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ASSESSMENT ON PREVALENCE OF BLINDNESS CAUSING EYE DISEASES AND THE EYE HEALTH VULNERABILITY INDEX IN ARMENIA

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ABSTRACT

Massive eye screenings of population were organized by the Armenian EyeCare Project in the Republic of Armenia during 2007-2009. Data on eye health of 26,711 persons voluntarily screened by the Armenian EyeCare Project team were obtained. Taking into account that the random sampling method was not applied, the acquired data were weighted to obtain age-sex and regional proportions of population in the country. Within this study the data were also extrapolated to estimate the nationwide indicators for prevalence of eye diseases causing blindness and to calculate the eye health vulnerability index. Methods of statistical analysis were applied using the SPSS software.

The analysis of data obtained signifies that in Armenia prevalence of blindness and visual impairment among the adult (above 16 years old) population was estimated at 0.7% and 4.8%. correspondingly. The prevalence of cataract was estimated at 8%, glaucoma spread made 1.3%. corneal diseases: 1.7%, diabetic retinopathy: 1.5%; macular degeneration prevalence amounted 2.3%. Thus, cataract was considered the most widespread eye disease among the adult population in Armenia. Nevertheless, the cataract surgical coverage was estimated at 23.8%; hence, a large part of avoidable blindness related to cataract was not covered by the surgical services.

The proportion of adults (≥16 years old population) with the blindness causing eye disease revealed at least in one eye was determined as the eye health vulnerability index and estimated at 13.3%. Among the cohort of persons at the age of ≥50 years old the mentioned index was 3 times higher: 37%.

According to the estimated econometric model, every additional 5 years of life after 50 increase the probability for a person to have vulnerable eye health by about 9%. Taking into account the estimates on the prevalence of eye diseases, in particular, cataract and its surgical coverage, as well as the processes of aging in the population of Armenia, the state health policy in the field of ophthalmology should be adjusted.

Keywords: *eye diseases, prevalence, blindness, cataract, surgical coverage.*

INTRODUCTION

In accordance to WHO global estimates, 39 million people in the world were blind in 2010 [*Pascolini D., Mariotti S., 2012*] and the number of blind people worldwide increased by 1-2 million per year [*Resnikoff S. et al., 2002*]. According to 2010 data, the main eye diseases causing blindness were cataract (51%), glaucoma (8%), and macular degeneration (5%).

Eye diseases and blindness are more widespread among the population above 50 years of age: the majority – about 82% of all blind people in the world – persons at the specified age make [*Pascolini D., Mariotti S., 2012*].

It should be mentioned that the officially published data on eye diseases in the Republic of Armenia include only two main indicators characterizing the eye health of the country population: a)

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general morbidity of the population related to the diseases of eye and *adnexa* (with a specification of glaucoma cases) and b) the number of first-time revealed cases of diseases of eye and *adnexa* per year. The cases of morbidity in general population are registered at the moment of taking medical advice and during preventive examinations [*Health. 2012*].

The dynamics of mentioned indicators shows that in Armenia the general morbidity related to diseases of eye and *adnexa* increased 2.5 times in the period of 2004-2011 and summed up to 3,272 persons per 100,000 population or nearly 88,000 people in 2011 (Figure 1) [*Health, 2012*]. Furthermore, in 2011 the number of first-time diagnosed cases also increased (nearly two times in the same period), while their share in the total eye morbidity cases comprised nearly 46%. The mentioned upward morbidity trend points out the importance for estimating prevalence of blindness and main eye diseases, especially blindness causing ones: cataract, glaucoma, age-related macular degeneration, retinopathy, corneal diseases, etc. Such estimates are especially important for adjusting the state eye care policy and priorities to the increased needs of the country population.

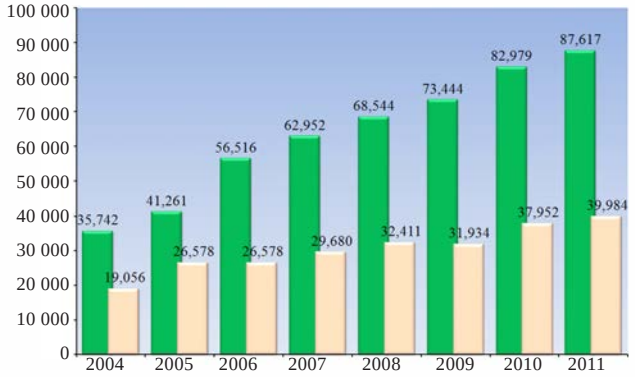

FIGURE 1. *Absolute number of registered (■) and first-time-revealed (□) cases of diseases of eye and adnexa in Armenia* [*Health, 2012*].

However, among diseases of eye and *adnexa* the official statistics specifies only glaucoma cases. According to 2011 data, in Armenia 7,458 subjects were diagnosed with glaucoma [*Health, 2012*]. The official statistics on other diseases of the eye and *adnexa*, as well as estimates on blindness prevalence, visual impairment and the main eye diseases causing blindness in different age groups of population are lacking. Some population-based sample surveys were carried out in order to estimate main eye health indicators among the country population; nevertheless, they had only regional representativeness and their results could not be applied or distributed to the national level [*Khachatryan N. et al., 2004*].

Thus, there is a lack of statistics on country-wide indicators on prevalence of blindness and main eye diseases.

The purpose of this article was to present the estimates on prevalence of main eye diseases causing blindness in Armenia and the eye health vulnerability index (EHVI) within different age groups of the country population. These estimates will enable decision-makers to assess the situation with eye diseases prevalence among the population and to determine the needs for specific eye care services in the country.

Material and Methods

Since 2003, the Armenian EyeCare Project (AECP) medical groups and the Mobile Eye Hospital (MEH) staff involved the overwhelming majority of country residents from urban and rural communities in the massive eye screenings. The Armenian EyeCare Project also carried out MEH-based laser and surgical treatment of eye diseases among the poor. Eye screening and examinations were conducted by a trained team of ophthalmologists and clinical residents from Yerevan clinics. A standard protocol for eye examination record was used at screenings. The examination included visual acuity tests using Landolt and/or Sivtsev-Golovin tables. Pinhole vision was tested in those individuals with visual acuity below 6/18 (either eye). The assessment of vision loss causes was undertaken using a standard protocol with a direct ophthalmoscope “Heine Beta 200” (Germany). Eye pressure was measured by a tonopen or Maklakov tonometer (“Medtronic Tono-pen XL”, USA).

The AECP completed three medical missions all over Armenia in the period of 2003-2009. On the whole, the ophthalmologists visited 841 rural and urban communities of the country (nearly 90% of the communities in Armenia). Due to the mentioned large-scale activities in the specified period, the AECP had screened and rendered eye services to around 160,000 persons (around 5% of the country population). The AECP combined eye screenings of

the population with relevant information collection and analysis. Data on the screened people were assembled in the databases (SPSS format). The statistical analysis of outcome data made it possible to estimate prevalence indices of eye diseases among the population of Armenia in accordance with the internationally accepted methodology.

In this article, we present the resulting scientific estimates on the prevalence of main eye diseases among the population of Armenia based on the AECP screening activities carried out in nine (out of ten) regions of the country during the AECP third medical mission in the period of 2007-2009. Data of precisely this period were selected for analysis taking into consideration two reasons: 1) regular upgrades/updates of the AECP questionnaires and filled-in forms secured a more detailed breakdown according to eye diseases; 2) these data embraced the most recent updates. During the third mission, AECP medical groups screened 26,711 persons (or around 0.9% of the country population) from 615 different urban and rural communities of Armenia; among the mentioned cohort 25,516 or 95.5% were adults (above 16 years old).

It is worth mentioning that the AECP database is not a result of population-based random sampling survey, since the participation of the population in the AECP screening was of a voluntary nature. For that reason, the bulk of obtained data was weighted to obtain the age-sex (the 5-year age interval) and geographic (rural-urban and regional) proportions of the screened population to the demographic and geographic characteristics of the country. Data were also extrapolated to estimate the nationwide indicators for prevalence of blindness causing eye diseases and to calculate the EHVI.

The estimations and indicators were calculated for the adult population (≥16 years old) and, particularly, for the population in the cohort of ≥50 years old, taking into account that: a) the latter cohort was the main age group at risk and b) the processes of population aging were obvious in Armenia. On the scale of the United Nations demographic aging, if the proportion of the population aged 65 and over comprises more than 7% of the country population, it is assumed that the population is aging. In Armenia, at the beginning of 2012 the proportion of the population aged 65 years and over comprised about 10%.

Results and Discussion

According to WHO definition, blindness corresponds to the visual acuity of less than 3/60 (0.05) in the better eye, with the best possible correction. People with visual acuity below 6/18, but equal to or better than 3/60 (0.05-0.33) in the better eye, with the best possible correction are considered as having low vision. The "visual impairment" definition includes low vision and blindness [*A framework, 2002*].

During the third mission AECP doctors found out 3,147 subjects with visual impairment among the population screened in Armenia during 2007-2009. Among the mentioned cohort, 425 persons were blind and 2,722 had low vision. In order to estimate the nationwide indicators of visual impairment prevalence, the data obtained were weighted for adjustment of the age-sex and regional distributions of the screened population in accordance to those of countrywide proportions. Upon the subsequent data extrapolation we assessed the prevalence of blindness (visual acuity less than 3/60 in the better eye, with the best possible correction) and low vision (visual acuity in the better eye, with the best possible correction 3/60-6/18) at the national level. According to our estimates, 0.7% of the country population was blind (95% confidence interval 0.5÷0.9), 4.1% (95% confidence interval 3.9÷4.4) had low vision, and in total 4.8% of population had visual impairment (95% confidence interval 4.4÷5.3).

It should be mentioned that according to WHO estimates, the prevalence of low vision in Caucasus is 2-3%, while the prevalence of blindness is 0.3-0.6%. Nonetheless, blindness prevalence estimates for Armenia obtained by AECP team were close to the upper threshold set by the WHO for the Caucasus, while the visual impairment (visual acuity in the better eye, with the best possible correction less than 6/18) estimates exceeded the upper threshold by 1.2 percentage points (Table 1). In Armenia the prevalence of visual impairment was nearly 2 times higher among the population above 50 years of age: almost 43% of subjects with visual impairment were in this age category.

In Armenia the main cause of visual impairment is cataract. It makes around 50.6% of the cases of visual impairment.

According to our results, among adults with visual impairment, 7.9% had glaucoma, 22% had

Table 1.

Estimates of visual impairment prevalence in Armenia (%)

Age groups among the total adult population	Blindness:	Low vision:	Visual impairment:
According to AECP 2007-2009 database			
≥16 years old	0.7	4.1	4.8
≥ 50 years old	1.6	6.8	8.4
WHO estimation for the Caucasus			
lowest estimation for the adult population	0.3	2.0	2.3
highest estimation for the adult population	0.6	3.0	3.6

fundus-related problems, and 15% had corneal diseases (Figure 2).

Visual impairment caused by cataract is avoidable through the surgical intervention applied in appropriate time. According to our estimations, 2.3% of adult population of the country underwent cataract surgery in one eye and another 0.7% – in two eyes. Based on AECP data, the percent indicator of cataract surgical coverage (CSC) reflecting the proportion of operated cataract cases in the total number of operable cataract cases was calculated using the following formula:

$$CSC = \frac{x+y}{x+y+z} \times 100$$

where: x = number of persons with unilateral (pseudo) aphakia and operable cataract in the other eye; y = number of persons with bilateral (pseudo) aphakia; and z = number of persons with bilateral operable cataract.

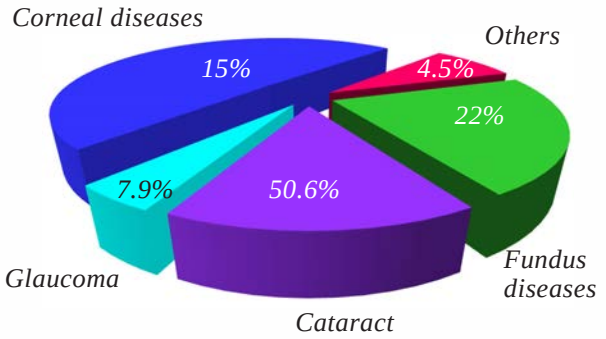

Figure 2. *Causes of visual impairment among the adult population of Armenia (% of adults with visual impairment).*

Among people with operable cataract the share of those, who underwent cataract surgery in one or both eyes, was estimated at 23.8%. For comparison: even in developing countries the indicator of CSC is much higher, e.g. 63% in India and 44% in Pakistan [*Jadoon Z. et al., 2007*].

According to the estimates based on AECP data, in Armenia the most widespread eye diseases among the adult (≥ 16 years old) population were those of the eye anterior segment (21.9%), cataract (8.4%) and different pathology states of the ocular fundus (7.9%) (Table 2).

Estimates on prevalence of the most serious

Table 2.

Estimates of the main eye diseases prevalence in Armenia

Eye disease	Among the total adult population (%)
Eye anterior segment diseases, including:	**21.9**
- corneal diseases	1.7
Cataract	**8.4**
Non-glaucomatous diseases of optic nerve	**1.2**
Glaucoma	**1.3**
Fundus-related diseases, including:	**7.9**
- diabetic retinopathy	1.5
- hypertensive retinopathy	2.1
- macular degeneration	2.3

blindness causing eye diseases have a special importance from the point of view of blindness prevention. In this study glaucoma, cataract, corneal diseases, diabetic retinopathy and macular degeneration were considered as the most serious eye diseases causing blindness. As already noted, eye diseases are more prevalent among the population above 50 years of age. We obtained quantitative estimates on the prevalence of the above-mentioned diseases not only among the general adult population, but also among the population above 50. According to our results, in the age group of ≥ 50 years old, the prevalence of cataract is 3.2 times higher than among the general adult population and comprises 27% *vs.* 8.4%, the prevalence of macular degeneration is almost 3 times higher and comprises 6.5% *vs.* 2.3%, the prevalence of glaucoma is 2.6 times higher comprising 4% *vs.*1.3%, and the prevalence of diabetic retinopathy is 3 times higher: 4.4% *vs.* 1.5% (Figure 3).

Based on the estimates on prevalence of main eye diseases causing blindness, the EHVI was calculated for adult (above 16 years old) and above 50 years of age population in Armenia. People with corneal diseases, cataract, glaucoma, diabetic retinopathy and/or macular degeneration were considered as having vulnerable eye health. The EHVI was calculated as a percentage of subjects having at least one of the mentioned diseases in the total number of population in the corresponding age group. The calculations showed that the share of adult people having eye diseases causing blindness is 13.3% in the country. On the other hand, 37% of the population above 50 years of age (or almost every 3rd among them) had vulnerable eye health, i.e. had at least one disease causing blindness. It means that the EHVI among the population above 50 years of age was 2.8 times higher than among the adult population on the whole.

Moreover, among the population above 50 years there was a clear linear relationship between age and vulnerability of eye health, which was natural. The lowest EHVI score was found among the population in the age group of 50-54 (23.8%). For the age group of 80 years and above, about 73% of subjects had vulnerable eye health. We performed a quantitative assessment of the relationship between age and vulnerability of the eye health. Estimation of the linear regression model showed that every additional 5 years of life after the age of 50 increased the probability of a person to have vulnerable eye health by about 9% (Figure 4). These results are particularly important, given the mentioned processes of aging in the population of Armenia.

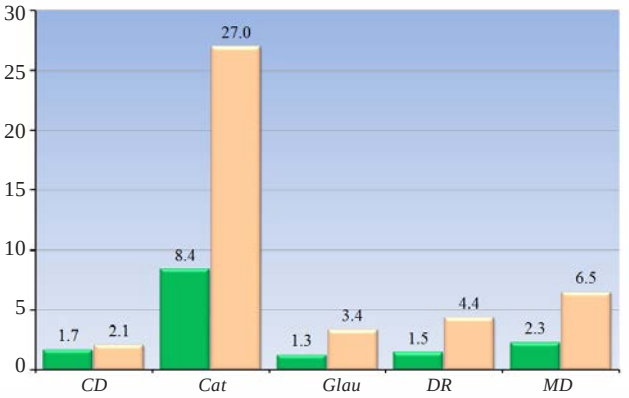

FIGURE 3. *The estimates on prevalence of main eye diseases in Armenia among the population above 50 years of age (■) and among the adult (16+ years old) (□)population on the whole.*

NOTES: ***CD*** *- Corneal diseases;* ***Cat*** *- Cataract;* ***Glau*** *- Glaucoma;* ***DR*** *- Diabetic retinopathy;* ***MD*** *- Macular degeneration.*

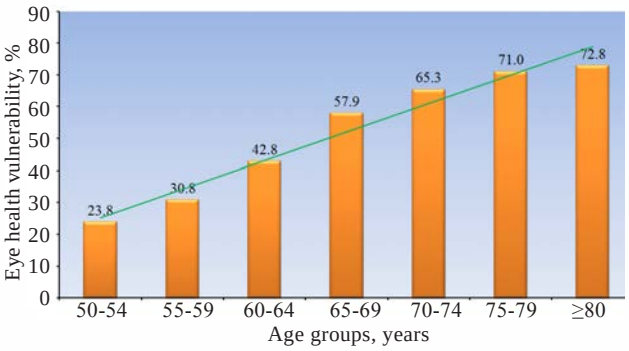

Figure 4. *Eye health vulnerability index (EHVI) for population by age subgroups and the linear regression estimation (%).*

CONCLUSION

According to official data, in Armenia the general morbidity related to the diseases of eye and *adnexa* increased in population by 2.5 times during 2004-2011. According to our findings, 4.8 % of adults (16 years old and above) had visual impairment, among which 0.7% were blind. The main cause of visual impairment was cataract (51% of the visual impairment cases). It should be mentioned that the most prevalent eye diseases among the adult population in Armenia were cata-

racts (8.4%) and the fundus-related diseases (7.9%). Nevertheless, the CSC was quite low in the country and comprised about 24%. Thus, the majority of blindness and visual impairment cases associated with cataract were not covered by surgical services.

Eye diseases were more prevalent among the population over 50 years of age. In this age group the prevalence of visual impairment was 1.8 times higher than among the adult population in general and comprised 8.4%; the prevalence of cataract comprises 27%, macular degeneration – 6.5%, glaucoma – 3.4%, diabetic retinopathy – 4.4%. As revealed by our study, 13.3% of the tested adult persons in Armenia had at least one eye disease that led to blindness: diseases of the cornea, cataract, glaucoma, diabetic retinopathy, macular degeneration, i.e., these subjects had vulnerable eye health. Among the population aged over 50 years the share of people with the vulnerable eye health was almost 3 times higher compared to the general adult population and comprised 37%.

Every additional 5 years of life after 50 increase the probability of having a vulnerable eye health by about 9%. Taking into account the estimates on the prevalence of eye diseases, and, particularly, of cataract and its surgical coverage, as well as the processes of aging in the population of Armenia, state health policy in the field of ophthalmology should be adjusted.

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