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Original research

Visual impairment and blindness in a population-based study of Mashhad, Iran

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Abstract

Purpose: To determine the prevalence of visual impairment and blindness and related factors in the 1- to 90-year-old urban population of Mashhad.

Methods: In this cross-sectional study of 1- to 90-year-old residents of Mashhad, in northeastern Iran, sampling was done through random stratified cluster sampling (120 clusters). After selecting the samples and their participation in the study, all subjects had vision testing including measurement of visual acuity and refraction, as well as examinations with the slit-lamp and ophthalmoscopy. Visual impairment (primary outcomes) was defined as a visual acuity worse than of 0.5 logMAR (20/60) in the better eye.

Results: Of the 4453 selected persons, 3132 (70.4%) participated in the study. The prevalence of visual impairment based on presenting vision and best-corrected vision was 3.95% (95% confidence interval [CI]: 3.13−4.77) and 2.23 (95% CI: 1.54−2.91), respectively. The prevalence of presenting visual impairment increased from 1.59% in children under 5 years of age to 43.59% in people older than 65 years of age; these figures were respectively 1.59% and 42.31% based on corrected visual acuity. In the logistic regression model, older age (OR = 1.06, 95% CI: 1.04−1.07, $P < 0.001$), higher education (OR = 0.16, 95% CI: 0.06−0.38, $P < 0.001$), and low income (OR = 1.36, 95% CI: 1.21−1.72, $P < 0.001$) correlated with impaired sight. Based on presenting vision and best-corrected vision, the prevalence of blindness was 0.86% (95% CI: 0.51−1.22) and 0.32% (95% CI: 0.1−0.55). The most common causes of visual impairment were uncorrected refractive error (41.8%) and cataract (20%).

Conclusions: According to our findings, the prevalence of visual impairment was intermediate in comparison with other studies. The prevalence of visual impairment in our study was similar to the global average; however, it was markedly high at older ages. Nonetheless, refractive errors and cataracts remain as the main causes of impaired vision and blindness in this population, while these two conditions are easily treatable with correction or surgery.

Keywords: Visual impairment; Blindness; Low-vision; Cross-sectional study; Middle-East

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Introduction

Visual impairment and blindness is a global problem with important socio-economic consequences that have proven effects on the quality of life of individuals, and usually impose great family-related and socio-economic losses.[1,2] According to the World Health Organization (WHO) estimates, visual impairment is responsible for 3.9% of the overall disease burden and disability-adjusted-life-year.[3] Also, the report by the WHO in 2010 indicated that about 39 million people were blind and 285 million of the world's population suffers from vision impairment.[4] In light of the importance of evaluating the trend and causes of visual impairment, the WHO established the Vision 2020 program in 1999 in order to eliminate preventable blindness throughout the world by 2020.[5,6] Studies show that despite reduced age-standardized prevalence rates of vision impairment and blindness in the past 20 years,[3] cataracts are still the leading cause of visual impairment and blindness based on corrected vision, such that by the end of 2010, cataracts were responsible for 1 out of every 3 cases of blindness and one out of 6 cases of visual impairment.[7] According to the WHO report in 2014, however, uncorrected refractive errors (myopia, hyperopia or astigmatism), with a prevalence of 43%, are the leading cause of presenting visual impairment around the world. The WHO reports also show that highest prevalence rates of visual impairment and blindness are found in developing countries, especially in the Eastern Mediterranean region, such that approximately 90% of the visually impaired live in low income countries,[4] while European and American countries have the lowest rates. In several studies, individual socio-economic indicators, such as low income, low education levels, and low social class have been introduced as factors contributing to increased prevalence of visual impairment and blindness.[8,9] Iran is a country in the Eastern Mediterranean region which considers the Vision 2020 program for eliminating preventable blindness a health priority. Given that more than 80% of the cases of visual impairment are preventable and easily treatable, knowledge of prevalence rates of visual impairment and blindness and their main contributing factors in the country is a prerequisite of success in the field of prevention and planning for the implementation of appropriate health policies. Therefore, to date, different studies in different parts of the country, in urban or rural areas, and in different age groups or population-based studies have been conducted to determine the prevalence of visual impairment and blindness. These include studies in Khuzestan,[10] Tehran,[11] Khorasan,[12] Shahroud,[13] Varamin,[14] and Yazd.[15] To facilitate achieving the goals of the Vision 2020 program in Iran, the present study was conducted to determine the prevalence of blindness and visual impairment as well as their leading causes in Mashhad, a city in the northeast of Iran and the nation's second most populated city.

Methods

The cross-sectional population-based study was conducted to evaluate refractive errors in the urban population of Mashhad in 2008. In this study, the target population was all the residents of Mashhad who were older than 1 year old. According to the most recent national census, the population of Mashhad was 2,451,712 in 2006. We used stratified cluster sampling to select the participants proportional to the population of different districts of Mashhad (city districts were considered as strata). In each district, the number of the selected clusters was proportional to the number of the household that lived in the district. We selected 120 clusters randomly using the blocks determined by the Statistical Center of Khorasan Razavi Province. In each cluster, the first house (determined based on the house number) was considered the head cluster.

We continued sampling in each cluster systematically for up to 10 households. After the interviewers introduced themselves and gave a brief explanation about the objective of the study, they completed a demographic questionnaire and invited the households to the optometry clinic of Mashhad University of Medical Sciences for a complete eye examination. Sampling was continued until 10 households were selected in each cluster. If one household was not willing to take part in the study or was not home at the time of sampling, the next house number was invited. This systematic method was used in a clockwise manner to invite 10 neighboring households to join the study. The participants were reimbursed for transportation to the clinic. Upon presenting at the clinic and receiving information about the study, a signed consent form was obtained from the head of the household if they were willing to participate in the study. The consent includes commitments to keep household information confidential and take responsibility for any complications that might occur as a result of the study. The Ethics Committee of Mashhad University of Medical Sciences approved the study protocol, which was conducted in accord with the tenets of the Declaration of Helsinki. All participants signed a written informed consent.

The examinations included direct and indirect ophthalmoscopy, slit-lamp biomicroscopy, measurement of uncorrected visual acuity and visual acuity with current glasses, lensometry of the previous glasses, refraction with and without cycloplegia, and measurement of the best corrected visual acuity. After that, both eyes were evaluated for phoria and vision. However, we only reported the results of refraction examinations with regards to the study objective. After performing direct and indirect ophthalmoscopy and slit-lamp biomicroscopy, the participants who had with pathological problems that influenced refraction or pseudophakic individuals were excluded from visual acuity and refraction tests.

Visual acuity was assessed with a Snellen E-chart and mirror system. The Lea Symbols acuity chart was used for children $\leq$5 years. Moreover, the preferential looking method was used for the measurement of visual acuity in children aged 1−2 years, and the children who could not answer were excluded from the study. We asked the participants to read or guess the letters in the uppermost line in order to measure the uncorrected visual acuity. If a person could not see the first

line, finger count, hand motion, and light perception were used in the mentioned order.

The TOPCON 8000 autorefractometer and Heine retinoscope was used to evaluate manifest, subjective, and cycloplegic refraction. For cycloplegic refraction, which was performed in individuals≤15 years of age, 3 drops of cyclopentolate 1% were instilled at 5-min intervals, and refraction was measured 30 min after the last drop. Individuals in whom to the use of cyclopentolate was contraindicated were excluded from the study. Manifest refraction was measured in all individuals before the measurement of corrected visual acuity. Subjective refraction was measured in cooperative participants.

In this study, we adopted the WHO definition of visual impairment.[11] Visual impairment including low vision and blindness was determined based on presenting visual acuity (PVA) and corrected visual acuity. By definition, a visual acuity of 0.5 logMAR (20/60) to ≤1.3 logMAR (20/400) in the better eye was considered low vision, and a visual acuity worse than 1.3 logMAR (20/400) in the better eye was defined as blindness. If there was more than one cause of visual impairment or two different causes in the contralateral eyes, the most correctable cause was considered. We excluded the individuals whose visual acuity was not measured and those who did not participate in all examination stages.

To determine the economic status, the data of 5 household assets as well as the status of the residential place and car ownership were collected and the asset index was produced using principal component analysis (PCA).

Statistical analysis

In this study, the prevalence of visual impairment is presented as percentage and 95% confidence interval (CI). In calculating 95% CI and standard errors, the design effect was applied, and the results were adjusted accordingly. Relationships were examined using multiple logistic regressions. We also reported the standardized prevalence of visual impairment and blindness based on the population of Mashhad in 2006 according to age and sex. Binomial distribution was calculated when the expected count was less than 5. Table 1 shows the age distribution of the population of Mashhad and our samples. All analyses in this study were done using the Stata Software version 11 (StataCorp LP, College Station, TX, USA).

Results

In this study, 4453 people were invited to the study. Of these, 3132 people (response rate: 70.4%) participated in the study. Moreover, 66.7% of the participants and 43.7% of non-participants were women ($P < 0.001$). The mean age of the participants and non-participants was 30.2 ± 16.6 and 29.1 ± 15.9 years, respectively ($P < 0.001$).

After applying the exclusion criteria, the study was completed with 2785 individuals; their mean age was 29.5 ± 17.5 years (range, 1–90 years), and 1821 (65.4%) were female. The prevalence of visual impairment by presenting vision and best corrected vision by age and gender are presented in Table 2. The age-sex-standardized prevalences are shown in Table 2.

The prevalence of visual impairment based on presenting vision was 3.95% (95% CI, 3.13–4.77). As presented in Table 2, there was no significant difference between the two genders ($P = 0.837$). The prevalence of visual impairment based on presenting vision significantly increased with age from 1.59% in children under 5 years of age to 43.59% in the over 65 age group. Based on presenting vision, the prevalence of blindness was 0.86% (95% CI, 0.51–1.22) with no significant inter-gender difference ($P = 0.771$); the highest prevalence was 7.69% in persons over 65 years of age.

Based on corrected vision, 2.23% (95% CI, 1.54–2.91) of the study participants were visually impaired, and there was no significant inter-gender difference ($P = 0.675$). The highest prevalence of visual impairment was found in the over 65 year old age group (42.31%).

Based on presenting vision, 21% of the illiterate were visually impaired; the rate was 2.7% for those without higher education and 1.9% for those with higher education. When results of corrected vision were considered, these rates were 14.2%, 1.1%, and 1.4%, respectively.

Table 3 summarizes the causes of visual impairment and blindness in percentages; the leading cause of visual

Table 1
The age and sex distribution of the population of Mashhad and participants in the study.

Age	The entire population of Mashhad in 2006				Participants in this study			
	Male	Female	Total	% of total	Male	Female	Total	% of total
0–9	200,954	192,718	393,672	16.1	183	204	387	12.4
10–19	258,510	253,701	512,211	20.9	260	358	618	19.7
20–29	284,633	293,626	578,259	23.6	119	383	502	16.0
30–39	185,683	181,111	366,794	15.0	119	348	467	14.9
40–49	141,705	137,374	279,079	11.4	169	321	490	15.6
50–59	81,898	79,164	161,062	6.6	175	182	357	11.4
60–69	46,241	42,749	88,990	3.6	70	54	124	4.0
70–79	26,690	25,455	52,145	2.1	65	54	119	3.8
80–89	8954	8534	17,488	0.7	29	34	63	2.0
Above 90	902	1110	2012	0.1	2	3	5	0.2
Total	1,236,170	1,215,542	2,451,712	100.0	1191	1941	3132	100.0

Table 2
The prevalence of visual impairment, low vision, and blindness in this study.

	n	Based on best corrected visual acuity			Based on presenting visual acuity		
		Visual impairment	Low vision	Blindness	Visual impairment	Low vision	Blindness
		% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Total	2785	2.23 (1.54–2.91)	1.90 (1.3–2.51)	0.32 (0.1–0.55)	3.95 (3.13–4.77)	3.09 (2.37–3.8)	0.86 (0.51–1.22)
Age-sex standardized prevalence		2.76 (1.9–3.63)	2.42 (1.61–3.22)	0.35 (0.09–0.61)	4.31 (3.35–5.27)	3.46 (2.58–4.33)	0.85 (0.48–1.23)
Male	964	2.39 (1.24–3.53)	1.97 (0.92–3.02)	0.41 (0.01–0.82)	3.84 (2.42–5.26)	2.90 (1.68–4.13)	0.93 (0.27–1.6)
Female	1821	2.14 (1.44–2.85)	1.87 (1.23–2.5)	0.27 (0.04–0.51)	4.01 (3.08–4.93)	3.19 (2.37–4)	0.82 (0.42–1.22)
Age group (years)							
1–5	126	1.59 (0.41–6.19)[a]	1.59 (0.41–6.19)[a]	0	1.59 (0.41–6.19)[a]	1.59 (0.41–6.19)[a]	00
5–15	640	0.31 (0.08–1.19)[a]	0.31 (0.08–1.19)[a]	0	1.25 (0.43–2.08)	0.31 (0.08–1.19)[a]	0.94 (0.2–1.68)
16–25	504	0.4 (0.1–1.59)[a]	0.4 (0.1–1.59)[a]	0	1.39 (0.36–2.42)	0.8 (0.02–1.57)	0.60 (0.19–1.86)[a]
26–35	473	1.9 (0.66–3.15)	1.48 (0.38–2.58)	0.42 (0.11–1.69)[a]	4.02 (2.26–5.77)	3.59 (1.93–5.26)	0.42 (0.11–1.69)[a]
36–45	488	0.61 (0.15–2.52)[a]	0.61 (0.15–2.52)[a]	0	1.64 (0.44–2.84)	1.64 (0.44–2.84)	0
46–55	350	0.29 (0.04–2.04)[a]	0.29 (0.04–2.04)[a]	0	2 (0.51–3.49)	2 (0.51–3.49)	0
55–65	126	7.94 (2.54–13.33)	4.76 (0.46–9.06)	3.17 (1.01–9.99)[a]	19.84 (11.76–27.92)	14.29 (7.69–20.89)	5.56 (0.69–10.42)
>65	78	42.31 (31.13–53.49)	38.46 (27.19–49.74)	3.85 (1.26–11.76)[a]	43.59 (32.37–54.81)	35.9 (24.28–47.52)	7.69 (2.04–13.35)

CI: Confidence interval.
[a] The 95% CI was calculated by binomial distribution.

Table 3
Causes of visual impairment in the participants based on presenting and best corrected vision.

	Presenting visual acuity		Best corrected visual acuity	
	Frequency	Percent	Frequency	Percent
Uncorrected refractive error	46	41.8	0	0
Cataract	22	20.0	21	33.87
Amblyopia	5	4.5	5	8.06
Diabet retinopaty	4	3.6	3	4.84
Retinitis pigmentosa	3	2.7	3	4.84
Keratoconus	5	4.5	4	6.45
Corneal opacity	4	3.6	4	6.45
Chorioretinal atrophy	2	1.8	2	3.23
Optic atrophy	1	0.9	1	1.61
Glaucoma	8	7.3	5	8.06
Age related maculapathy	10	9.1	7	11.29
Unknown	0	0	7	11.29

impairment was uncorrected visual acuity (41.8%) followed by cataracts (20%). Major causes of corrected visual impairment were cataracts and age-related macular degeneration. The leading causes of visual impairment in children were refractive errors by presenting vision and amblyopia by corrected vision.

Results of this study showed a significant reverse relation between visual impairment and income, and even between blindness by presenting vision and income.

The relationship of visual impairment based on presenting vision and corrected vision with age, gender, education, and income were examined in a multiple logistic regression model. The results of this model are shown in Table 4. As demonstrated, younger age, lower education, and lower income levels significantly correlated with visual impairment by presenting vision and corrected vision.

Discussion

This study is one of the large population-based studies in Iran that has included all age groups over one year of age and determined the prevalence rates of visual impairment and blindness using the WHO criteria.

Based on the results of this study, the prevalence of visual impairment among the 2785 eligible people who were

Table 4
The association between visual impairment based on presenting visual acuity and best corrected visual acuity and their risk factors in multiple regression logistic.

Variable		Presenting visual acuity		Best corrected visual acuity	
		Odds ratio (95% CI)	*P*-value	Odds ratio	*P*-value
Gender	Female	1.00		1.00	
	Male	0.74 (0.46–1.18)	0.203	0.63 (0.34–1.15)	0.133
Age	Year	1.06 (1.04–1.07)	<0.001	1.09 (1.07–1.12)	<0.001
Education	Illiterate	1.00		1.00	
	Without higher education (1–14 years)	0.31 (0.18–0.52)	<0.001	0.30 (0.15–0.6)	<0.001
	Higher education (>14 years)	0.16 (0.06–0.38)	<0.001	0.27 (0.09–0.83)	0.022
Income		1.36 (1.21–1.72)	<0.001	1.72 (1.41–2.05)	<0.001

CI: Confidence interval.

included in the analysis was 3.95%; the prevalence of low vision and blindness was 3.09% and 0.86%, respectively. This shows that the prevalence of low vision in Mashhad is close to the global average of 3.4%.[16] Also, results of our study indicate a higher prevalence of low vision in the city of Mashhad compared to Khuzestan (2.6%),[10] Tunisia (3%),[16] Italy (1.8%),[17] and Canada (0.4%),[18] while the prevalence is lower in comparison with Tehran (4.04)[11], Indonesia (5.8%),[19] and Bangladesh (13.5%).[20] In their systematic review article, Stevens et al state that 0.5% of the total population of the world was blind in 2010, and rates ranged between 0.1% in high income countries in North America to 0.7% in Eastern Mediterranean countries.[3] Blindness prevalence in our study was 0.86% which is lower compared to studies in Tehran (1.09%),[11] Bangladesh (1.52)[20], and Pakistan (1.9%)[21] but higher compared to China (0.6%),[8] Denmark (0.53)[22], and Canada (0.03%).[18] Prevalence rates in sub-Saharan countries range between 0.1% in Uganda up to 9% in Eritrea. In these countries, cataracts have been reported as the leading cause blindness.[23] This shows that the prevalence of blindness in this study is higher than in developed countries, and as expected, the prevalence of blindness is much higher in low income developing countries compared to developed countries.

The findings of our study show that uncorrected refractive errors and cataracts are the leading causes of visual impairment by presenting and corrected visual acuity, respectively. Among the few population-based studies conducted in urban areas of the country, the studies in Shahroud (40–64 year old age group) and Sari have reported the main causes of visual impairment based on uncorrected visual acuity, and in agreement with our study, they have stated it to be uncorrected refractive errors.[13,24] Also, in a study by Hashemi et al[12] in rural areas of Khaf in the northeast of Iran, refractive errors were the leading cause with a prevalence of 57%. As shown in Table 5, various studies indicate that uncorrected refractive errors are the major cause of visual impairment based on presenting vision in the six WHO regions including developing and developed member states. Although these studies have been done on different populations and sometimes with different methodologies, they are all based on the WHO definition of impaired vision using the same measurement. Therefore, similar results confirm that refractive errors are common in all ages and impose a greater burden than other causes of visual impairment.

Studies show that more than 35 million people around the world (18.4%) are visually impaired by cataracts,[7] and the annual cost of patient care and treatment in the United States is more than $3 billion.[41] Our results indicated that cataracts were the second leading cause of visual impairment based on corrected visual acuity with a prevalence of 21% which is lower compared to many other studies. This is while according to Bastawrous et al, population-based studies in 15 African countries have found cataracts to be the leading cause of uncorrected visual impairment in the over 50 population, and Ghana has the highest prevalence (more than 80%) of cataract-related vision impairment.[23] In Shahroud, Sari, and Khaf studies, the prevalence of cataracts based on presenting vision was respectively 20.2%,[13] 16.7%,[24] and 27.6%,[12] which points to a lower prevalence of cataracts in Mashhad compared to rural regions. Although the prevalence of cataracts in the present study is higher than in Sari and Shahroud studies, it should be noted that only the over 50 population was included in Sari, and the age distribution of the sample in Shahroud was 40–64 years. Other population-based studies in Iran have often reported cataract-related visual impairment based on best corrected visual acuity. Of these, Tehran,[11] Khuzestan,[10]

Table 5
Comparison of the results of blindness and leading causes of visual impairment in worldwide.

WHO region	Study	Age (years)	Leading causes of visual impairment		Prevalence of blindness
			By presenting visual acuity	By corrected visual acuity	
Southeast Asia	India – Delhi[25]	>40	Refractive errors		1.2
	South Korea – Seoul[26]	>40	Refractive errors	Cataracts	0.26
The Americas	El Salvador[27]	>50	Cataracts		2.4
	Brazil – Botafogo[28]	1–91	Refractive errors	Cataracts	2.2
	United States – Los Angeles[29]	>40		Cataract	0.4
	Paraguay[30]	>50	Refractive errors	Cataracts	1
Western Pacific	Japan[31]	>40	Glaucoma		not reported
	Singapore[32]	40–80	Refractive errors	Cataracts	0.67
Africa	Ghana[33]	>40		Cataracts	0.75
	South Africa[34]	1–92	Refractive errors	Cataracts	10.90
	Nigeria[35]	>40		Cataracts	4.20
	Libya[36]	>50		Cataracts	3.25
Europe	United Kingdom[27]	42–90	Refractive errors		0.74
	Germany[37]	>1		AMD	0.04
	Denmark[22]	20–84		Myopia-related retinal disorders	0.20
Eastern Mediterranean	Jordan[38]	>40	Cataract		
	Saudi Arabia[39]	>18	Refractive errors		not reported
	Egypt[40]	>40	Refractive errors		9.30
	Iran – Sari[24]	>54	Refractive errors	Cataract	3.70

and Yazd[15] Eye Studies can be mentioned; in agreement with our results, they have reported cataracts as the leading cause of impaired corrected vision. Overall, it seems that lack of a timely correction of refractive errors in Iran has made it the leading cause visual impairment in our country, while cataracts come first in certain African countries.

According to our findings based on PVA, uncorrected refractive errors were the most important cause of visual impairment in the studied children. In a study by Yamamah et al in Egypt, about 30% of children had some degree of impaired presenting vision and the most common cause in their sample (mean age, 10 years) was uncorrected refractive errors.[16] Similar to adults, studies in children suggest that the prevalence of visual impairment in children in developed countries is lower compared to developing countries, but in most regions, the prevalence of refractive errors based on presenting vision is higher than other causes of visual impairment.[42] Given that, unlike cataracts and other vision disorders, refractive errors can affect individuals from a younger age, their timely diagnosis can help improve their quality of life and education during their school years.

As expected, in line with the results of other studies,[8,17,22] the prevalence of visual impairment and blindness increased with age, such that 62% of the visually impaired and 14% of the blind were in the over 55 year age group. In the Yazd Eye Study, Katibeh et al reported that the odds of visual impairment increased threefold per every decade of aging. In light of increased life expectancy and the aging population in Iran, education about eye health and screening programs for over 50 age groups seem essential for the early detection of visual impairment, and thus improving the quality of life for these people. There is evidence suggesting an interaction between age and gender, such that the prevalence of visual impairment increases with age in women but not in men.[13] Overall, studies suggest that the prevalence of visual impairment in women, due to better access to health care in recent years, is higher compared to men.[22,23] However, in agreement with many other studies[11] our results showed no significant difference between male and female in the prevalence of visual impairment.

Various researches, especially in developed countries, have addressed the effect of the economic status and inequality in creating visual impairment.[21,43,44] For adults, the universal recommendation is to have an eye examination once or twice a year, but results of these studies show that most adults living in developing countries do not use eye care services, and the level of income has been found a strong predictor in this regard. The Shahroud Eye Cohort Study showed that 25% of those with low income levels never had an eye examination, while this ratio was 10% for high-income participants; this means the odds of not having a visit was 2.5-fold high in low income groups compared to the well-off.[45] It should be noted that the relationship between economic status and vision impairment is two-way; visual impairment can on the one hand lead to loss of career opportunities, and on the other hand, it can increase the risk of accidents, falls, burns, and depression, and thus, hospitalizations, which make them vulnerable to financial distress. In the meta-analysis by Wanger et al in the United States, insurance coverage and income status were two factors that affected receiving annual visits and eye care independent of other factors.[46] In agreement with these studies, our results showed that the levels of income and education are two important demographic indicators that have a reverse relationship with impaired vision and blindness. Therefore, in light of the above discussion, and with emphasis on the fact that indirect costs imposed by impaired vision are far greater than direct costs such as medications, it seems that family expenses can be reduced and quality of life can be improved by expanding services and eye care such as implementing free screenings, increasing insurance services, and promoting access to affordable prevention and consultation services. The Health Sector Evolution program is a breakthrough for the ongoing health programs of the Islamic Republic of Iran to reduce the economic inequality in the prevalence of visual impairment and blindness and cut out of pocket patient costs.

Certain population-based studies have shown that the odds of developing visual impairment is six times higher for the less-educated compared to people with higher education; this confirms the role of education as well as its interaction with economic status.[47] We recommend further research and assessment of health literacy regarding public awareness about eye care which is a necessary step to determine the direction of educational programs for target populations, especially over 40 age groups. Considering the confirmed role of income, education, and economic inequality in the high prevalence of visual impairment and blindness,[27,48] less access to health care for these groups, and their less awareness about eye health, it seems necessary to place more emphasis on educational programs for the less educated and implement screening programs in these sub-populations in order to achieve the goals of the Vision 2020 initiative.

Our study had some limitations. The non-response rate of about 30% was one of the most important limitations which could result in the underestimation of the prevalence of visual impairment in this study. Moreover, it should be noted that the response rate was higher in women than men.

Increased life expectancy and the aging of the population in Iran, as well as the higher prevalence of certain conditions such as hypertension and diabetes which can effective visual quality, make it essential to conduct population-based studies to determine the prevalence and causes of visual impairment. The present study describes the prevalence of visual impairment and its leading causes in the city of Mashhad. Results showed that more than 77% of the cases were due to two preventable causes, i.e. refractive errors and cataracts. Also, contrary to many studies, the findings of this study showed there was no significant intergender difference in the prevalence of visual impairment, but the prevalence of visual impairment significantly increased with aging. It was also shown that economic inequality and low education are determinants of a higher prevalence of visual impairment.

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