and Gegharkunik marz**

Identification Number: \_\_\_\_\_

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ (dd/mm/yy)

- Residency area     1. Yerevan  
                           2. Gegharkunik marz

**Please mention.**

**1. Your child's approximate weight just after delivery.**

1. \_\_\_\_\_kg

**2. Your child's approximate height just after delivery.**

1. \_\_\_\_\_cm

**3. Please mention approximate the duration of your pregnancy? (weeks or months)**

1. \_\_\_\_\_(months) or \_\_\_\_\_(weeks)

**4. Does your child have any of mentioned diseases? (mention all possible answers)**

- |   |  |
|---|--|
| <input type="checkbox"/> 1. Allergy to medication | <input type="checkbox"/> 4. Tuberculosis         |
| <input type="checkbox"/> 2. Cardiac Disease       | <input type="checkbox"/> 5. Diabetes             |
| <input type="checkbox"/> 3. Frequent diarrhea     | <input type="checkbox"/> 6. Other diseases _____ |

**5. Did your child have any eye injury in the past?**

1. Yes \_\_\_\_\_(*mention what*)  
 2. No

**6. Did your child have eye surgery?**

1. Yes \_\_\_\_\_ (*mention what*)

2. No

**7. Do you or your husband (your child's parents) have any visual problems?**

1. Yes, mother (mention the eye problem \_\_\_\_\_)

2. Yes, father(mention the eye problem \_\_\_\_\_)

3. Both of them(mention father's the eye problem \_\_\_\_\_)

4. None of them(mention mother's the eye problem \_\_\_\_\_)

**8. In general, how will you evaluate material situation of your family?**

1. Rather low from average

2. Slightly below from average

3. Average

4. Slightly higher from average

5. Rather above average

**9. On average, the monthly amount of money spent by your family.**

1. Less than 50000 drams

2. 50000-100000 drams

3. 100001-200000 drams

4. 200001-300000 drams

5. More than 300000 drams

**Thank You for answering the questions!!!**

**Please put this questionnaire in the provided envelop and seal it.**

**Կարճատեսության  
զարգացման օրհանգրվանների հայտնաբերումը Երևանի և Գեղարքունիք մարզի 6-18  
տարեկան դպրոցահասակ երեխաների շրջանում  
(ծնողների հարցաշար)**

Տարբերակման համար: \_\_\_\_\_

Ամսաթիվ: \_\_\_\_/\_\_\_\_/\_\_\_\_

(օր/ամիս/տարի)

Հետևյալ հարցերը վերաբերում են հետազոտությանը մասնակցող երեխային  
Խնդրում ենք նշել՝

1. Ձեր երեխայի մոտավոր քաշը ծնվելիս:

1. \_\_\_\_\_ կգ

2. Ձեր երեխայի մոտավոր հասակը (բոլոր) ծնվելիս:

1. \_\_\_\_\_ սմ

3. Ձեր հղիության մոտավոր տևողությունը: (ամիս կամ շաբաթ):

1. \_\_\_\_\_ (ամիս) կամ \_\_\_\_\_ (շաբաթ)

4. Ձեր երեխան ունի՞ արդյոք նշված հիվանդություններից որևէ մեկը:

1. Ալերգիա դեղորայքի նկատմամբ

4. Թոքախտ

2. Սրտի հիվանդություն

5. Շաքարախտ

3. Հաճախակի լուծ  
հիվանդություններ \_\_\_\_\_

6. Այլ

**5. Ձեր երեխաներին՞ ստացել է աչքի վնասվածք:**

1. Այո (նշել ինչպիսի վնասվածք -----)

2. Ոչ

**6. Ձեր երեխաներին՞ ունեցել է աչքի վիրահատություն:**

1. Այո (նշել ինչպիսի վնասվածք -----)

2. Ոչ

**7. Խնդրում եմ նշել Դուք (երեխայի ծնողները) ունե՞ք որևէ տեսողական խնդիր՝  
կարճատեսություն, հեռատեսություն կամ աստիգմատիզմ:**

1. Այո, միայն մայրը( նշել տեսողական խնդիրը \_\_\_\_\_)

2. Այո, միայն հայրը(նշել տեսողական խնդիրը \_\_\_\_\_)

3. ԵՎ հայրը, և մայրը(նշել ի՞նչ տեսողական խնդիրը \_\_\_\_\_)  
(նշել մոր տեսողական խնդիրը \_\_\_\_\_)

4. Ոչ հայրը, ոչ մայրը( նշել տեսողական խնդիրը \_\_\_\_\_)

**8. Ընդհանուր առմամբ ինչպե՞ս կգնահատեիք Ձեր ընտանիքի նյութական վիճակը:**

1. Միջինից բավականին ցածր

2. Միջինից մի փոքր ցածր

3. Միջին

4. Միջինից մի փոքր բարձր



5. Միջինից բավականին բարձր

**9. Միջինում որքան գումար է ծախսում Ձեր ընտանիքը:**

1. 50000 դրամից քիչ

2. 50000-100000 դրամ

3. 100001-200000 դրամ

4. 200001-300000 դրամ

5. 300000 դրամից ավել

5. Չգիտեմ/ Հրաժարվում եմ պատասխանել

**Շնորհակալություն հարցերին պատասխանելու համար:**

Խնդրում ենք Ձեզ տեղադրել լրացված հարցաթերթիկը տրամադրված ծրարի մեջ և փակել այն: