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**REPORT  
to  
UNICEF and Jinishian Memorial Foundation**

**Boarding School  
Visual Impairment Project 2002**

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*See also, separate appendix: Manual of Operations*

## **Executive Summary**

Hundreds of millions of children worldwide are on the margins of society due to wars, deep poverty, or other family upheavals. Their exclusion from proper education, health care, and family support, has long-term and life-threatening consequences. Many of them live in institutions under governmental patronage. Very often the living conditions and attitude of staff are not appropriate to create a healthy environment and family atmosphere for children. Those children are often at higher risk for health disorders. GMEIPO proposed and implemented “Boarding School Visual Impairment Project 2002”, designed to determine visual impairments and other major health problems among approximately 600 children living at or attending four institutions in Armenia with support from UNICEF/Armenia and the Jinishian Memorial Fund.

The rate of blindness and low vision among screening participants was determined: it exceeds the European benchmark several times over. The main causes of blindness were congenital glaucoma and cataract. The analysis revealed high rates of refraction pathologies, strabismus and vernal conjunctivitis among screened children.

Anthropometric measurements of the children revealed stunting and under nutrition. The pediatrician’s assessment detected delayed physical development, short height, and body weight deficiency in a majority of the schoolchildren. Specific deformations and pathologies of skeletal-muscular system are very frequent among children in the surveyed schools, ranging from one-third to more than half of all children surveyed, which could be attributed to the inadequate physical exercise and overall low level of harmonic physical development of a child. Many children have specific retardation of learning abilities development, delayed reactions, and communication problems. These disorders are mainly explained by defects of

upbringing, lack of attention from the adults (both parents and teachers) to children, and poor education compounded by poor nutrition, likely stemming back to the prenatal period.

Analysis of the data revealed that children in boarding schools need special attention of governmental and international health organizations: special prevention and treatment interventions are required.

It is highly recommended to organize similar health screening, prevention, and treatment programs in other boarding schools of Armenia in order to have comprehensive and generalizable information on health status of institutionalized children in the country and to begin addressing the unmet needs.

While not generalizable, these findings confirm that institutionalized children are indeed among Armenia's most vulnerable population and are in dire need of improved medical and health conditions if they are to reach their full potential. This treatment and assessment program highlights the critical need for expanding programs and assessments to ensure the health of institutionalized children.

## Key Project Participants

### ***Naira Khachatryan, MD, MPH: Program Manager***

Dr. Khachatryan was responsible for day-to-day management of the project, development of detailed study procedures, training of staff, direct supervision of the examination of participants, analysis of the data, submission of final report, and monitoring of the study budget.

### ***Ylizabeth Danielyan, MD, MPH: Project Assistant***

Dr. Danielyan was involved in preparatory activities, development of research methods and tools, training of field staff, data management and analysis, as well as preparing of final report.

### ***Michael E. Thompson, MS, DrPH: CHSR Director***

Dr. Thompson provided consultation and guidance throughout the project. He was responsible for the development of an appropriate data management and analysis system for the study.

### ***Gajane Manrikyan: Pediatrician***

Dr. Manrikyan performed health examination of all children involved in the study. Her activities included interviewing a child and conducting external examination. Dr. Manrikyan was also responsible for identification of children requiring further diagnostic and/or treatment and provision of written recommendations.

### ***Serunan Aghamiryan: Neuropathologist***

Dr. Aghamiryan conducted screening of children with a focus on detection of neurological disorders. Her activities included brief interview of a child and then detailed external examination. Dr. Aghamiryan was also responsible for making a final diagnosis and providing written recommendations.

### ***Anastasia Stepanyan: Ophthalmologist***

### ***Andranik Gasparyan: Ophthalmologist***

### ***Lilit Aghayan: Ophthalmologist***

Drs. Stepanyan, Gasparyan, and Aghayan had primary responsibility for conducting the detailed eye examination on those subjects who were referred after basic eye screening. They also conducted basic eye screening. When necessary, participants were provided with written recommendations for further treatment and follow-up or prescription for glasses.

### ***Samvel Petrosian: Optometrist***

### ***Henrik Khachatryan: Optometrist***

These optometrists were responsible for assisting in conducting basic eye screening and matching the lenses and frames for the children.

### ***Ruzanna Manukyan, MD: Interviewer***

Dr. Manukyan was responsible for conducting face-to-face interviews with all participants to obtain socio-demographic information and medical history, as well as information on food intake and nightblindness symptoms.

## **1. Background**

UN experts estimate that hundreds of millions of children worldwide are on the margins of society due to wars, deep poverty, or other family upheavals. Their exclusion from proper education, health care, and family support, has long-term and life-threatening consequences [1-4]. Many of them live in institutions under governmental patronage. In Armenia, institutionalization, quite apart from being an alternative for children deprived of their parents, is effectively a substitute for parents who do not have the means to maintain their children. Children, who are disabled, also make up a high proportion of the institutionalized in the country.

In Armenia, reliance on institutionalized care for children is a legacy of the communist period. Now, a number of institutions such as public orphanages are barely able to support the children residing there [1-4]. Very often, the living conditions and attitude of staff are not appropriate to create a healthy environment and family atmosphere for children. Those children are at higher risk for a variety health disorders. Special attention is required from governmental and non-governmental organizations to ensure that quality health care, including preventive care, is monitored and guaranteed for those children.

The study conducted by Garo Meghrigian Eye Institute for Preventive Ophthalmology of the Center for Health Services Research and Development, American University of Armenia, during summers 2000 and 2001 measuring the prevalence and risk factors of eye diseases as well as nutritional status of almost 6 000 school-age children in summer camps of Armenia supports this assumption. The prevalence of various eye pathologies was higher among orphanage children and children from vulnerable families. The analysis revealed that almost half of the children living in orphanages were stunted and a quarter had protein-energy malnutrition (PEM). The analysis also demonstrated a high rate of stunting, PEM and wasting

among children in vulnerable categories with statistically significant association between vulnerability and stunting and PEM [5,6].

Based on UNICEF reports [1-4] as well as results from Summer Camps Projects [5,6] and WHO defined “Vision 2020” program priorities, GMEIPO proposed and implemented “Boarding Schools Visual Impairment Project 2002”, designed to determine visual impairments and other major health problems among approximately 500-600 children living at or attending four institutions in Armenia. While not a population-based study, the program was designed to be thorough in its assessment so as to provide as much good as possible to the participating children and to provide policy makers a sense of the magnitude and distribution of problem facing all institutionalized children.

## **2. Specific Aims**

The specific aims of the project were:

- Conduct an eye screening of approximately 600 children residing at, or attending four boarding schools selected by UNICEF and the Ministry of Education and Science of Armenia.
- Conduct examinations of each child by a pediatrician and a neurologist to determine the prevalence of various health disorders among institutionalized children.
- Interview each child to complete a questionnaire designed to collect information about socio-demographics, nutrition patterns, and nightblindness to identify sub clinical manifestations of Vitamin A deficiency (VAD).
- Conduct anthropometric measurements of each child for nutritional status evaluation based on height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) indicators.

- Correct refractive errors and provide free eyeglasses to improve the child's visual acuity, visual function, and visual comfort.
- Identify those children who needed further diagnostics, therapeutical treatment, and/or surgical interventions beyond the scope of this project, providing written recommendations for advanced diagnostics/treatment in specialized hospitals.
- Analyze data and provide a written final report containing a detailed descriptive summary with recommendations for follow-up interventions or studies.

### **3. Methods and Materials**

#### **3.1 The design and components of the study**

The project was a cross-sectional study of the prevalence of blindness and low vision, Vitamin A deficiency, physical development problems, mental and neurological pathologies, developmental deficiencies, and other health related disorders among institutionalized children. For that reason four boarding schools were selected and 593 children studying/living there were screened. An ophthalmologist, a pediatrician and a neurologist examined the children. Each child was interviewed on the issues of socio-demographics, nutrition patterns, and night blindness. For more precise evaluation of nutrition status, anthropometric measurements based on height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) indicators were performed [7,8].

#### **3.2 Manual of Operations**

The GMEIPO staff developed a Manual of Operations, which included questionnaires on food intake and nightblindness symptoms; pediatric, neurological, and basic, and detailed eye screening forms; and guidelines for interviewer, pediatrician, neurologist and ophthalmologist (separate for basic and detailed eye examination). A questionnaire on food intake was developed to assess the nutritional status of children with emphasis on Vitamin A intake to reveal sub-clinical manifestation of nightblindness. This instrument was developed by

GMEIPO staff using the Helen Keller International (HKI) food frequency method to assess the Community risk of Vitamin A deficiency, and Alfred Sommer's "Vitamin A deficiency and its consequences – a field guide to detection and control" [9, 10]. Apart from that, the questionnaire also included minimal socio-demographic information, such as age, gender, place of residence, place of birth, nationality, parents' occupation, and sources of income.

The staff of GMEIPO in consultation with qualified pediatricians and neurologists developed the examination forms for general health and neurological screenings. Eye Screening instruments were developed based on forms previously elaborated and tested for projects implemented by GMEIPO (Summer camps-2000 and 2001 projects) [11, 12]. In preparation for the current project, only minimal changes were introduced to correct identified weaknesses and to amend the format.

The study instruments were pre-tested on 6 randomly selected children from a Yerevan boarding school for children with speech disorders, and subsequently revised to the final form.

### **3.3 Staff training**

Job vacancies for pediatrician, neurologist, ophthalmologist and interviewer were announced via the AUA job server list. The Announcements were also placed at the polyclinics and ophthalmic clinics of Yerevan. Overall, there were 21 applicants of whom 7 were recruited via a competitive interview process. The field staff was formed out of three ophthalmologists, a pediatrician, a neurologist, an interviewer, and one optometrist from "Linza" Ltd, who kindly donated his time and was fully involved in the entire phase of project implementation. The field staff completed two day training at GMEIPO.

### **3.4 Ethical Considerations**

The informed consent for caregivers was developed by GMEIPO in English and Armenian languages. In general, the project was mainly provision of medical services, however the interview included also information on children's family life. The project proposal was reviewed and approved by the AUA Committee on Human Research (IRB). The written informed consent form (Manual of Operations) was addressed to a caregiver of a child. This decision was made because of the fact the majority of the children in boarding schools were from different regions of Armenia and it was difficult to reach their parents to provide them with informed consent, and some of the children were orphans. In each of the schools, the director was considered the person legally responsible to give his/her permission for a child's participation. Apart from general information about the study, the informed consent also stated the child's right to refuse to answer to any question, to stop the interview and the screening itself, and assured confidentiality of the information provided.

### **3.5 Data review, entry, cleaning and analysis**

A database was constructed using the SPSS statistical software package. Trained data entry operators performed double entry and cleaning of the data. The statistical analysis was carried out using SPSS.11.0 software. Recoding and rescaling of some questions was performed. New variables on food intake were created. The questionnaire was composed to allow determination of whether or not there was a Vitamin A deficiency among children under study, rather than determine the amount of daily intake of Vitamin A.

According to recommendations of HKI Food Frequency Method [9] for analysis of the received data the following groups were separated after appropriate calculations: the total consumption of animal sources of Vitamin A; the adjusted consumption of plant sources; and the weighted total consumption. Each one of the four surveyed boarding schools was considered as a community and in order to receive the final variables on vitamin A deficiency

the following procedures were performed. For each school, two variables were calculated: the mean frequency of consumption of animal sources of Vitamin A and the mean frequency of total consumption of animal and plant sources of Vitamin A (weighted by the source).

According to HKI FFM standards [9] Vitamin A deficiency is observed if the mean frequency of consumption of animal sources of Vitamin A is 4 days per week or less, or the mean frequency of total consumption of animal and plant sources of Vitamin A (weighted by source) is 6 days per week or less.

In this study visual acuity was presented in decimals [13]. In decimal system, the inverse quantity of the visual angle 1 is accepted as a normal visual acuity, equal to one (visus=1.0).

If the angle is larger, i.e. 5, the visual acuity will decrease (visus=0.2); if the angle is smaller, i.e. 0.5, then the visual acuity will be twice larger (visus=2.0) [14].

The data ranged from 1.0 to 0.0. In case of finger counting and light perception, the data was recorded as 0.0. The visual acuity data was then converted into the following categories: 1.00-0.40; 0.30-0.20; 0.01-0.05; <0.05. The WHO classification of ranges for vision loss was used [13]. Visual acuity 1.00-0.40 was considered Normal Vision, patients with visual paucity 0.30-0.05 were considered Visually Impaired, and those with vision less than 0.05 were classified as Blind. New variables for visual acuity were developed representing the best and worst visual acuity for both eyes. Separate variables on myopia, hyperopia, and astigmatism for each eye were combined and new variables were generated to represent refraction pathology in one or both eyes.

New variables were also created to group pediatric, neurological and ophthalmologic data.

Statistical tests of significance were conducted using  $\chi^2$  tests for proportions or for trend as appropriate. Univariate analysis was performed.

GMEIPO staff regularly observed the interviewing of participants and the process of screening in order to assure quality.

#### **4. Results**

The field phase of the project started on 29 May 2002 and concluded on 18 July. Based on recommendations of the Ministry of Education and Science, four boarding schools were selected for the project: Yerevan Boarding School for Children with Visual Impairments, Goris Boarding School for Children with Poor Vision and Socially Unprotected Children, Vardashen Republican Special Educational Complex, and Dilijan Sanitary Boarding School Number 8 attached to Sanatorium. All children present at the boarding schools at the time of the screening participated in the survey. Overall, data for 593 children were obtained in the course of the project and 176 pairs of glasses were prescribed.

The administrative staff in each selected school was contacted by GMEIPO two weeks in advance of the screening. The lists of all children attending the institutions were obtained and in cooperation with administration of each particular school, schedules for the screenings were designed.

The number of children screened in the four schools is as follows: 80 of children in Yerevan Boarding School for Children with Visual Impairments; 291 children in Goris Boarding School for Children with Poor Vision and Socially Unprotected Children; 56 children in Vardashen Republican Special Educational Complex; and 166 children in Dilijan Sanitary Boarding School Number 8 attached to Sanatorium.

#### 4.1 Interview

In *Yerevan Boarding School* out of 111 children studying there, 72% (n=80) were screened.

The main reason for incomplete coverage was the late start of the project: children had been dismissed for summer holidays. As many of them live in remote regions of Armenia and in Nagorno Karabagh, it was difficult to contact those children, and/or they could not arrange to return to Yerevan.

The age of children ranged from 8 to 20 years old with mean age 13.8 (median 4.0, SD 3.6).

The proportions of boys and girls in the school were equal. Children studying in this school were from the following regions: Vedi, Vajots Dzor, Yerevan, Ararat, Artashat, Amasia, Giumri, Karabagh, Lori, and Masis. Only one child was refugee.

From the personal history, the main finding was the poor compliance with the immunization schedule: 83% received their vaccination late, for 8.3% of children immunization was incomplete: only 8.3% had normal vaccination.

In *Goris Boarding School*, out of 302 children studying there 96.4% (n=291) were interviewed and screened by physicians. The mean age of children was 12.3 (median 12.0, mode 12, SD 2.8) ranging from 6 to 18 years old. Boys composed 55% of all schoolchildren and girls 45%. In 95% of cases, the birthplace of children was Goris. Some 3.8% (n=11) of the children were refugees.

Review of personal histories revealed birth trauma (asphyxia, preterm birth, cephalohematoma, etc.) in 5.5% of children. Immunization was normal for 31.5% of the children, late for 63.1% and incomplete for 5.4%.

In *Vardashen Educational Complex*, 93.3% of all children (n=60) were screened and interviewed. Mean age of children was 14.6 (median 15.0, mode 14, SD 1.9), ranging from 10 to 19 years old. There were more boys (51.8%) than girls (48.2%). Of all children, 3.6% were refugees. Children studying in Vardashen school were born in different regions of Armenia. More than one-third of them (35.7%) were born in Yerevan, 21.4% in Giumri, and the rest of the children were born in Artashat, Armavir, Goris, Ijevan, and several other regions. There were no personal histories of the children in school; consequently, no information was collected.

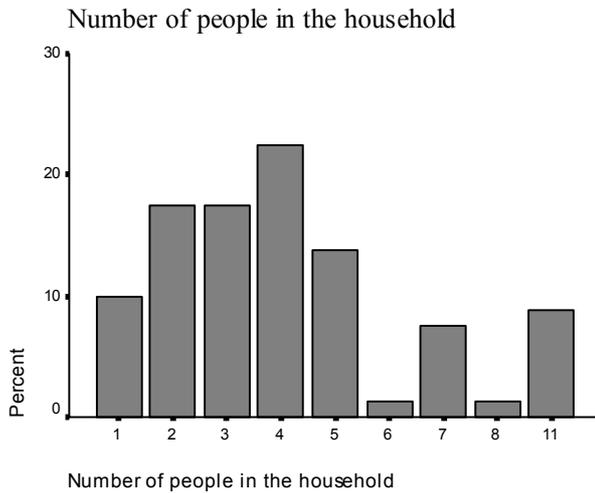
*Dilijan Sanitary School #8* has special status. Apart from the children who study there on a regular basis, many children from different regions of Armenia come to that school during the summer holiday as a health centre. Children who had TB contacts are also sent to that school as a sanatorium. This unique status of the school does not allow drawing inferences about the health status of institutionalized children in the Dilijan region. They are conditionally considered as a separate population and referred to in the text as “children in Dilijan”. Overall, 166 children were examined by physicians. The mean age of children in that school was 12.2 (median 13.0, mode 13, SD 2.2) and ranged from 5 to 18 years old. There were 50.6% boys and 49.4% girls in the school. Majority of children (70.5%) were born in Yerevan. The rest were born in Dilijan, Metsamor, Vanadasor, Abovian, Armavir, Echmiadzin, and several other regions. Refugees composed 3.1% of the children.

#### ***4.1.1. Household Composition and parental status and employment***

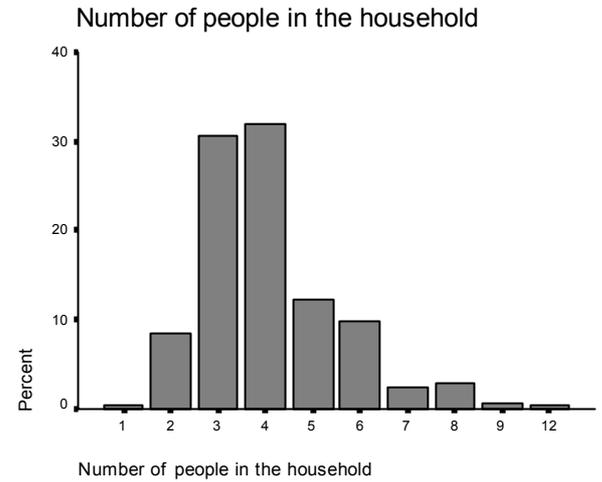
The mean number of people living in a household was on average 4.0 in all surveyed schools. The ranges were also similar varying from 1 to 12. However the proportions of different household sizes varied among four schools (Figures 1-4). Children in Yerevan Boarding School and Vardashen Educational Complex mentioned one person in the household in 10

and 11 percent of cases respectively. Yerevan school was also the leading (8.8%) in proportion of households comprised of 11 family members (Figure 1).

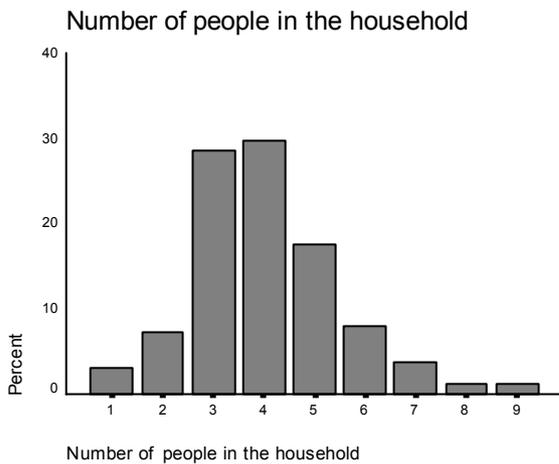
**Figure 1. Number of people in family in Yerevan Boarding School N=80.**  
 Mean=4.2 (median 4.0, SD 2.7, range 2-11)



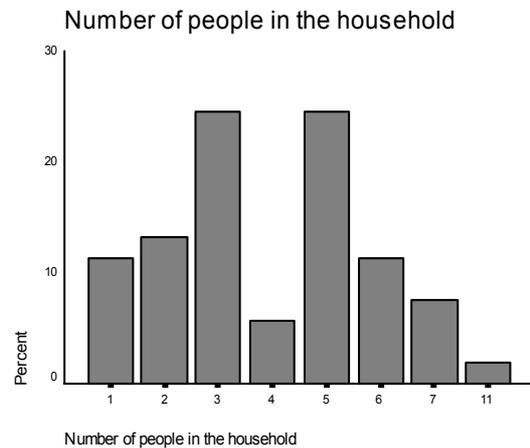
**Figure 2. Number of people in family in Goris Boarding School N=291**  
 Mean=4.1 (median 4.0, SD 1.51, range 1-12)



**Figure 3. Number of people in family in Dilijan Sanitary School N=166.**  
 Mean=4.0 (median 4.0, SD 1.5, range 1-9)



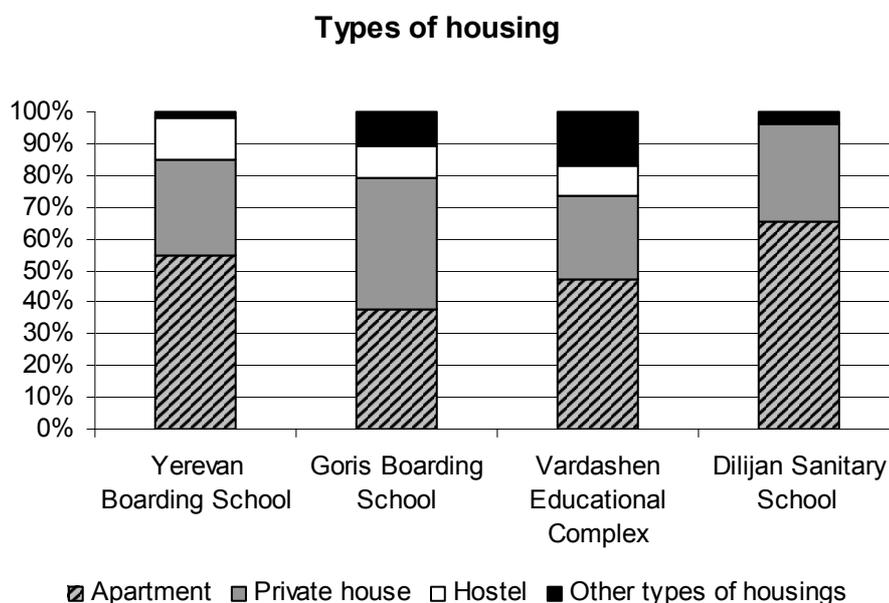
**Figure 4. Number of people in family in Vardashen Educational Complex N=56**  
 Mean=3.8 (median 3.0, SD 2.1, range 1- 11)



In Yerevan boarding school the majority of children (55.1%) indicated apartment as a housing type, 29.5% house, 12.8% hostel. In Goris, more children (40.9%) mentioned living in house than an apartment (38.1%). Equal proportions of children live in hostel (10.1%) and in other types of housings (10.8%). In Vardashen, majority of children (51%) live in apartments,

29.1% live in private households, 1.8% - in hostel, and the rest of the children (18.2%) in other types of housings. About 31% of children in Dilijan sanitary school said that they live in private households and majority (65.2%) live in apartments.

**Figure 5. The distribution of various types of housings where surveyed children live. Boarding School Visual Impairment Project 2002.**



Naturally in Yerevan Boarding School, few children mentioned livestock/animals in the household. Dairy cows were indicated by 18.2% of children (n=4), sheep/goats by 13.6% children (n=3), pigs by 9.1% children (n=2), and poultry by 18.2% children (n=4). In Goris of those children who live in private households, 24.8% (n=28) mentioned that they have dairy cows and 34.5% have poultry in their households. Sheep/goats and pigs were mentioned by 2.7% and 3.5% respectively. In Vardashen, similarly to Yerevan, only a few children mentioned having livestock/animals in the household. In Dilijan school those children who live in private houses mentioned having dairy cows in 10.4% of cases (n=5), pigs in 12.5% of cases (n=6) and poultry in 31.3% of cases (n=15).

Children were also asked to answer some questions about their parents. In *Yerevan Boarding School*, 18.7% mentioned that their fathers do not live with them. About 25% indicated that their parents are divorced. Those children whose fathers live with them mentioned that their

fathers are unemployed in 59.3% of cases. Of those, whose fathers are employed 95.5% mentioned “state job” as a type of their work. About 31.5% of the children reported that their fathers are pensioners and another 31.5% of the children said that their fathers have disability. Nearly all children (98.7%) mentioned living with their mothers, 65.3% of whom are unemployed. About 13.3% of children indicated that their mothers are pensioners and 12% mentioned that they are disabled. Those children, whose mothers were employed mentioned “state job” as a type of mother’s work in 84.6% of cases. Majority of the children (57.5%) had family members living outside Armenia of whom 71.1% were in contact with their families. Overwhelming majority of children 89.5% mentioned that their families receive family benefits, from state or different charitable funds.

In *Goris Boarding School*, majority of children (81.4%) answered that their fathers live with them. Divorce of the parents was mentioned by 6.87% of the respondents. Those children who live with their fathers reported that they are unemployed in 63.6% of cases. In case of employment the main type of work was “state job” (98.7%) and some 4.24% of children mentioned that their fathers work outside Armenia. About 12% of the children indicated that their fathers are pensioners, and 14.8% said that they are disabled. Nearly all of the children (98.3%) mentioned that they live with their mothers, of whom only 35.9% are employed. The type of job was indicated as a “state job” by 99% of children, whose mothers were employed. Only 4.4% of the children mentioned that their mothers are pensioners, and a similar proportion of children indicated that they have disabilities. Nearly half of all children (46.2%) reported that they have family members living outside Armenia, and 64.9% of them are in contact with their families. The majority of the children (62.5%) indicated that their families receive family benefits from state or different charitable funds.

In *Vardashen Educational Complex*, a large proportion of the children (44.6%) mentioned that they do not live with fathers. The percent of those children who indicated that their parents are divorced composed 37.5%. Fathers were unemployed for 38.9% of children. State job was the only type indicated by children, whose fathers worked. About 31.6% of the children said that their fathers are pensioners and a similar proportion reported that fathers have some disabilities. The majority of the children (94%) indicated that they live with their mothers. The overwhelming majority of mothers are unemployed according to children's answers (73.9%), the rest have state job. About 14.9% of the children answered that mothers are pensioners and 8.5% reported that their mothers are disabled. Majority of the children (59.3%) reported having relatives outside Armenia, of those about 35.5% are in contact with their families. About 60.4% of children reported receiving family benefits from state or different charitable funds.

In *Dilijan Sanitary School*, the majority of the children (78.3%) mentioned that their fathers live with them. The percent of divorced parents was 8.4%. The proportion of children who answered that their fathers are unemployed was 26%. Children indicated that their fathers have state job in 90.7% of cases, private business or farm in 8.2%, and work outside Armenia in 7.2% of cases. Equal proportions of children mentioned that their fathers are pensioners or disabled (5.4%). As in all other schools, the overwhelming majority of children (98.8%) indicated that they live with their mothers. The proportion of those children whose mothers are unemployed was 50.6%. Those mothers who were employed had state job in 98.7% of cases. About 3.8% of the children indicated that their mothers are pensioners and 4.4% that they are disabled. Majority of the children reported that they have family members living outside Armenia, of whom 82.3% are in contact with their families. Almost 45% of the children mentioned that their families receive benefits from state or different charitable funds.

#### ***4.1.2. Vitamin A intake and nutritional status***

Detailed assessment of children's nutritional status was not in the scope of the project objectives, however, some information was received through questionnaire on food intake and children's anthropometric measurements. The questionnaire included those food items which are considered as the main sources of  $\beta$ -carotene and retinol. Such specific choice of food items was stipulated by the objective to assess the Vitamin A intake among the institutionalized children and to ascertain the presence of sub clinical symptoms of Vitamin A deficiency.

With regard to frequency of food intake in all four schools the majority of children mentioned that the number of meals they have during the day is three or more. In *Yerevan Boarding School for Children with Visual Impairments*, 85% of children, in *Goris Boarding School for Children with Poor Vision and Socially Unprotected Children* 84.1% of schoolchildren, in *Vardashen Educational Complex* 98.2%, and in *Dilijan Sanitary School* nearly all children (98.8%) mentioned having their meal three or more times a day.

According to the recommendations of HKI Food Frequency Method [9] the most rich in retinol and  $\beta$ -carotenes food items available in Armenia were selected for analysis. The frequency of eating specified food items during the seven days before the interview was asked about.

*In Yerevan Boarding School*, about 42.5% (n=34) of the schoolchildren mentioned eating dark green leafy vegetables two-three times a week. About 27.5% mentioned eating it nearly every day, and about the same proportion of children (23.8%) never eats it. Of those who responded to that question (n=61) all 100% mentioned eating these vegetables at home. There were two main reasons for not eating this product: unavailability (47.4%, n=9) and not liking that food (47.4%).

Majority of children (76.3%, n=61) never ate raw carrot during the seven days prior to the study. In the majority of cases (80.3%), unavailability of the product was the main reason, followed by not liking it (16.4%). Those who consumed raw carrot (n=19) and its dishes were all served it at home. Nearly all children (93.8%, n= 75) mentioned never eating pumpkin, stating as a main reason unavailability in 70.7% of cases (n=53) and not liking the product in 26.7% of cases (n=20). Those who eat pumpkin were served it at home. Raw tomatoes were used once or two-three times a week by 41.3% of children (in common), while 55% never used it during the past seven days. All children mentioned home as a source of consumption. The main reasons for not eating were unavailability (43.2%) and expensiveness (54.5%). Children were asked about consumption of apricots (considering the season in the way of juice or dried fruit). Overwhelming majority of children (78.8%, n=63) never used apricot juice during the previous 7 days, explaining that by unavailability in 92.1% of cases and by expensiveness in 6.3% of cases. Even more children (87.5%, n=70) never used dried apricots during the last seven days. The main reasons were the same: unavailability (90.1%) and expensiveness (7%). Those who consumed apricot juice or dried apricot were served them at home. Another plant source of vitamin A is raisin. However, majority of children (61.3%, n=49) mentioned that they never consumed it during the last seven days, about 33.8% consumed it once or two –three times a week and 5% (n=4) used raisin in food nearly every day. Nearly all children eat raisin at home. Among children who did not consume raisin the proportion of those who mentioned unavailability as a main reason was 83.7%, those who mentioned expensiveness was 6.1% and 10.2% of children answered that they did not like raisin.

Children were also asked about consumption of animal sources of Vitamin A. Nearly all children (96.3%, n=77) never consumed liver. The proportions of answers regarding the

reasons for not eating are the following: 47.4% unavailability, 37.2% expensiveness, 15.4% did not like. Egg yolk (boiled) was in the diet of a majority of children (63.8%). About 33.8% of children mentioned eating egg yolks two-three times a week, 17.5% once a week, and 12.5% nearly every day. Those children, who did not eat egg yolks during the last seven days, explained it by the following reasons: unavailability 48.3%, expensiveness 27.6%, child does not like egg yolk 24.1%. All those children who consumed egg yolk were served it at home. The situation with fried eggs was nearly the same. About 62% of children consumed it either two-three times a week (40.5%), once a week (15.2%), or nearly every day (6.3%). All children mentioned eating fried eggs at home. Those who did not consume fried eggs during the last seven days, explained it mainly by unavailability (70%), expensiveness (23.3%), or by not liking it (6.7%). Cooked fish was used in food during the last seven days by 26.6% of children either once a week (21.5%), or two-three times a week (5.1%). About 14.3% of children mentioned eating fish at boarding school and 85.7% at home. The majority of children (73.4%) did not eat fish during the last seven days, explaining it by unavailability in 59.6% of cases, expensiveness in 17.5% of cases and by not liking fish in 21.2% of cases.

More than a half of children (55.7%, n=44) mentioned that they did not consume butter during the previous seven days. That was explained by unavailability in 47.7% of cases, expensiveness in 18.2% of cases and by not liking it in 34.1% of cases. Those children, who consumed butter, were served it at home.

*In Goris Boarding School* about 40% of the respondents answered that they eat dark green leafy vegetables two-three times a week (in 100%, the source was “home”), 5.2% once a week, and 13.1% never ate it. Of those who did not eat this food item, 44.7% mentioned as a reason “unavailability”, 23.7% “expensiveness”, and 31.6% “not liking it”. Raw carrots in the way of salad or juice were never consumed by 78.7% of the children and the rest of them ate

it at home either once a week (9.3%), or two-three times a week (10%). In overwhelming majority of cases (90.8%) the reason for not consuming was “unavailability”. Pumpkin was never used in food by 88.6% of children, and used once a week or two-three times a week by 7.6% and 3.8% respectively. The source of food consumption was again home. Pumpkin was not used because of its “unavailability” in 89.8% of cases, its “expensiveness” in 4.7% of cases, and child did not like it in 5.4% of cases.

Raw tomatoes were used by 56.4% of children in their meal during the last seven days. All were served it at home. The main reason for not using in majority of children (70.1%) was “expensiveness”. Answering to the question whether they consume apricot (canned/juice) 96.2% of children said “never”, explaining it by “unavailability” in 98.9%. Practically the same was situation with consumption of dried apricots. Raisin was never consumed by 79.3% of children because of “unavailability” in 96.1% of cases. The rest of the children ate it once a week (11%) and two-three times a week (9%) and only at home.

Of the retinol sources used in food liver was mentioned by 10.7% of children, being served at home in 100% of cases. The reasons for not eating it were: “unavailability” indicated by the 38.1% of children, “expensiveness” by 51.9% of them and “not liking it” by 10% of children. Majority of children (67%) had in their diet egg yolks (boiled), almost 100% served at home. Half of the children who did not eat this food explained it by “expensiveness” (51%), “unavailability” (34.4%), and “not liking it” (14.6%). About 50.2% of children mentioned eating fried eggs. Fish was never consumed during the previous week by 86.3% of children because of the “unavailability” (64.1%) and “expensiveness” (31.5%). All those who ate fish had it at home. Children who did not eat butter (70.4%) explained it in 39.9% by “unavailability”, in 25.6% by “expensiveness”, and in 34.5% they said that “do not like it”. Of

the children consuming butter, 14.8% mentioned eating it nearly every day, 11.7% two-three times a week, and 3.1% once a week (all of them eat it at home).

In *Vardashen Educational Complex* the interview on food intake gave the following results.

All children consumed dark green leafy vegetables, though with different frequency.

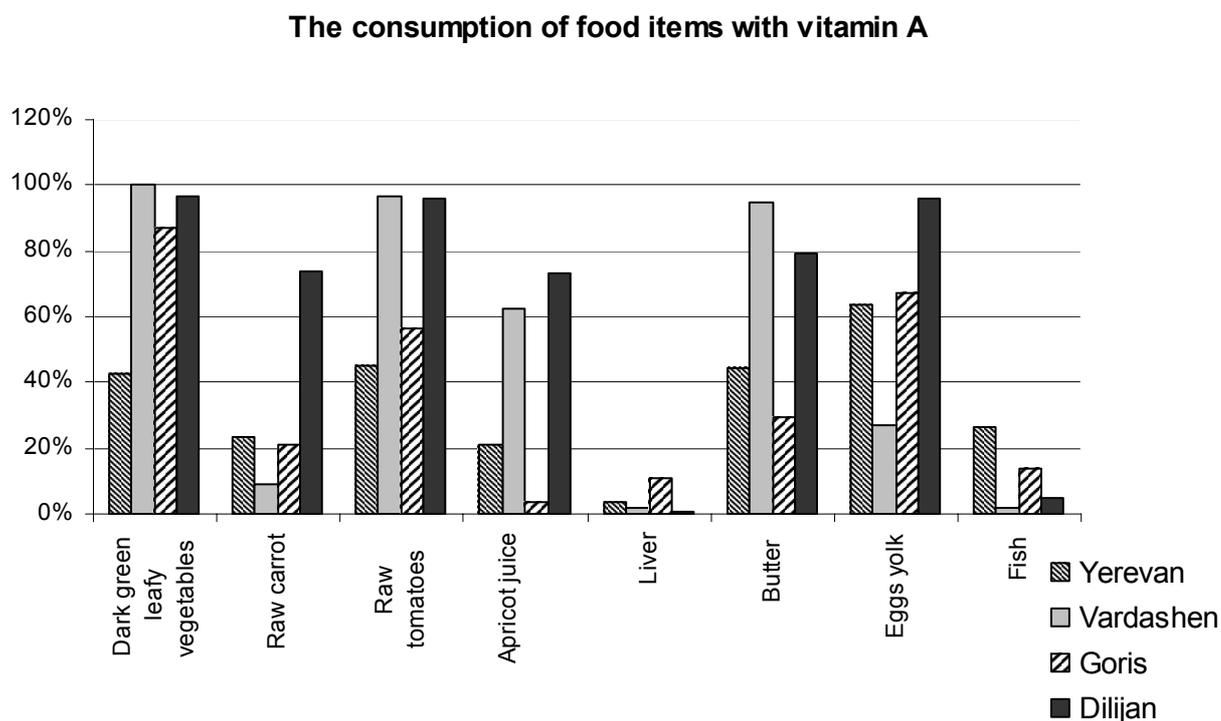
Overwhelming majority (80.4%) mention eating it two-three times a week, 17.9% of children eat it nearly every day, and 1.8% once a week. About 85.2% of the children are served this food in school, and 14.8% at home. Raw carrots were not used in food by 91.1% of the respondents and “unavailability” was the only reason of not consuming it. Pumpkin was not in the children’s diet in 94.6% of cases and on the same reason (98.1%). Nearly all children (96.4%) ate raw tomatoes, in 50% of cases 2-3 times a week, in 41.1% - nearly every day, and in 5.4% - once a week. About 90% of the children indicated boarding school as a source of receiving this food product. Canned apricot juice was used by 62.5% of the children: 33.9% 2-3 times a week, 17.9% once a week, and 10.7% nearly every day. Overwhelming majority of children (81.3%) received apricot juice in boarding school. Those who did not use it mentioned “unavailability” in 100% of cases.

In contrast to juice, dried apricots were not used in food by nearly all children (98.1%).

“Unavailability” was the only explanation. The situation with raisin consumption was absolutely the same. The same results were received when children were asked about liver consumption. Egg yolks (boiled) were not used in food by overwhelming majority of children (73.2%), and fried eggs were not consumed by even more children (91.1%). More than 95% of children explained not eating eggs because of their “unavailability”. Fish was never consumed by 98.2% of children and nearly all of them mentioned the same “unavailability”. The consumption of butter was nearly overwhelming (94.6%), with most of children (87.5%) eating it nearly every day. Butter was served at boarding school in 97.9% of responses.

In *Dilijan Sanitary School*, nearly all children (96.4%) mentioned eating dark green leafy vegetables and in 95% that was served at school. Majority of children (69.9%) ate this product 2-3 times a week. Raw carrots were in the diet of 48.2% of children once a week, and 24.7% of the children 2-3 times a week, being served in 89.9% of cases at school. Those children who did not eat carrots (26.5%) explained it by “not liking” that food item (23.3%) and its “unavailability” 76.7%. Pumpkin was not consumed by 98.2% of the children, mainly because of its “unavailability” (98.7%). Raw tomatoes were in the weekly diet of nearly all children (95.8%), and in majority of cases (60.8%) 2-3 times a week. Nearly all children (95.7%) were served tomatoes in boarding school. Apricots canned /juice were also in the weekly diet of majority of the children (73.3%). About 81% of children mentioned school as source of product consumption and those who did not use it mentioned as a reason only “unavailability”. Dried apricots were not used at all by the interviewed children, who explained that fact by “unavailability” of that product. The situation with consumption of raisin and liver was practically the same. Egg yolks were used 2-3 times a week by 60.8% of children, nearly every day by 31.3% of the children, and once a week by 3.6% of the children. About 95% of the children mentioned eating this food in boarding school. Children who did not eat egg yolks explained it by “not liking” this product in 87.5% of cases. Fired eggs were consumed only by 12.6% of the children, and nearly all of them (95%) had it at home. All of the children answered that do not eat this food because it is “unavailable”. Fish was another product not used by nearly all of the children (95.2%). The reason for not eating fish was “unavailability”. About 78.9% of the children had butter in the weekly diet. The majority of them (65.7%) consumed it nearly every day, being served it in school in 98.3% of cases. The main reason for not eating it was “not liking” this product (97.2%).

**Figure 6 . Comparison of consumption of main food items containing vitamin A among schoolchildren in four surveyed boarding schools. Boarding School Visual Impairment Project 2002.**



According to HKI Food Frequency Method's recommendations [9] the animal and weighted total Vitamin A scores on each questionnaire were calculated and then the average score for each school was computed. Whether or not children in each particular school have Vitamin A deficiency problem was determined by either of two threshold values:

- $\leq 4$  days per week for mean frequency of consumption of animal sources of vitamin A;
- $\leq 6$  days per week for mean frequency of total consumption of animal and plant sources of vitamin A (weighted by the source).

According to the above indicated standards two threshold values were calculated. Table 1 displays the findings.

Even though the figures received are higher than threshold values showing Vitamin A deficiency in the community, they are still very small and close to the boundary levels. The

worst indicators were received for the boarding school in Goris, followed by the Yerevan boarding school.

A set of questions designed to reveal the subclinical manifestation of Vitamin A deficiency was also included in the interview.

**Table 1. The mean frequency of consumption of animal sources of vitamin A and total consumption of animal and plant sources of Vitamin A. Boarding School Visual Impairment Project 2002.**

<b>The mean frequency</b>	<b>Yerevan</b>	<b>Goris</b>	<b>Vardashen</b>	<b>Dilijan</b>
<b>Animal sources of vitamin A</b>	6.26	5.86	7.45	9.41
<b>Animal and plant sources of vitamin A</b>	7.48	7.07	9.2	11.1

In *Yerevan Boarding School* of the respondents 53.8 % indicated having “quite poor” eyesight in daytime, 46.2% “quite good” or “perfect”. The data on eyesight in dark are given in Figure 7. About 36% of the children (n=72) mentioned that they cannot play outside at dark and 58.3% cannot see as well as their friends. More than a half of children (60.9%) said that they cannot see objects easily in the dark. However, about 74.2% of the children said that their vision does not decrease in evening. Of all responding children (n=70), 35.7% indicated that they fear being injured in the dark, but only 17.1% bump into things when playing at night. All these questions are grouped into two main parameters for evaluation of nightblindness: a) Orientation and vision in the dark, which is divided into the following categories: poor vision in the dark 56.9%; satisfactory vision in the dark 16.7%; good vision in the dark 26.4%; and b) Vision and perception at night, which is grouped as following: poor vision in the dark 20.8%; satisfactory vision in the dark 27.8%; good vision in the dark 51.4%.

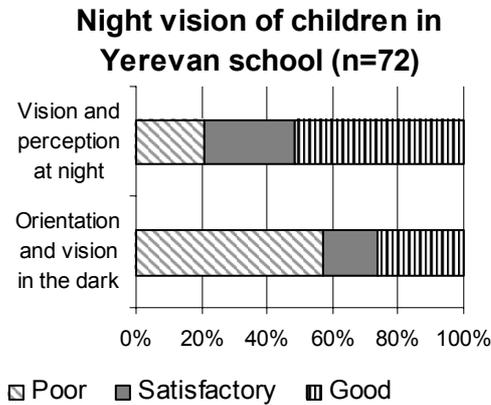
In *Goris Boarding School* about 80.7% (combined) of schoolchildren assessed their eyesight in daytime as “perfect” and “good”. About 19.3% of all children rated their eyesight in daytime as “awful” and “quite poor”. The data on eyesight in the dark are given in the Figure 8. About quarter of all children (25.5%) said that they cannot play outside in the dark. Nearly the same proportion of children (24.1%) cannot see as well as their friends in the dark. Seeing objects around easily in the dark can 78.4% of all respondents. Surprisingly, only 8.9% of all children mentioned that their vision decreases in the dark. Some 11.9% fear being injured in the dark. Bumping into things at night was mentioned only by 2.8% of the children.

In *Vardashen Educational Complex*, overwhelming majority of children rated their eyesight in daytime as “perfect” and “quite good” and 17.9% as “quite poor” and “awful”. The data on eyesight in dark are given in the Figure 9. Even though 28.6% of the children mentioned that they cannot see as well as their friends in the dark, only 12.5% of them said that they do not play outside in the evening hours. Seeing objects in the dark is possible for 72.7% of the children while 20.4% reported vision decrease at night. Some 25% of the children answered that they fear being injured in the dark; and 14.3% mentioned that they bump into things at night.

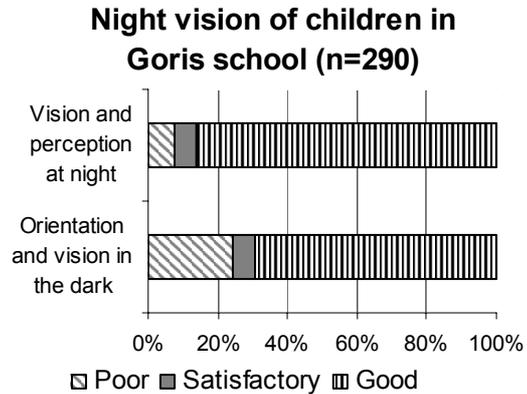
In *Dilijan Sanitary School*, eyesight in daytime was rated as “quite poor” or “awful” by 25.4% of the children and as “perfect” or “quite good” by 74.5% of the respondents. The data on eyesight in dark are given in the Figure 10. The majority of children (83.6%) agreed that they can play outside in the dark. Nearly the same proportion of children (86.1%) indicated that they see objects easily in the dark. However, 75.8% reported seeing as well as their friends in the evening hours. Vision decrease at night was mentioned by 4.3% of the children, and

bumping into things in the dark by 3%. However, 13.9% of the respondents indicated that they fear being scared in the dark.

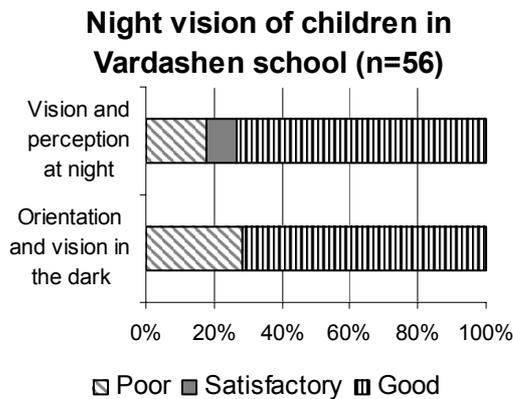
**Figure 7. Vision and orientation at night in Yerevan Boarding School (n=72). BSVIP 2002.**



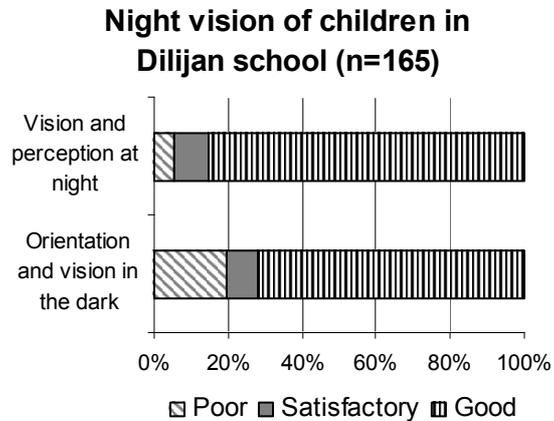
**Figure 8. Vision and orientation at night in Goris Boarding School (n=290) BSVIP 2002.**



**Figure 9. Vision and orientation at night in Vardashen Educational Complex (n=72). BSVIP 2002.**



**Figure 10. Vision and orientation at night in Dilijan Sanitary School (n=290) BSVIP 2002.**



The proportion of children with “good”, “satisfactory”, and “poor” night vision and orientation were similar in all schools, except for Yerevan, where the majority of children had some serious visual disorders.

#### **4.2. Pediatric examination (screening)**

Pediatric screening included interviewing a child and checking for complaints, followed by objective examination of general health status by organ systems.

##### **4.2.1. Interview**

Of all schoolchildren screened in *Yerevan Boarding School for Children with Visual*

*Impairments* (n=79) 14.1% had health complaints. Children were asked to assess whether their health limits their daily activity. About the half of respondents (45.5%) mentioned that they cannot play as well as their friends, and overwhelming majority (70.8%) agreed that they can do less than they would like. Almost 32% of children agreed that they get tired easier than their friends. Of all children, 41.3% agreed with the statement that “their condition is somewhat worse now than a month ago”, about 50.7% mentioned that their condition is the same and only 8% disagreed with the statement.

In *Goris Boarding School for Children with Poor Vision and Socially Unprotected Children*, about 8.3% of all children mentioned having health complaints; however, nearly all children (98.2%) assessed their overall health as “very good”. Only 7.7% of all children felt that they cannot play as well as their friends, but nearly all children (96.1%) agreed with the statement that they can do less than they would like. Of the respondents 12.2% mentioned that they get tired easier than their friends. And 23.8% rated their current health condition as “somewhat worse now than a month ago”. Majority of the respondents (72%) rated it as the “same”.

In *Vardashen Republican Special Educational Complex* 13.2% of all children had health complaints, at the same time nearly all children (98%) mentioned that they feel very good. About 11.6% of the responding children agreed that they cannot play as well as their friends. The overwhelming majority of children (90.9%) mentioned that they can do less than they would like. Of all children 24% indicated that they get tired easier than their friends.

Comparing their current health condition with that of month ago about 16% of all children said that they feel “somewhat worse” and 78% assessed their condition as the “same”.

In *Dilijan Sanitary Boarding School #8*, about 9% of all children indicated that they have some health complaints, but nearly all respondents (98.8%) answered that they feel very good. A very small proportion of children (6.8%) mentioned that they cannot play as well as their friends. As in all other schools nearly all children (96.8%) indicated that they can do less than they would like. About 11% of all children answered that they get tired easier than their friends. The majority of the children (68.1%) rated their current health condition as the “same as a month ago”, but 28.3% mentioned that it became “worse”.

During the interview with pediatrician a list of various symptoms was read out to each child to choose the appropriate ones as well as to indicate their frequency according to the following scale: every day, every week, once a month, rarely, never. The figures given below are based on the complaints with frequency of every day/week or once a month. In Yerevan boarding school the main complaints were headache (16.5%), cough (14%), cold/flu (17.7%), sore throat (6.3%), high fever (7.6%), nausea or vomiting (12.7%), night sweating (8.9%), lack of appetite (10%). In Goris boarding school the main mentioned complaints were headache (6.2%), night sweating (12.5%), night urination (7.6%), sore throat (2.8%), lack of appetite (4.8%). In Vardashen educational complex about 16% of children complained of having headaches, 21.4% indicated night sweating, and 23.2% night urination. In Dilijan sanitary school the main health complaints among schoolchildren were headaches (7.2%), cough (5.4%), and night sweating (3%).

Physical activities were tested by another group of questions. Children were asked about types of exercises they usually perform. Their answers are grouped in the Table 3. In all four

schools, majority of children mentioned that they exercise/play games nearly every day: in Goris 99.3%, in Dilijan 98.8%, in Vardashen 81.8%, in Yerevan 67.6%. The duration of daily exercise/sport game was two hours in 97.2% of cases in Goris, 89.6% in Dilijan, 81.8% in Vardashen, and 38% in Yerevan. In the later school 23.9% of all children mentioned that the duration of their daily physical activities is about one hour and 38% mentioned that it is usually half an hour.

**Table 2. Main health symptoms mentioned by children as health complaints. Boarding School Visual Impairment Project 2002.**

School	Main health symptoms mentioned by children as health complaints								
	Headache	Cough	Cold/flu	Sore throat	High fever	Nausea or vomiting	Night sweating	Lack of appetite	Night urination
<b>Yerevan Boarding School</b>	16.5%	14%	17.7%	6.3%	7.6%	12.7%	8.9%	10%	-
<b>Goris Boarding School</b>	6.2%	-	-	2.8%	-	-	12.5%	4.8%	7.6%
<b>Vardashen Educational Complex</b>	16%	-	-	-	-	-	21.4%	-	23.2%
<b>Dilijan Sanitary School</b>	7.2%	5.4%	-	-	-	-	3%	-	-

To have more complete information about physical development of schoolgirls, they were asked about the age at first menarche. It was noticed that in Goris and Vardashen schools girls had their first menarche at older age than girls in Yerevan and Dilijan schools (Table 4).

Comparison of means showed statistically significant difference between the results of four schools ( $p=0.000$ ).

**Table 3. Types of physical activities among children in four boarding schools. Boarding School Visual Impairment Project 2002.**

Name of School	Daily exercise	Sport classes at school	Sport games	No exercises
<b>Yerevan Boarding School for Children with Visual Impairments</b>	26 32.9%	43 54.4%	52 65.8%	4 5.1%
<b>Goris School for Children from Socially Vulnerable Families and with Visual Impairments</b>	3 1%	8 2.8%	281 97.9%	1 0.3%
<b>Special Educational Complex in Vardashen</b>	2 3.8%	9 17.3%	47 90.4%	2 3.8%
<b>Sanitary School in Dilijan</b>	1 0.6%	1 0.6%	164 98.8%	2 1.2%

**Table 4. Mean age at first menarche among schoolgirls in four screened boarding schools. Boarding School Visual Impairment Project 2002.**

Name of School	Mean age at first menarche	Standard Deviation	Median	Range
<b>Sanitary school in Dilijan</b>	12.1	1.0	12.0	10-14
<b>Yerevan Boarding school for children with visual impairments</b>	12.6	1.3	12.5	10-15
<b>Special Educational Complex in Vardashen</b>	13.5	1.1	13.5	12-16
<b>Goris School for children from socially vulnerable families and with visual impairments</b>	13.6	1.2	14.0	11-16

(ANOVA, p=0.000)

#### **4.2.2. Anthropometric measurements**

In order to have complete information about physical development of the child, anthropometric measurements were taken. The height-for-age (HAZ), an indicator of past nutritional adequacy was used to identify stunting resulting from extended period of

inadequate food intake in early childhood. Weight-for-age (WAZ), an acute index of malnutrition, was used to assess protein-energy malnutrition (PEM) and over-nutrition.

Weight-for-height (WHZ), an index of current nutritional status was used to measure wasting as well as over-nutrition.

The United States National Center for Health Statistics (NCHS) growth percentiles recommended by the World Health Organization (WHO) were used in analysis as an international reference for comparisons of health and nutritional status among countries [7,8]. Below the fifth/over the ninety-fifth percentile ( $\pm 2SD$ ) was considered to be the "cut-off point" for all three parameters used in this study and children with indices below/over this value are considered to be stunted, wasted or obese. When the value received is on 95<sup>th</sup> percentile it means that only 5 of 100 children (5%) of the same age and gender in the reference population have a higher parameter [7,8].

The data in Table 5 summarizes anthropometric measurements of 593 children aged 6-19 in 4 surveyed boarding schools.

**Table 5. Results of anthropometric measurements of children in four surveyed schools calculated using WHO standards. Boarding School Visual Impairment Project 2002.**

Name of school	Total N	Stunted HAZ	Under nourished WAZ	Over weight WAZ	Wasted WHZ	Obese WHZ
<b>Yerevan Boarding School</b>	80	12.5%	8.3%	0.0%	1.7%	5.1%
<b>Goris Boarding School</b>	291	14.2%	9.6%	0.0%	1.0%	0.7%
<b>Vardashen Educational Complex</b>	56	25.0%	17.0%	1.9%	0.0%	0.0%
<b>Dilijan Sanitary school</b>	166	8.5%	4.2%	0.6%	0.0%	2.4%
<b>TOTAL</b>	<b>593</b>	<b>73</b>	<b>47</b>	<b>2</b>	<b>4</b>	<b>9</b>

*Stunted children (p=0.021)*

*Undernourished children (p=0.028)*

The highest proportion of children with stunting (25%) was detected in Vardashen Educational Complex, showing extended period of inadequate food intake in early childhood. In Goris Boarding School there were 14.2% of stunted children. And the lowest proportion of stunted children (8.5%) was detected in Dilijan Sanitary School. The sequence of schools by values of acute index of malnutrition (WAZ) was similar to that of stunting. The highest index was detected in Vardashen Educational Complex (17.0%), then in Goris Boarding School (9.6%), in Yerevan Boarding School it composed 8.3%, and in Dilijan Sanitary School this index had the smallest value of 4.2%.

Children's weight was compared with their height to see if there are wasted children. Wasted children were detected only in two schools: in Yerevan Boarding School for Children with Visual Impairments (1.7%) and in Goris Boarding School (1.0%). By WHZ index there were 5.1% of obese children in Yerevan Boarding School, 2.4% in Dilijan Sanitary School, and 0.7% in Goris Boarding School. By WAZ index there were 1.9% of children with overweight in Vardashen educational complex and 0.6% in Dilijan sanitary school. The difference between children in the four schools was statistically significant in stunting ( $p=0.021$ ) and undernutrition ( $p=0.028$ ). The data in Table 6 show the prevalence of the specified anthropometric parameters among boys and girls. Except for Goris, the proportions of stunted, undernourished and wasted children are higher among boys than girls.

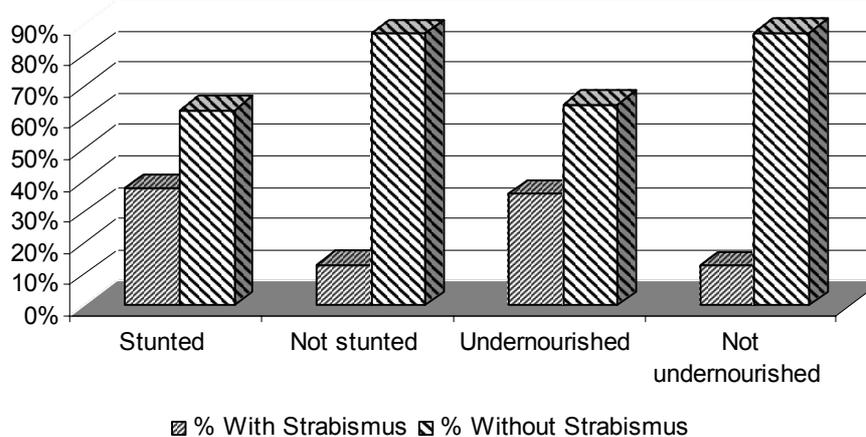
A Statistically significant association was revealed between two anthropometric parameters, showing past and present nutritional status: stunting (p-value=0.009), under nutrition (p-value=0.021) and strabismus.

**Table 6. Distribution of anthropometric parameters by gender in four surveyed schools calculated using WHO standards. Boarding School Visual Impairment Project 2002.**

Name of school	Total N	Stunted		Under nourished		Over weight		Wasted		Obese	
		HAZ %		WAZ %		WAZ %		WHZ %		WHZ %	
		M	F	M	F	M	F	M	F	M	F
<b>Yerevan Boarding School</b>	<b>80</b>	19.2	4.5	11.5	4.5	0.0	0.0	3.6	0.0	7.1	3.7
<b>Goris Boarding School</b>	<b>291</b>	13.5	15.1	7.1	12.7	0.0	0.0	0.6	1.6	0.0	0.0
<b>Vardashen Educational Complex</b>	<b>56</b>	30.8	19.2	33.3	0.0	3.7	0.0	0.0	0.0	0.0	0.0
<b>Dilijan Sanitary School</b>	<b>166</b>	13.3	3.7	6.0	2.5	0.0	1.2	0.0	0.0	1.2	3.7
<b>TOTAL</b>	<b>593</b>	45	28	28	19	1	1	2	2	3	4

**Figure 11. Association between anthropometric parameters showing current and past nutritional status (undernourished and stunted children) and strabismus. Boarding School Visual Impairment Project 2002.**

**Association between strabismus and nutritional status of children**



#### 4.2.3. *The main findings of the objective examination*

There were noticeable differences in distributions of some of health disorders among schoolchildren of the four screened boarding schools (Figure 13). Many of the detected disorders, such as teeth cavities, chronic tonsillitis, acute respiratory infections, and skeletal-muscular deformations can be attributed to poor nutritional status, either current or past, subsequent decreased immunity and insufficient physical development (lack of physical fitness). The highest percentage (39.2%) of teeth cavities was among children in Yerevan Boarding School for Children with Visual Impairments. The smallest proportion of teeth cavities (16.2%) was diagnosed among schoolchildren of Goris Boarding School. This difference can be explained by the teeth screening conducted by the Hovard-Karagyozyan Foundation among children living in Goris. Many children had already seen dentists and had their teeth filled. Others were on a waiting list. In the Dilijan Sanitary School and Vardashen Educational Complex the proportion of children with teeth cavities were 17.5% and 19.6% respectively.

Various disorders/pathologies of skeletal-muscular system, such as winged scapulae, chest deformations, spine curvature, and flat foot were the most frequently detected abnormalities of physical development (Figure 13). Chest and spine deformations were more widespread among children in Dilijan sanitary school (13.3%, n=22). In Goris boarding school 9.3% of children had this pathology, in Yerevan boarding school about 3.8%, while in Vardashen educational complex not a single case was detected.

**Table 7. Chest and spine deformations among screened children. Boarding School Visual Impairment Project 2002.**

<b>Disorder</b>	<b>Yerevan Boarding School</b>	<b>Goris Boarding School</b>	<b>Vardashen Educational Complex</b>	<b>Dilijan Sanitary School</b>
<b>Chest and spine deformations</b>	3.8%	9.3%	.0%	13.3%

Winged scapulae showing lack of appropriate physical exercises on a regular basis and poor nutritional status composed a very high percentage (55.7%) in children in Yerevan boarding school. About half of children in Goris (47.2%) had the same disorders. Children in Dilijan and Vardashen had winged scapulae in 31.9% and 28.6% of cases respectively.

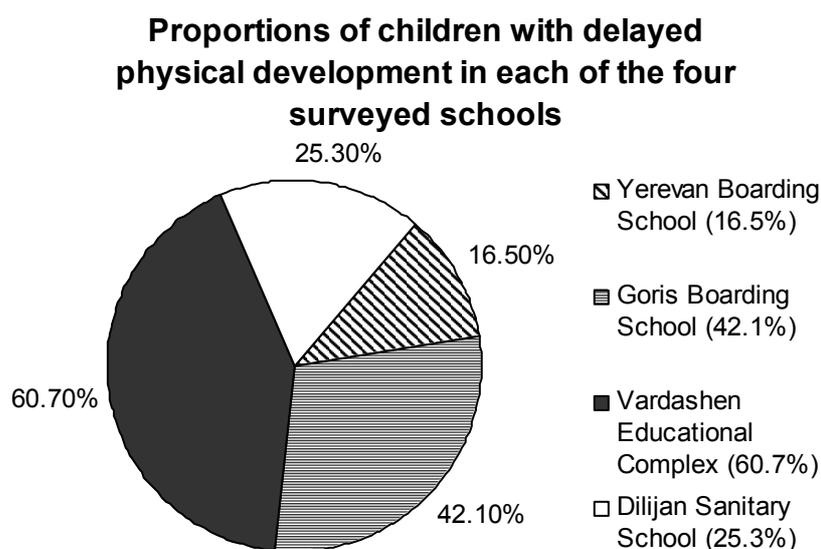
Flat foot is often a result of wearing bad quality shoes, without instep/arch supports. The low socio-economic conditions in families of the majority of the screened children do not allow parents to buy them good shoes, etc. In Vardashen and Yerevan boarding schools, the proportions of children with flat foot were 23.3% and 20.3% respectively. In Goris, there were 19% of such children. The lowest proportion (13.3%) was detected among children in Dilijan Sanitary School (Figure 13).

Apart from the specific deformations and pathologies of skeletal-muscular system many children in all surveyed schools were diagnosed as having delayed physical development, short height and body weight deficiency. The largest proportions of such children were in Vardashen Special Educational Complex (60.7%) and in Goris Boarding School (42.1%). In Dilijan Sanitary School, it was about 25.3%. The smallest percent (16.5%) was detected in Yerevan Boarding School (Figure 12).

The proportion of children with acute respiratory infections and exacerbations of chronic bronchitis was the highest (7.6%) in Yerevan Boarding School for Children with Visual Impairments. In the three other schools the proportions of children with such pathologies were smaller: 5.4% in Dilijan Sanitary School, 3.6% in Vardashen Educational Complex, and 0.7% in Goris (Figure 13). Reviewing personal histories of children and thorough questioning of the pediatrician revealed children having frequent acute respiratory infections. The highest rate was among children in Yerevan Boarding School (27.5%), and the lowest in Vardashen

Educational Complex (8.9%). In Goris Boarding School and Dilijan Sanitary School it was 15.2% and 10.8% respectively. Frequent respiratory infections may be a result of decreased immunity and poor nutrition status.

**Figure 12. Delayed physical development, short height and body weight deficiency among screened children. Boarding School Visual Impairment Project 2002.**



Difficulties with breathing due to curvature of nasal partition and/or adenoids were widespread among children in Yerevan Boarding School (27.5%), and Goris Boarding School (15.2%); in Dilijan children with such abnormalities composed 10.8% and in Vardashen 8.9%. Curvature of nasal partition and especially adenoids, which disturb normal breathing (children breath with open mouth), may also play role in frequent respiratory infections. However, the analysis did not reveal any statistically significant association between these two disorders.

In Dilijan Sanitary School there were also children who had contacts with Tuberculosis patients. Their proportion was 10.2%. However, at objective examination pediatrician did not reveal any suspected cases.

Many children had chronic tonsillitis. The situation was the worst in Vardashen Special Educational Complex and in Goris Boarding School: 37.5% and 35.5% respectively (Figure 13). In Yerevan Boarding School the proportion of children with chronic tonsillitis was 17.7% and in Dilijan Sanitary School there were 24.1% of such children. Analysis showed statistically significant association between teeth cavities and development of chronic tonsillitis (Table 8). This was an expected association and is biologically plausible as these two pathologies may have the common causative organism *streptococcus*. Dental caries is a focus of chronic infection in the mouth and may facilitate development of tonsillitis or contribute to its chronic nature [15].

**Table 8. The association between teeth cavities and chronic tonsillitis among children screened in four boarding schools.**

	Teeth cavities		Chronic tonsillitis	
	Total	% with	% with	% without
% with	118	38.1%	38.1%	61.9%
% without	473	28.1%	28.1%	71.9%
<b>Total</b>	<b>591</b>	<b>178</b>	<b>178</b>	<b>413</b>

( $\chi^2$ , p-value=0.034)

Mild disorders of the cardio-vascular system, such as arrhythmia, enlargement of the heart area at percussion, and muted heart tones, connected mainly with chest and backbone deformations, were diagnosed in 10% of all children in Yerevan Boarding School and 8.9% of children in Vardashen Educational Complex. In Dilijan Sanitary School only 1.8% of children

(n=3) had cardiovascular system disorders and in Goris Boarding School the percentage of such children was 0.7% (n=2).

Of the disorders of endocrine system the most frequently detected were delayed puberty and menstrual cycle disorders, and hirsutism (Figure 13). Delayed puberty and menstrual cycle disorders were diagnosed in 20.3% of schoolchildren in Yerevan Boarding School. In three other schools this abnormality was detected in 7.1% at the Vardashen Educational Complex, in 5.5% at the Goris Boarding School, and in 4.8% at the Dilijan Sanitary School. The analysis of association between this disorder and various other abnormalities revealed statistically significant inverse association between delayed puberty and visual acuity.

**Table 9. Association between delayed puberty and menstrual cycle and visual acuity (with the best eye, as presented). Boarding School Visual Impairment Project 2002.**

Children with delayed puberty and menstrual cycle	Visual acuity with the best eye (as presented)			
	Total	1.0-0.4	0.3-0.05	<0.05
YES	21	42.9%	33.4%	23.8%
NO	190	68.4%	24.7%	6.8%
<b>Total</b>	211	139	54	18

( $\chi^2$ , p-value=0.017)

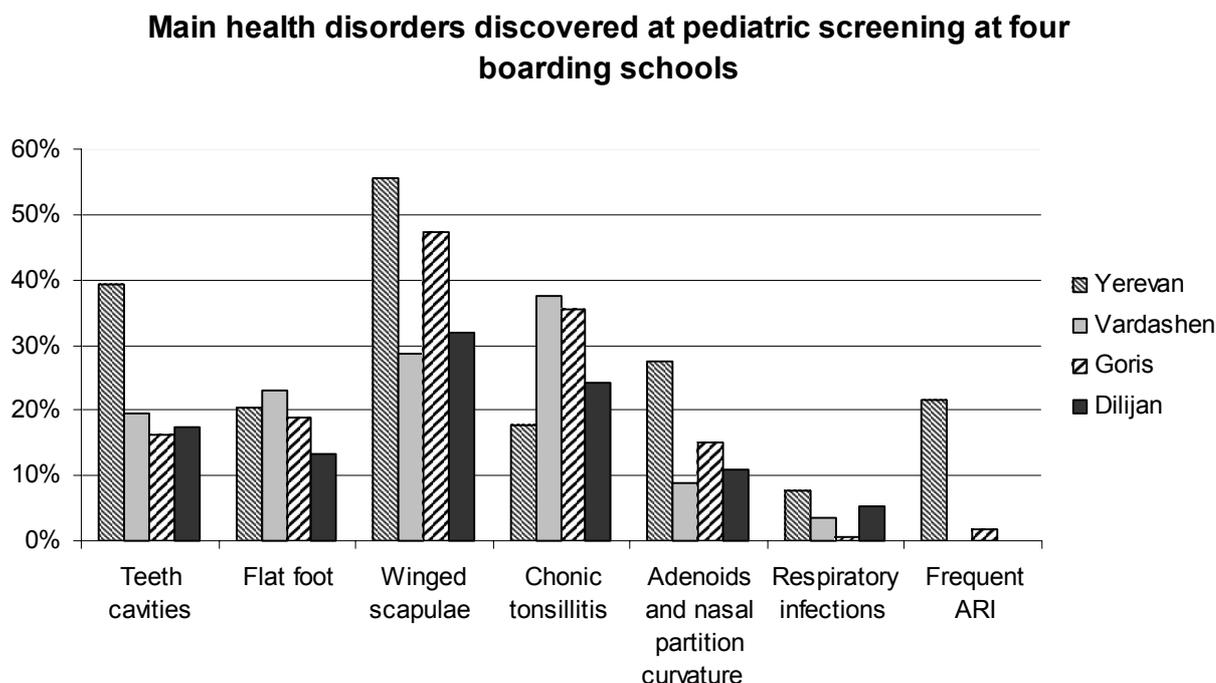
Hirsutism was diagnosed in 7.1% of children in Vardashen Educational Complex, in 5.1% of children in Yerevan Boarding School, in 3.6% of children in Dilijan Sanitary School, and in 3.1% of children in Goris Boarding School. Enlarged thyroid gland was diagnosed only among schoolchildren in Goris Boarding School (2.8%, n=8) and Dilijan Sanitary School (2.4%, n=4).

Gastrointestinal system pathologies, such as gastritis, gastroduodenitis, and hepatitis were diagnosed in very small proportions of children in all four schools. The smallest proportion

was 0.6% in Dilijan Sanitary School and the biggest proportion was 5.4% in Vardashen Special Educational Complex.

Other detected health disorders, such as vegetative vasal dystonia, food allergy, allergic rhinitis, inguinal hernia, rheumatism, enuresis, speech disorders, etc. was 21.4% in Vardashen Educational Complex, 16.5% in Yerevan Boarding School, 13.9% in Dilijan Sanitary School, and 13.1% in Goris Boarding School.

**Figure 13. Main health pathologies discovered during pediatric screening and grouped by systems of organs. Presented by four schools involved into project. Boarding School Visual Impairment Project 2002.**



### 4.3. Neurological examination

#### 4.3.1. Interview

A short interview preceded the physical examination of a child. It included questions about general health condition, having headaches, and other complaints. A neurologist in concluding about the diagnosis later used this information.

In *Yerevan Boarding School* the majority of the children (62.8%) had health complaints. About half of all children (49.4%) mentioned having headaches, 17.9% had blackouts of consciousness with or without cramps, and 20.8% of children indicated that they had head trauma.

In *Goris Boarding School*, about 52% of children said repeated health complaints. Of all children, 41.4% complained of headaches. Blackouts of consciousness were mentioned by 11.4% of the children, a small proportion of children (6.2%) indicated that they had head trauma.

In *Vardashen Educational Complex*, health complaints were mentioned by 58.9% of the children. Many children (67.9%) complained of headaches. The largest proportion among all four screened schools indicated having blackout of consciousness (21.2%) and head trauma in the past (25.9%).

In *Dilijan Sanitary School*, 45.2% of all children indicated health complaints. A similar proportion of children complained of headaches (43.4%). The proportion of children with blackouts of consciousness and head trauma in the past were 6.6% and 3.6% respectively.

There was also a set of questions about school performance. Typical school grade for participants differed across the schools (Table 10).

The worst progress in studies was among schoolchildren in Vardashen Special Educational Complex. Children were also asked to place themselves into the three of categories of schoolchildren: excellent, good, or average/bad. The figures were nearly the same as with school grades in all schools.

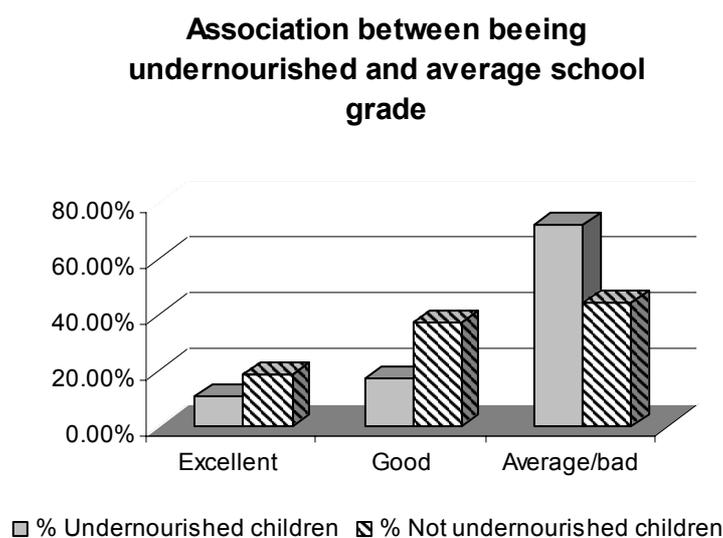
**Table 10. School performance of children in four boarding schools in Armenia. Boarding School Visual Impairment Project 2002.**

School name	Typical school grade		
	Excellent	Good	Average/Bad
<b>Yerevan Boarding school for children with visual impairments (n=78)</b>	<b>14.1%</b>	<b>43.6%</b>	<b>42.3%</b>
<b>Goris School for children from socially vulnerable families and with visual impairments (n=291)</b>	<b>21.0%</b>	<b>32.0%</b>	<b>47.1%</b>
<b>Special Educational Complex in Vardashen (n=56)</b>	<b>1.8%</b>	<b>14.3%</b>	<b>83.9%</b>
<b>Sanitary school in Dilijan (n=163)</b>	<b>18.4%</b>	<b>44.8%</b>	<b>36.8%</b>

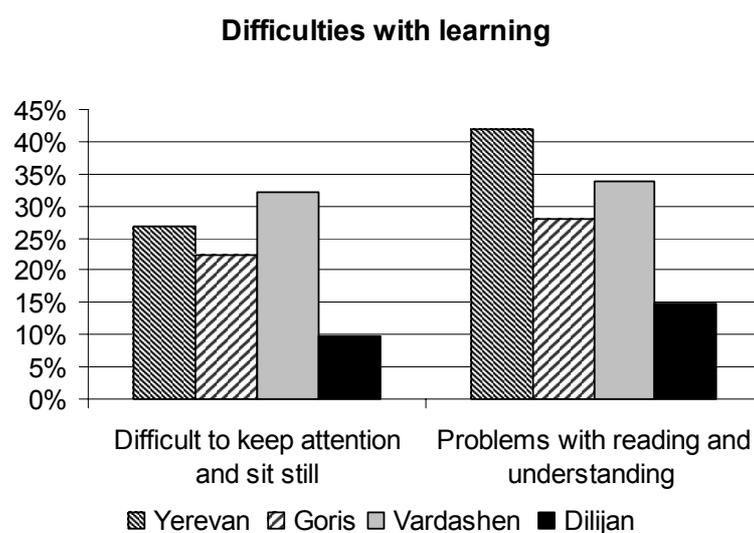
Analysis of school performance (typical school grades) and nutritional status of children revealed a statistically significant association ( $\chi^2$ ,  $p=0.001$ ) between being undernourished (WAZ) and performance (Figure 14). Children with weight deficiency by WAZ index showed worst school performance. The combined variable of delayed physical development, short height, and body weight deficiency received in result of analysis of external pediatric examination data was also tested for association with school performance. It revealed statistically significant association ( $\chi^2$ ,  $p=0.006$ ).

Difficulties with learning were most of all prominent among children in Vardashen Educational Complex and Yerevan Boarding School. However, in the first one this, as well as the low school performance can be related to the fact that the school has a status of reformatory and many of the children there are difficult to bring up or even have some criminal past. The situation was different with Yerevan Boarding School. Majority of the children studying there are blind or have serious visual disorders.

**Figure 14. Association between nutritional status (WAZ index) and school performance. Boarding School Visual Impairment Project 2002.**



**Figure 15. Difficulties with learning as compared among four surveyed schools. Boarding School Visual Impairment Project 2002.**



#### **4.3.2. Main findings at objective examination**

External examination by neurologist included detection of possible anomalies of development, checkup of craniocerebral nerve's function, motor functions and muscular tone, tendinous and skin reflexes, pathologic reflexes, static and coordination of movements, sensibility and vegetotrophic impairments, as well as highest (supreme) cortical functions.

#### *4.3.2.1. Anomalies of development*

In *Yerevan Boarding School*, the neurologist detected the following main anomalies among 29% of schoolchildren (n=78): exophthalmus 30.4%; microphthalmia 21.7%; high or low position of helix 13%; saddle shaped nose 4.3%;

In *Goris Boarding School* neurologist detected the following main anomalies among 4.5% of schoolchildren (n=291): exophthalmus 7.7%; microphthalmia 15.4%; “gothic palate” 15.4%; dolichocephaly 7.7%; retrognation of maxilla 7.7%.

In *Dilijan Sanitary School*, only 3% of all children (n=166) children were diagnosed as having some anomalies: high or low position of helix – 60%, and retrognation of mandible – 40%.

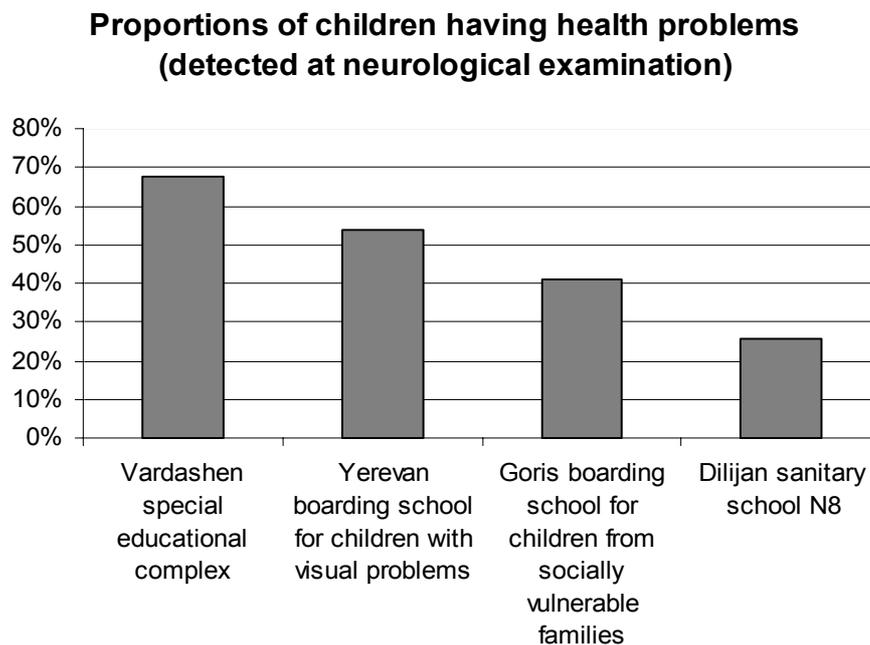
In *Vardashen Educational Complex*, neurologist did not detect any serious anomalies of development.

#### *4.3.2.2. Main health disorders*

The proportions of children diagnosed by neurologist as having any health disorders were different for the four surveyed schools. The largest was in Vardashen Educational Complex (68%) and the smallest in Dilijan Sanitary School (27%).

The specific diagnoses set by neurologist were grouped into seven main groups and comparison of these groups among children in four screened schools gave the following results.

**Figure 16. The proportions of children diagnosed by neurologist as having some health problems as compared among four surveyed schools. Boarding School Visual Impairment Project 2002.**



The biggest group of disorders is “Mild cerebral dysfunction with retardation of mental development and boundary intellectual insufficiency and retardation of special learning skills”. According to the neurologist, these disorders are mainly explained by defects of upbringing, lack of attention from the adults (both parents and teachers) to children, and poor education. Logically, the worst rate was detected in Vardashen Special Educational complex (30.4%). In Yerevan Boarding School, the proportion of children with such disorders was also high: 19.7% of children in Goris boarding school in their majority lived with parents at home and not in the school, having more control and care and consequently a low rate of the specified disorders (12.4%). Children in Sanitary School in Dilijan had the lowest proportion of the specified disorder (4.8%).

Functional disorders of the nervous system included neurotic reactions, anxiety neurosis, bedwetting (enuresis), neurasthenia, neurotic tics, and logoneurosis. These abnormalities are mainly connected with upbringing disorders, various stress factors, puberty, and heredity.

Again, children in Vardashen Educational Complex had the highest proportion of these disorders (28.6%). Children in Goris Boarding School were second after Vardashen (13.8%). In Yerevan and Dilijan schools the rates were 11.8% and 7.2% respectively.

Angioneurosis/vegetative vasal dystonia and Raynaud's disease had the highest rates among children in Vardashen Educational Complex (17.9%). The lowered level of body oxygen may cause vegetative vasal dystonia, which in its turn may be a result of inappropriate physical activities. Raynaud's disease may develop due to frostbiting of extremities (not wearing gloves in winters). In the three other schools, the proportion of children with such disorders was 15.1% in Dilijan Sanitary School, 10.5% in Yerevan Boarding School, and 10.3% in Goris Boarding School.

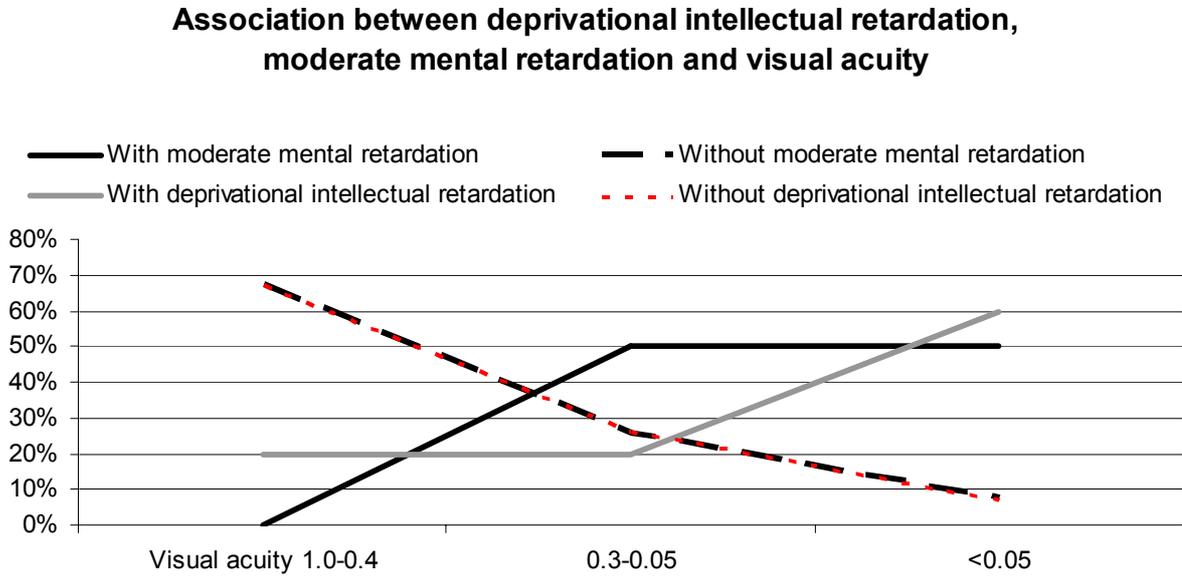
Deprivational mental retardation, which is one of the symptoms of sensory integration disorder (DSI), was detected only in the Yerevan Boarding School for Children with Visual Impairments (6.6%). This was expected outcome as such condition is a result of severe impairment of one of sense organs. For the average child, all senses develop and work together: touch, sight, sound, taste, and smell. The proper interaction of the above senses enables people to function and feel comfortable. If any of the sense organs does not function properly and the interaction of these organs is affected such children develop sensory integration disorder. Symptoms can be quite annoying, and if left unrecognized and treated, often affect a child's behavior, development, and ability to properly interact and learn.

As presumed, analysis revealed a statistically significant association ( $\chi^2$ , p-value=0.000) between visual acuity and deprivational intellectual retardation (Figure17). Moderate mental retardation due to early organic disorders/abnormalities of central nervous system was diagnosed at children in Yerevan and Goris boarding schools with proportions of 6.6% and

1.0% respectively. This infirmity was also associated with visual acuity ( $\chi^2$ , p-value=0.003).

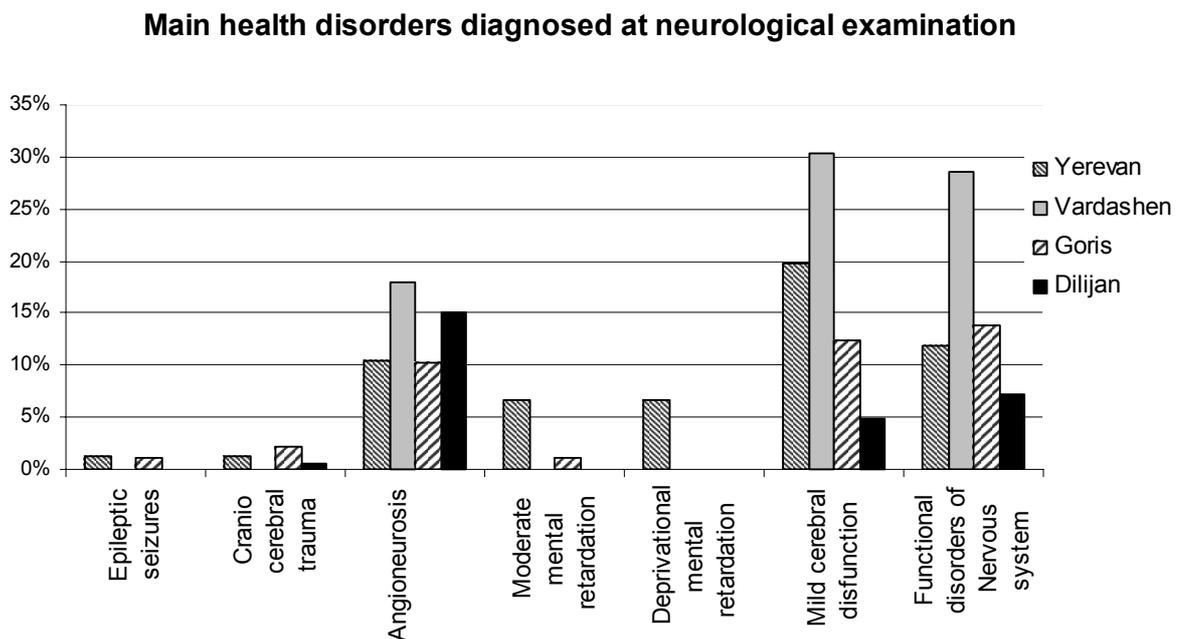
(Figure17A)

**Figure 17A. Association between visual acuity and developed deprivational intellectual retardation and moderate mental retardation due to early organic disorders of Central Nervous System. Boarding School Visual Impairment Project 2002.**



There were small proportions of children with epileptic seizures and craniocerebral trauma in anamnesis (Figure 17B).

**Figure 17B. The main groups of health disorders diagnosed at children during neurological examination as compared among four screened schools. Boarding School Visual Impairment Project 2002.**



#### **4.4 Ophthalmic Examination**

##### **4.4.1 Basic Eye Screening**

Of the 593 children screened, 212 (35.8 %) were referred for a detailed ophthalmic evaluation. Of all screened children 128 (22 %) mentioned current and/or past eye problems. Visual acuity less than 1.0 (20/20) was the reason for referral in 27.2 % cases (n=161). Increased intraocular pressure, determined by palpation, was reported in 2.4 % of the participants (n= 14), and abnormal eye position in 9.3 % of participants (n=55). Few (n=11) participants reported blind 1<sup>st</sup> degree relatives (5.7%). It was determined that 87.4% of the screening participants had current eye problems and 76.3% had some past eye problems. About 69.3 % of the attendants mentioned they had no previous check-ups by ophthalmologist. Of those ever having a visit to ophthalmologist, 97.3 % indicated eye problems as the reason of visit to ophthalmologist and only 2.7 % indicated preventive check-ups.

##### **4.4.2 Detailed eye examination**

Of the 212 children referred for a detailed screening 100 % keep the appointment. A detailed eye examination was administered to 212 participants, of which only 0.5% (n=1) was identified as healthy (“false positive”).

###### **4.4.2.1 Visual Acuity**

The first step of the detailed eye examination was determining of presenting visual acuity (Table 11). Of those screened by the project ophthalmologists (n=212), 31.1 % (n=66) were considered visually impaired in one eye and 25.5 % (n=54) in both eyes (visual acuity 0.3-0.05); and 14.2% (n=30) blind in one eye and 8.5% (n=18) blind in both eyes (visual acuity <0.05).

After providing the appropriate correction, most of the participants demonstrated essential improvement of the visual acuity of both eyes (Table 12).

**Table 11: Presented visual acuity with both eyes. Boarding School Visual Impairment Project 2002.**

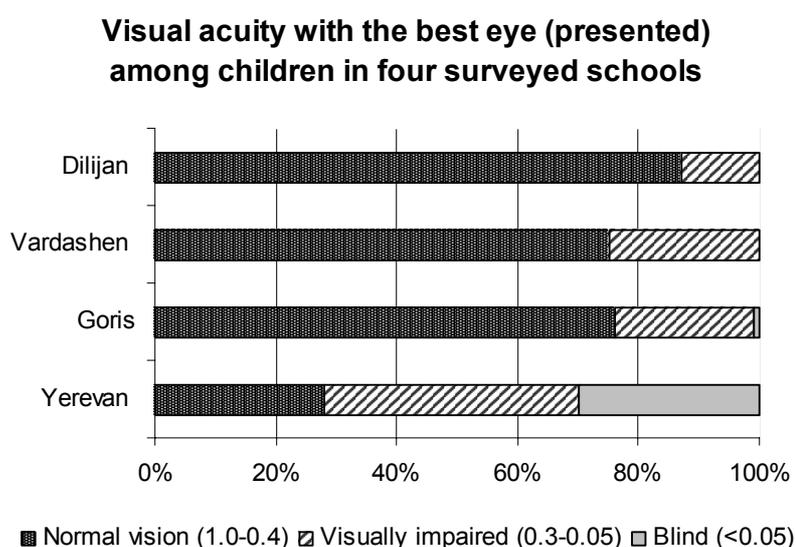
WHO classification	Visual acuity with both eyes	Frequency	Percent
Normal Vision	1.0- 0.4	139	65.6
Visually Impaired	0.3- 0.2	17	8.0
	0.1-0.05	37	17.5
Blind	<0.05	18	8.5
	Missing	1	0.4
<b>Total</b>		<b>212</b>	<b>100.0</b>

**Table 12: Visual acuity for both eyes with the best possible correction. Boarding School Visual Impairment Project 2002.**

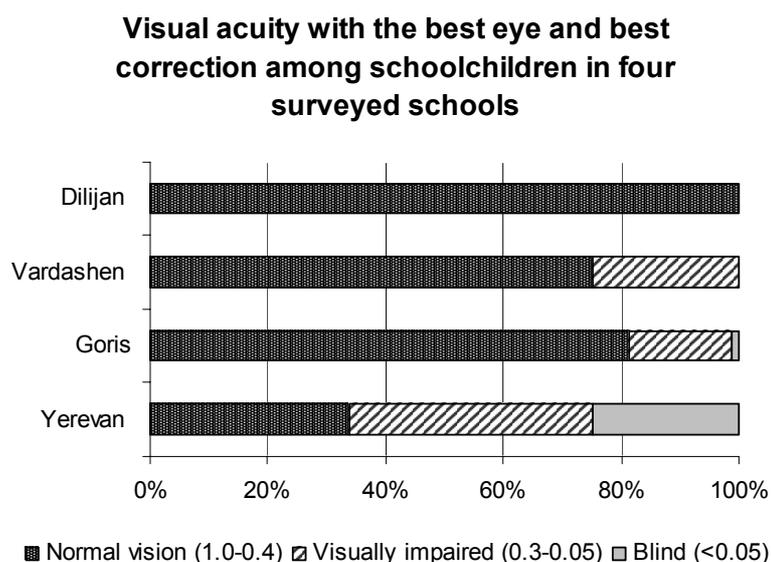
WHO classification	Visual acuity with both eyes	Frequency	Percent
Normal Vision	1.0-0.4	154	72.6
Visually Impaired	0.3-0.2	23	10.8
	0.1-0.05	18	8.5
Blind	<0.05	15	7.1
	Missing	2	1
<b>Total</b>		<b>212</b>	<b>100.0</b>

Distribution of presented and best-corrected visual acuity among children in different schools is presented in Figure 18.

**Figure 18. Presented visual acuity with both eyes among screened children. Boarding School Visual Impairment Project 2002.**



**Figure 19. Best corrected visual acuity with both eyes among screened children. Boarding School Visual Impairment Project 2002.**



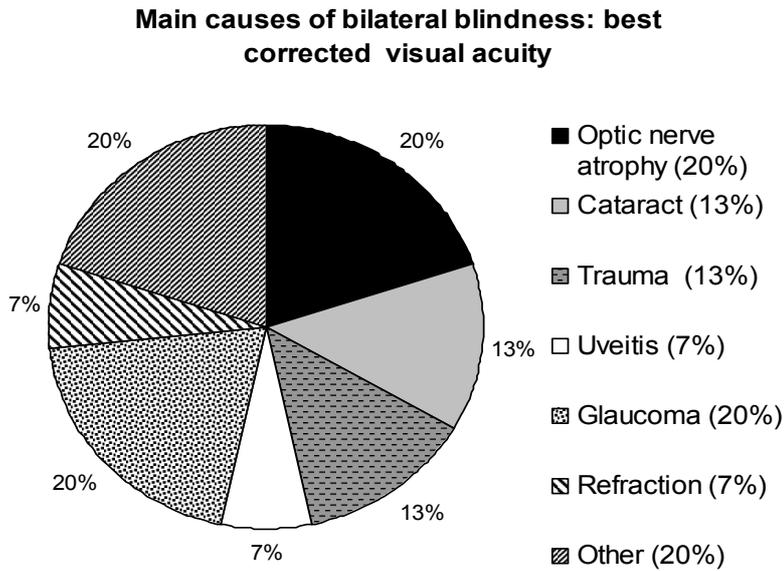
### **Main causes of bilateral and mono lateral blindness**

Overall in 4 boarding schools (n=593), 11.1 % (n=66) were considered visually impaired in one eye and 9.1 % (n=54) in both eyes (visual acuity 0.3-0.05); and 14.2% (n=30) blind in one eye and 8.5% (n=18) blind in both eyes (visual acuity <0.05).

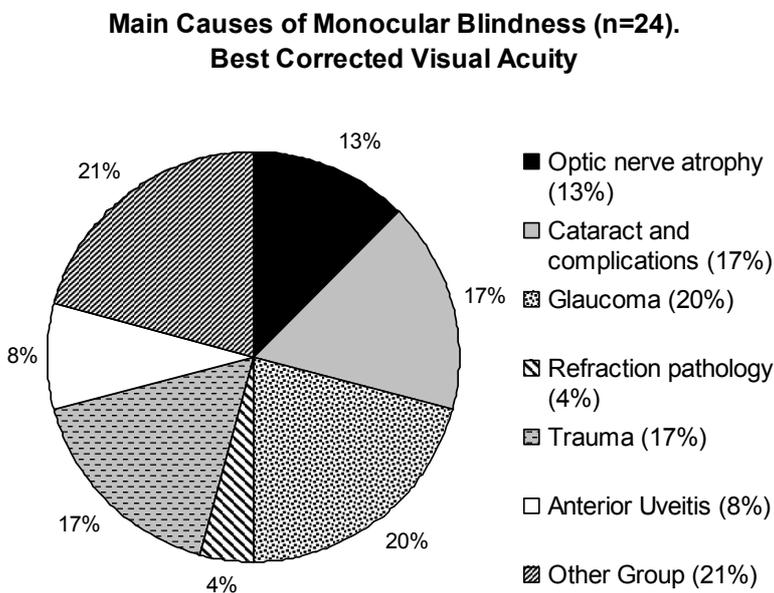
After best possible correction, there were 15 (2.2%) bilaterally blind children (best corrected visual acuity < 0.005) of all screened participants (n=593). Main causes of bilateral blindness were optic nerve atrophy in 3 cases, congenital glaucoma in 3 cases, congenital cataract in 2 cases, and complications after trauma in 2 cases (Figure 20).

A total of 30 children presented blindness in one eye. The main causes of mono lateral blindness were congenital cataract (19%), glaucoma (17%), refraction pathologies (17%), trauma (13%), and anterior uveitis (7%). After best possible correction considerably changed the number of monocularly blind patients with refraction pathologies from 17% to 4% (Figure 21). This indicates that the importance of provision of appropriate and good quality low vision aids and spectacles for visually impaired children.

**Figure 20. Main causes of bilateral blindness with best-corrected visual acuity among screened children. Boarding School Visual Impairment Project 2002.**



**Figure 21. Main causes of monocular blindness with best-corrected visual acuity among screened children. Boarding School Visual Impairment Project 2002.**



#### 4.4.2.2 Main eye diseases

**Refraction pathologies** Refraction pathology is considered to be the most common eye disease among children and adults [16, 17]. It is found in approximately 25% of the adult population of the US [16,17]. Refraction is the phenomenon in which parallel rays of light entering the eye at rest are brought to focus on the retina (nerve layer of the bottom of eye). This makes image formation possible for eye. If the image of a distant object cannot be focused exactly on the retina, refraction pathology occurs [16-18].

Examination indicated that 73.1% (n=155) of detailed eye screening participants (n=212) had refraction pathology in one or both eyes, of which 5.7% (n=12) had myopia, 5.7% (n=12) had hyperopia, and 60.8% (n=129) had astigmatism. Of all participants 8 were diagnosed spasm of accommodation.

The participants with myopia were divided into 3 groups with respect to the refraction after cycloplegia: 0.5-3.0 D-mild, 3.5-6.0 D-moderate, >6.0 D-severe myopia. A similar classification was used for hyperopia. In the case of astigmatism, the type of astigmatism as well as the degree and the axis were determined (Table 13).

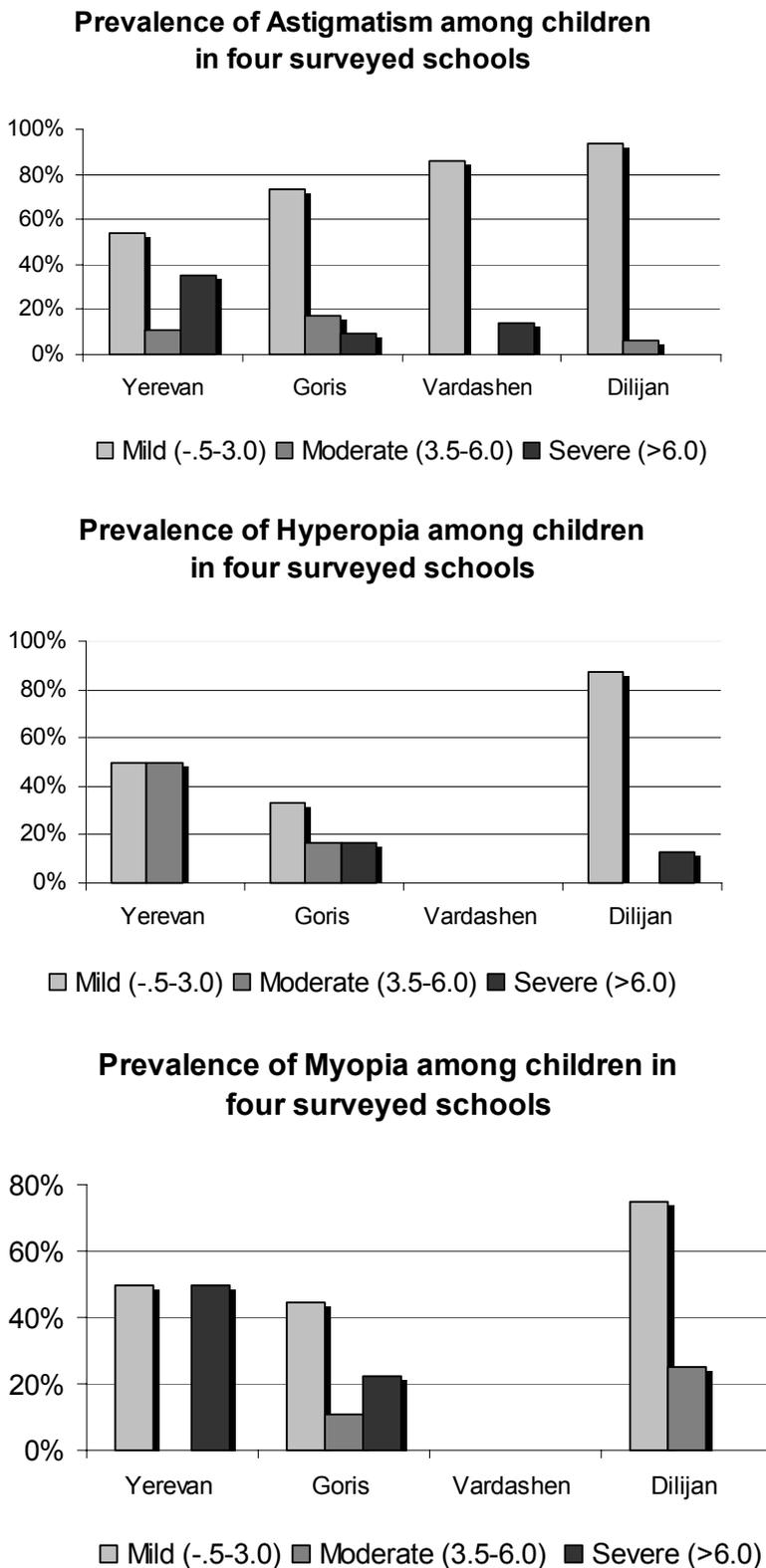
**Table 13. Astigmatism among participants of the detailed eye screening. Boarding School Visual Impairment Project 2002.**

Astigmatism	Refraction	Frequency	Percent
<i>Mild</i>	0.5 - 3.0	95	16
Moderate	3.5 - 6.0	15	2.5
<i>Severe</i>	>6.0	19	3.2
Total with Astigmatism		129	21.7
Total Screened		593	100.0

The rates of refraction pathologies were different among selected schools. The highest prevalence of severe conditions, as expected, was in Yerevan Boarding School for Children

with Visual Impairments. However, rates of severe astigmatism and myopia were also noticeably high in Goris Boarding School (Figure 22).

**Figure 22. Prevalence of refraction pathologies among children in four surveyed schools. Boarding School Visual Impairment Project 2002.**



Refraction pathologies in this study were significantly associated with gender of screened children. The rate was highest for females (81.1%) as compared for males (67.2%) (Table 13).

**Table 14. Association between refraction pathologies and gender of children. Boarding School Visual Impairment Project 2002.**

Gender	Total	Refraction Pathologies	
	N	Frequency	Percent
<b>Male</b>	122	82	67.2
<b>Female</b>	90	73	81.1
<b>Total</b>	212	155	100.0

( $\chi^2$ , p-value=0.019)

**Strabismus** Another common pathology among screened participants was strabismus.

Strabismus is a visual defect in which the eyes are misaligned and pointed in different directions [17,18]. According to the statistics, nearly 3% of the children worldwide have strabismus [17,18]. During the screening it was determined that 32 children presented this pathology that is nearly 5.4 % percent of all participants.

Univariate analysis showed that the rate of strabismus noticeably varies among different groups of participants (Table 15). The rate of strabismus was highest for children in Yerevan School for Blind and Visually Impaired, and school in Goris.

**Table 15. Prevalence of strabismus in different schools (n=593). Boarding School Visual Impairment Project 2002.**

Schools	Disease group/Strabismus	
	n	%
<b>Yerevan</b>	80	11.3
<b>Vardashen</b>	56	1.8
<b>Goris</b>	291	6.2
<b>Dilijan</b>	166	2.4
<b>Total</b>	593	5.4

**Cataract** The lens is the part of the eye that helps focus light on the retina. To help produce a sharp image, the lens must remain clear. A cataract is a clouding of the eye's lens that can cause a progressive, painless loss of vision. Cataract is the main cause of low vision and

blindness in the world. It accounts for a large proportion of the workload of most ophthalmologists and eye clinics. In many cases, full sight can be restored after a relatively simple operation, even among those who have been blind from cataract for many years [19,20].

During the Boarding Schools Visual Impairment Project, 13 children with cataract in one or both eyes were identified, which is 6.1 % of all participants of the detailed eye screening. The highest rate of congenital cataract was among male participants (Tables 16).

**Table 16. Association between congenital cataract and gender of children. Boarding School Visual Impairment Project 2002.**

Gender	Total	Congenital Cataract	
		N	Percent
Male	121	12	9.9
Female	88	1	1.1
<b>Total</b>	<b>209</b>	<b>13</b>	<b>100.0</b>

(p-value=0.009)

In some of the cases, cataract was present with other eye pathologies. Cataract was seen with glaucoma in 1 case, in 9 cases cataract was seen with different refraction pathologies, in one case with strabismus.

**Glaucoma** Glaucoma is a group of diseases that can lead to damage to the eye's optic nerve and result in blindness. It is one of the leading causes of preventable blindness in the developed countries. There are no early warning signs for this dangerous disease that is sometimes called the "sneak thief of sight." Early diagnosis and ongoing treatment can help slow or stop further vision loss [19,21-24]. A total of 6 patients (2.8 %) from 212 screened participants were diagnosed with congenital glaucoma, of which all 6 cases had glaucoma in both eyes. Glaucoma was combined with cataract in 2 cases, atrophy of eye globe in 2 cases. In 2 cases, glaucoma patients also had refraction pathologies, and in 1 case optic nerve

atrophy. All cases with glaucoma demonstrated low vision or blindness in both eyes with statistically significant association (p-value< 0.001) (Table 17).

**Table 17. Association between congenital glaucoma and visual acuity. Boarding School Visual Impairment Project 2002.**

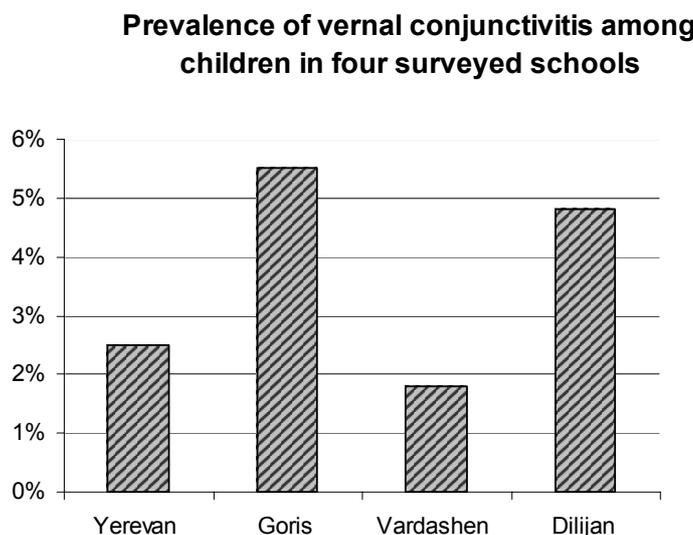
Disease group/Glaucoma	Best corrected visual acuity with both eyes				Total N
	1.0-0.4 %	0.3-0.2 %	0.1-0.05 %	<0.05 %	
Yes			33.6	66.7	6
No	77.0	10.5	7.5	5.0	206

**Vernal conjunctivitis** According to the previous surveys conducted by the Garo Meghriyan Eye Institute, [25] vernal conjunctivitis is considered to be an endemic disease for most of Armenia's regions. Vernal conjunctivitis, or pinkeye, is an inflammation of the mucous membrane (the conjunctiva) that lines the eyelid and upper eyeball caused by allergy or overexposure to sunlight [26,27]. Vernal conjunctivitis, usually affecting young boys, tends to be bilateral and occurs in warm weather. The high altitude and increased exposure to the sun contribute to this condition [26,27]. In this study population, vernal conjunctivitis was present in 26 participants, which is 4.4 % of all the children.

The distribution of children with vernal conjunctivitis among those receiving the detailed screening by district of residence is presented in Figure 22. The percentage of those children was especially high in Goris and Dilijan boarding schools.

The highest rate of vernal conjunctivitis was among children from refuge families (Table 18).

**Figure 23. Prevalence of vernal conjunctivitis among children in four surveyed schools. Boarding School Visual Impairment Project 2002.**



**Table 18. The rate of vernal conjunctivitis among refugee children. Boarding School Visual Impairment Project 2002.**

Disease group/Vernal conjunctivitis	Refugee		Total
	Yes	No	N
	%	%	
Yes	50.0	50.0	8
No	12.6	87.4	206

p-value= 0.001

## **5. Conclusions/Recommendations**

### **5.1 Service Project**

As a public service program, the project was highly effective, providing important health services to approximately 600 impoverished children. The project succeeded in demonstrating the effectiveness of cooperative efforts which draw synergy for combining resources and expertise in addressing compelling social concerns. Many parents/caregivers expressed their gratitude to the project staff, emphasizing that the organized screening was long awaited and that the children would not have another opportunity to be so scrupulously screened.

Overall, 593 children, studying in four boarding schools in Armenia were screened during the project. Qualified physicians gave each child. The pediatrician considered 543 children as having health problems at different levels of severity. The main disorders detected were various impairments of skeletal-muscular system development, chronic tonsillitis, teeth cavities, respiratory infections, and adenoids. Overall, 241 (40.6%) children were diagnosed with neurological problems, the main of which were functional disorders of Nervous system, mild cerebral dysfunctions with retardation of learning skills, moderate mental retardation, and angioneurosis. In case of a health problem, the project physicians informed the parent/caregiver, and written and oral recommendations for further treatment were provided.

All participant of the project underwent basic eye screening: 212 were diagnosed as having eye pathologies. Of the 212 screened by ophthalmologist, 57 children were recommended treatment in specialized eye clinics. Outpatient treatment was recommended to 22 people and 131 children were recommended for follow-up by the ophthalmologist in the regional polyclinic.

In total 29.7% (n=176) of the children screened during the Boarding School Visual Impairment Project benefited from the project by receiving prescription glasses. The project staff educated children about glass wear and care as well as assisted them in selecting frames.

Data from this study support conventional wisdom that regular health screenings detecting various health problems at early, correctable stages, minimize long-term permanent disability and improve quality of life.

## **5. 2 Limitations of the study**

As with all field projects, this study is subject to a number of limitations that may influence the generalizability of the findings, etc. The major limitations that might result in inaccurate

or misleading findings are summarized here and are taken into account to the extent possible in interpreting findings and drawing conclusions.

First, participants were selected from the boarding schools serving specific population: visually impaired children; socially unprotected children; difficult adolescents; and children that have had contacts with consumptives. Second, boarding schools were not selected randomly, but were chosen by UNICEF and the Ministry of Education and Science from all functioning boarding schools, what may also introduce a selection bias. In addition, medical and family histories were obtained via the children's self-report, possibly introducing a variety of reporting biases. This impacted the character of the study and made impossible precisely estimate the burden of health problems applicable to all school age children in boarding schools of Armenia. The findings are not generalizable but do provide insight into the problems of institutionalized children and may be used to guide development of recommendations to solve and/or possibly prevent these problems.

### **5.3 Conclusions**

Although the results of the study differ to various extents for the four schools surveyed, the inferences are the same for all of them.

#### **5.3.1 Vision**

Overall 211 of all children were diagnosed with different eye pathologies. In 4 boarding schools 11.1 % of children were considered visually impaired in one eye and 9.1 % in both eyes; and 14.2% blind in one eye and 8.5% blind in both eyes. This rate is high if compared with estimates of the prevalence of visual impairment and blindness in Europe [28-32].

Although results of the screening are not population-based, they point out that low vision and blindness are a significant public health problem among school-age children in boarding schools of Armenia.

Main causes of bilateral blindness as well as monocular blindness were congenital glaucoma, optic nerve atrophy, congenital cataract, and complications after trauma, and refraction pathologies. After best possible correction the number of monocularly blind patients with refraction pathologies changed from 17% to 4%. This indicates the importance of providing appropriate and good quality low vision aids and spectacles for visually impaired children.

Only 47% (n=279) of the participants (n=593) had ever visited ophthalmologist; and 17.2% (n=102) participants had ever had a preventive check up. There is need for improving preventive eye care provision for school age children.

Severe blinding conditions such as congenital cataract and glaucoma were present mainly among children in Yerevan Boarding School for Children with Visual Impairments. In the other 3 schools, refraction pathologies, strabismus and vernal conjunctivitis were the most common eye pathologies. An overall unadjusted prevalence of refraction pathology of 22.6 %, strabismus (4.5 %), vernal conjunctivitis (4.9%) was observed in the study subjects from boarding schools in Dilijan, Goris and Vardashen, which is considerably higher than in findings from Europe and North America [28-34]. Currently in Armenia, children placed in boarding schools typically are from unsuccessful families or have low socio-economic status. Studies suggest that a history of late and less frequent attendance of antenatal care services, unmarried motherhood, unwanted pregnancy, abuse, nutritional factors, poverty, and social deprivation during pregnancy [35-44], and poverty [45] increase the risk of ocular motility disorders, specifically strabismus, and may place a child at risk for conditions that may negatively impact the visual system. These might be an explanation of high prevalence of strabismus and other eye pathologies among screened children.

According to the accepted hypothesis there are distinctive gender patterns in distribution of myopia [33-34,46]. For instance, the 1971 and 1972 NHANES data showed higher prevalence rates in females than in males [47]. However, in the boarding school study, a higher preponderance of myopia in males (65.6 %) as compared to females (8 %), with statistically significant differences ( $\chi^2$  test,  $p=0.02$ ) was found.

In this study, strabismus was inversely associated to two anthropometric parameters, showing past and present nutritional status (stunting and under nutrition). These statistically significant associations could be explained by several factors. A child with strabismus may have poorer nutrition as a result of less care (they are less valued) or stress due to negative peer attitude. Another possibility is an associated retarded physical development of children with strabismus. However, there might be no direct association between strabismus and stunting, as a multitude of social vulnerabilities affect children in boarding schools, possibly confounding the relationship.

The correlation analysis between the disorders of endocrine system and various eye pathologies revealed statistically significant association ( $\chi^2$ ,  $p$ -value=0.017) between delayed puberty and visual acuity. Low vision along with poor nutrition could result in growth retardation. More studies are needed to test this hypothesis.

### **5.3.2 Nutrition**

The overwhelming majority of the children were from socially vulnerable families and in most cases parents of the children were unemployed. Nutritional status/food intake was checked for the seven previous days. For all but the Yerevan boarding school, this was a time when school was not in session, but it still may be used as an example of children's average nutritional pattern, limited only to frequency of intake of Vitamin A containing food items, and not the source of food. Analyses revealed that the staples in the children's diet were

bread, potato and pasta. Nutrition with an insufficient amount of vegetables and fruits (especially rich with Vitamin A) was typical for the surveyed children. The worst nutritional patterns were in Yerevan Boarding School for children with Visual Impairments and Goris Boarding School for Children from Socially Vulnerable Families and with Visual Impairments.

Anthropometric measurements of the children revealed stunting and under nutrition. The prevalence of these conditions varied among schools with the worst situation in Vardashen Special Educational Complex, where stunting, showing extended period of inadequate food intake in early childhood (25%) and under nutrition, as an indicator of current nutritional status (17%) were frequently seen. Based on the pediatrician's assessment, delayed physical development, short height, and body weight deficiency were detected in a majority of schoolchildren. The largest proportions of such children were in Vardashen Special Educational Complex (60.7%) and in Goris Boarding School (42.1%).

School performance (typical school grades) was rather low among surveyed institutionalized children; the worst situation was in Vardashen Educational Complex. Analysis revealed statistically significant association between being undernourished and school performance. Children with weight deficiency showed the poorest performance. The combined variable of delayed physical development, short height, and body weight deficiency was also associated with poor school performance.

### ***5.3.3 Skeletal muscular system***

It was also determined that specific deformations and pathologies of skeletal-muscular system are very frequent among children in the schools, ranging from one-third of the children in one of the schools to more than a half in other. Winged scapulae and chest deformations were the most frequently detected abnormalities. This maybe attributed to the inadequate amount of

physical exercise and overall low level of appropriate physical development of a child. Except for the Vardashen Educational Complex, only only a few children mentioned sport classes at school.

About 20% of all children had flat foot, which is often a result of wearing bad shoes lacking instep/arch support.

#### ***5.3.4 Main health disorders***

The prevalence of teeth cavities was on average 20% among children in the three schools. The highest percentage (39.2%) of cavities was detected among children in Yerevan Boarding School for Children with Visual Impairments. The situation was under control in the Goris Boarding School, where the Hovard-Karagyozyan Foundation was conducting a dental health program.

Chronic tonsillitis was diagnosed in one-fifth to one-third of screened children. Further analysis revealed a statistically significant association between teeth cavities and chronic tonsillitis. Review of personal histories revealed a high percentage (22%) of frequent ARI among children in Yerevan Boarding School for Children with Visuals Impairments. The same children had the highest rate of adenoids and nasal partition curvature; however, analysis did not reveal a statistically significant association.

#### ***5.3.5 Neurological Development***

Many children had specific retardation of learning development, delayed reactions, and communication problems. Seven main groups of health disorders were detected. The largest group of disorders was “mild cerebral dysfunction with retardation of mental development and boundary intellectual insufficiency and retardation of special learning skills”. These disorders are mainly explained by defects of upbringing, lack of attention from the adults

(both parents and teachers) to children, and poor education. They may also have roots in antenatal and perinatal period, and be associated with poor maternal nutrition. As one would expect the worst rate (30.4%) was detected in Vardashen Special Educational Complex. Functional disorders of the nervous system included neurotic reactions, anxiety neurosis, bedwetting (enuresis), neurasthenia, neurotic tics, and logoneurosis. These abnormalities, mainly connected with upbringing disorders, various stress factors, puberty, and heredity were detected in children varying from 7.2% in Dilijan Sanitary School to 28.5% in Vardashen Educational Complex.

Another disorder detected, primarily in the Yerevan Boarding School (6.6%), was deprivational mental retardation, which is one of the symptoms of sensory integration disorder (DSI). Moderate mental retardation due to early organic disorders/abnormalities of central nervous system was diagnosed in children in Yerevan and Goris boarding schools with proportions of 6.6% and 1.0% respectively. This infirmity, as well as deprivational mental retardation, was significantly associated with visual acuity.

#### **5.4 Recommendations**

- Organize similar health screenings in other boarding schools of Armenia in order to have comprehensive and generalizable information on health status of institutionalized children in the country
- Provide follow up care for those children diagnosed with severe health pathologies, requiring thorough diagnostic or treatment in specialized clinics
- Elaborate and conduct special program of psychological consultations/rehabilitation for the children in boarding schools to address various problems revealed during the screening

- Conduct dental health screenings, and cavity prevention and treatment programs for institutionalized children (starting in Yerevan Boarding School for Children with Visual Impairments and Vardashen Special Educational Complex)
- Review boarding school's curriculum allotting more hours for the classes of physical training and elaborate program of physical conditioning and comprehensive exercises with equal/even loading for all parts of skeletal muscular system
- Look for patron/sponsor organizations for the boarding schools to organize and provide healthy nutritious diet for the institutionalized children. Organize food control and monitoring on a regular basis conducting sensitive to short-term changes measurements to assess nutritional status of the children
- Establish regular yearly vision checkups in all boarding schools using school medical personnel. For this purpose it is recommended to organize a short training for medical personnel on the visual acuity screening using AMAGB test. The test is available at GMEIPO, and could be distributed in all boarding schools (free of charge).
- Establish low vision services center for children in Armenia. The main role of low vision service is to serve as a bridge between medical, educational, and rehabilitative services. The low vision center can act as a referral point for the child to access other services that may be required, e.g., orientation and mobility training, early intervention, provision of low cost glasses and low vision devices. Currently low vision devices are not available in the overwhelming majority of optic shops/services. Most of the devices can be produced locally using indigenously available materials and appropriate technology. The use of simple magnifiers can help children pursue education in normal stream schools and improve their quality of life.
- Conduct Childhood Blindness study in all schools for Blind and Visually Impaired children in Armenia, using WHO instructions and standards in order to define the main causes of childhood blindness in Armenia.

- A population based blindness survey is needed to precisely estimate the prevalence of blindness and low vision among school age children in Armenia.
- It is highly recommended to conduct further multivariate analysis of this data, as there were many children who were diagnosed as having several pathologies at once. Their overlapping may have confounded the univariate data analysis.

### **In summary**

1. The project was highly effective:
  - 593 children were screening by pediatrician and neurologist during the Boarding Schools Visual Impairment Project
  - 212 children underwent detailed eye screening
  - 543 children were considered as having health problems at different levels of severity by pediatrician, 241 (40.6%) were diagnosed with neurological problems, 211(35.6%) presented eye problems
  - All children in need were provided with written and oral recommendations for further treatment, parents/caregivers were informed about any health problems of children
  - 176 pairs of prescription glasses were distributed to the participants
2. The rate of blindness and low vision among participants exceeds the European benchmark several times over
3. Provision of prescription eye glasses considerably decreased the rate of blindness and low vision among participants
4. The main causes of blindness were congenital glaucoma and cataract
5. Blindness survey is essential to obtain population based data on prevalence and main causes of reduced vision
6. Anthropometric measurements of the children revealed stunting and under nutrition.

7. The pediatrician's assessment detected delayed physical development, short height, and body weight deficiency in a majority of schoolchildren surveyed.
  8. Specific deformations and pathologies of skeletal-muscular system are very frequent among children in the surveyed schools, ranging from one-third of overall number of children in each particular school to more than a half, which could be attributed to the inadequate amount of physical exercises and overall low level of harmonic physical development of a child
  9. Many children have specific retardation of learning abilities development, delayed reactions, and communication problems. These disorders are mainly explained by defects of upbringing, lack of attention from the adults (both parents and teachers) to children, and poor education.
- Further multivariate analysis of this data is recommended to guide future programmatic and assessment activities.
  - Children in boarding schools need special attention of the governmental and international health organizations: special prevention and treatment interventions are required.
  - While not generalizable, these findings confirm that institutionalized children are indeed among Armenia's most vulnerable population and are in dire need of improved medical and health conditions if they are to reach their full potential. This treatment and assessment program highlights the critical need for expanding programs and assessments to ensure the health of institutionalized children.

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