Original Article

Prevalence and causes of low vision and blindness in Tehran Province, Iran

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Abstract

Objective: To determine the prevalence and causes of blindness and low vision selected population at Tehran province, Iran in 2006.

Methods: A population-based cross-sectional study was conducted in the rural and urban population of Tehran province, Iran. The study design was based on the World Health Organization (WHO) criteria and a pilot study. Multi-stage cluster random sampling method was used and sample size was calculated based on the distribution of population in Tehran province derived from the national census and estimated rate of blindness from the pilot study. Information was collected using a questionnaire filled after screening by optometrists and referral examinations by ophthalmologists. Categorization of blindness and low vision was based on the International Classification of Diseases version 10 (ICD-10).

Results: Overall, 11,975 subjects with mean age of 27.77 ± 18.9 years participated (primary response rate of 90.4%). The prevalence of bilateral blindness was 1.09% (95% CI: 0.90-1.61%). There was a significant positive correlation with age (P<0.001) but no significant difference by gender. The prevalence of low vision in both eyes was 4.04% (95% CI: 3.69-4.39%). The prevalence of bilateral low vision increased with age (P<0.001) and was higher among females (OR = 1.42, 95%CI: 1.16-1.74). The leading causes of visual impairment were cataract (33.9%), amblyopia due to uncorrected refractive errors (22.7%), vitreo-retinal diseases (12.3%), corneal blindness (10%) and diabetic retinopathy (4.92%).

Conclusion: The prevalence of blindness and low vision in Tehran province, Iran is similar to other developing countries. The majority of cases have treatable and/or preventable causes; reduction of blindness can be achieved by appropriate screening strategies.

Keywords: Prevalence, Blindness, Low vision, Tehran, Iran (JPMA 61:544; 2011).

Introduction

Every 5 seconds one person in the world goes blind. The World Health Organization (WHO) estimated that in 2004, 40-45 million people around the world were blind and three times or more had visual impairment, mainly in low-income countries. This figure is projected to reach 76 million by the year 2020 if no action is taken to further control blindness.[1] This provided the basis for the launch of the VISION 2020 programme in 1999; the global initiative for elimination of preventable blindness.[2] The prevalence of blindness and low vision varies in different communities ranging from 0.2 to 1.0 percent for blindness and from 1.1 to 3.0 percent for low vision by WHO sub-region.[3] Globally, the main causes of blindness are cataract, glaucoma and age-related macular degeneration (AMD). Epidemiologic studies on the prevalence and causes of blindness and low vision started in 1995 and expanded to many developed and developing countries. The majority of these research projects were carried out according to WHO criteria and the International Classification of Diseases (ICD-10).[4]

Population-based prevalence data are critical for developing eye care programmes and for identifying areas for research.[5] The absence of reliable population-based epidemiologic data on blindness and low vision in Iran is a serious problem which affects national planning to reach VISION 2020 goals in Iran. There are few published studies about the status of this problem in Iran. Until 4 years ago, there was almost no information on the prevalence or causes of low vision and previous studies have been mainly focused on the urban population of one city.[6] The projected population of Tehran province in 2004 based on a national census was approximately 10.5 million. It is a province with 12 cities including Tehran, the capital of Iran. This study was conducted in a representative sample to determine the prevalence and causes of blindness and low vision in Tehran province, Iran.

Methods

A population-based cross-sectional study was performed in 2006 involving all inhabitants of Tehran province with a total population of 10.5 million. The study design was based on WHO criteria[2] and our previous pilot study preformed in the rural and urban areas in the city of Karaj (a city with 1,160,000 population located 35 kilometers

north-west of Tehran). The study implemented multi-stage cluster random sampling which included 138 randomly allocated clusters (118 urban and 20 rural, with 21 to 23 households in each cluster). Sample size was calculated based on the distribution of the total population in Tehran province derived from the national census and an estimated rate of blindness derived from our pilot study. Data were obtained from rural and urban health centers by completing a questionnaire including general information, results of optometrists' and ophthalmologists' examinations and the main cause of visual impairment. (The questionnaire was in Persian language and is available on request from the corresponding author).

Trained field interviewers completed the general information section of the questionnaire and visual acuity was obtained by trained optometrists using standardized Snellen E-charts with and without pinhole. Subjects with visual acuity equal or less than 20/60 in either eye were referred to ophthalmologists for determination of best spectacle-corrected visual acuity (BSCVA). Visual impairment was defined as BSCVA less than 20/60 and included low vision (BSCVA less than 20/60 but more than 20/400) and blindness (BSCVA less than 20/400). Main causes of blindness and low vision were determined and categorized based on ICD-10 criteria by ophthalmologists. More details on methods and implementation of study design have been published elsewhere.[7] The center of disease control (CDC) in Iran approved this survey regarding methodology and ethical consideration. Informed consent was obtained from each participant or his/her guardian before enrollment.

Statistical analysis was performed using SPSS software version 11.5. The numerators for the prevalence of low vision or blindness were the sum of weighted cases for each cause of low vision or blindness. Age-standardized data were used to estimate the number of people with low vision, blindness, causes of visual loss and the prevalence for the entire population of Tehran province in 2005. 95% confidence intervals (CIs) were calculated using multivariate analyses (Figure).

Results

Overall, 11,975 subjects with average age of 27.77

Table-1: Prevalence of low vision and blindness according to ICD-10 Criteria.

	Percent (95% confidence interval)			
Age group	**H 54.0**	**H 54.1**	**H 54.4**	**Number**
Female				
1-9	0	0	0	1061
10-19	0.58(0.26-1.09)	0.90(0.49-1.51)	0.13(0.02-0.46)	1557
20-29	0.83(0.45-1.41)	1.22(0.73-1.89)	0.32(0.10-0.74)	1572
30-39	0.67(0.29-1.31)	1.26(0.70-2.10)	0.67(0.29-1.1)	1193
40-49	1.01(0.46-1.91)	1.35(1.46-3.57)	1.90(1.12-03.3)	893
50-59	2.65(1.62-4.34)	6.02(4.21-8.31)	1.95(0.97-3.46)	565
60-69	3.22(1.62-5.68)	10.82(7.53-14.10)	3.80(2.04-6.4)	342
70+	10.18(5.59-14.80)	25.75(25.75-32.4)	5.39(2.50-9.98)	167
Total	1.12(0.88-1.36)	2.49(2.13-2.85)	0.88(0.67-1.10)	7350
Male				
4-9	0.32(0.-04-1.14)	0.32(0.04-1.14)	0	1060
10-19	0.78(0.25-1.80)	2.02(1.08-3.42)	0.78(0.25-1.80)	1139
20-29	0.67(0.18-1.72)	1.17(0.47-2.41)	0.50(0.10-1.46)	644
30-39	0.68(0.14-1.97)	1.58(0.64-1.23)	0.90(0.25-2.30)	596
40-49	0.90(0.19-2.61)	2.40(1.04-4.68)	2.40(1.04-4.68)	443
50-59	1.44(0.30-4.13)	3.83(1.67-7.40)	1.91(0.52-4.83)	333
60-69	5.33(2.46-9.87)	13.2(7.94-18.10)	6.51(3.29-11.30)	209
70+	9.45(5.79-14.40)	25.87(19.80-31.90)	6.97(3.86-11.40)	201
Total	1.04(0.75-1.33)	2.57(2.12-3.03)	1.06(0.76-1.35)	4625
In both genders				
4-9	0.15(0.02-0.54)	0.15(0.02-0.54)	0	2121
10-19	0.63(0.35-1.06)	1.22(0.80-1.76)	0.32(0.13-0.65)	2216
20-29	0.63(0.37-1.01)	0.96(0.63-1.41)	0.30(0.13-0.58)	2696
30-39	0.61(0.31-1.09)	1.23(0.78-1.86)	0.67(0.35-1.17)	1789
40-49	0.90(0.47-1.57)	2.17(1.46-3.11)	1.87(1.21-2.75)	1336
50-59	2.00(1.19-3.16)	4.68(3.39-6.27)	1.67(0.93-2.74)	898
60-69	3.63(2.23-5.55)	10.71(8.13-13.30)	4.36(2.81-6.41)	551
70+	9.78(6.95-13.31)	25.82(21.30-30.30)	6.25(4.00-9.23)	368
Total	1.09(0.90-1.27)	2.52(2.24-2.80)	0.95(0.78-1.13)	11975

H54.0: Blindness in both eyes
H 54.1: Blindness in one eye and low vision in the other eye
H 54.4: Blindness in one eye and normal vision in follow eye.

Table-2: Prevalence and distribution of low vision based on ICD-10 Criteria regarding gender and age.

Age group(year)	Percent (95% confidence interval) H 54.2	H 54.5	Number
Female			
<1	0.0	0.0	181
1-3	0.0	0.0	191
4-9	0.58(0.15-1.48)	0.73(0.24-1.69)	689
10-19	2.76(2.01-3.70)	2.25(1.57-3.11)	1557
20-29	5.53(4.45-6.78)	2.99(2.20-3.96)	1572
30-39	4.61(3.50-5.96)	2.51(1.70-3.57)	1193
40-49	4.14(2.94-5.67)	4.93(3.61-6.56)	893
50-59	7.43(5.41-9.92)	8.49(6.43-11.10)	565
60-69	10.53(7.27-13.80)	14.33(10.60-18.00)	342
70+	17.96(12.10-23.80)	14.37(9.05-19.70)	167
Total	4.54(4.07-5.02)	3.84(3.40-4.28)	7350
Male			
<1	0	0	211
1-3	0	0	221
4-9	0.32(0.04-1.14)	0.48(0.10-1.39)	628
10-19	2.95(1.79-4.57)	3.73(2.40-5.50)	1139
20-29	4.53(3.01-6.52)	3.86(2.46-5.73)	644
30-39	4.06(2.42-6.34)	3.16(1.74-5.24)	596
40-49	3.60(1.87-6.21)	6.31(3.95-9.48)	443
50-59	5.74(3.00-9.82)	11.96(7.56-16.40)	333
60-69	15.98(10.50-21.50)	13.6(8.44-18.80)	209
70+	16.42(11.30-21.50)	10.45(6.22-14.70)	201
Total	3.24(2.73-3.75)	3.33(2.81-3.85)	4625
In both genders			
<1	0	0	392
1-3	0	0	412
4-9	0.46(0.17-0.99)	0.61(0.26-1.19)	1317
10-19	2.80(2.15-3.57)	8.66(0.26-1.42)	2216
20-29	4.23(3.50-5.06)	2.60(2.03-3.27)	2696
30-39	4.08(3.22-5.11)	2.46(1.79-3.29)	1789
40-49	3.67(2.73-4.82)	4.87(3.78-6.16)	1336
50-59	6.01(4.55-7.77)	8.13(6.43-10.10)	898
60-69	11.43(8.78-14.10)	13.072(10.30-15.90)	551
70+	17.12(13.30-21.00)	12.23(8.88-15.60)	368
Total	4.04(3.69-4.39)	43.6(3.31-3.98)	11975

H54.2: Low vision in both eyes.
H 54.5: Low vision in one eye and normal vision in fellow eye.

18.9 years participated (response rate 90.4% for the first stage of the study). A group of 1,273 subjects (9.6%) were not available for examination or declined to participate in the study and 24% of the population who were screened by the optometrist failed. Comparison for distribution of age and residential area between subjects in this study and the total population derived from the national census showed no significant difference. However, male subjects were under-represented in the sample in comparison to the target population. The prevalence of bilateral blindness was 1.09% (95% CI: 0.90-1.27%). There was a significant positive correlation with age (P<0.001) but no significant difference regarding gender or residential area. Using ICD-10 criteria, the prevalence of blindness in one eye, and low vision in the other eye (H54.1) was 2.52% (95% CI: 2.24-2.8%), and blindness in one eye and normal vision in the other eye (H54.4) was 0.95% (95% CI: 0.78-1.13%). There was a significant correlation between these figures with age (P<0.001), but no statistical difference existed between males and females (OR= 1.08, 95% CI: 0.74-1.56) or urban and rural areas (OR = 0.97, 95%CI: 0.59-1.61). Table-1 shows the prevalence of different types of blindness by age and gender. The prevalence of low vision in both eyes (H54.2) was 4.04% (95% CI=3.69-4.39). The prevalence of bilateral low vision increased with older age (P<0.001) and was higher among females (OR=1.42, 95%CI: 1.16-1.74%). Table-2 shows the prevalence of different types of low vision by age group and gender.

The leading causes of visual impairment were cataract (33.9%), amblyopia (22.7%) vitreo-retinal disorders (12.3%), corneal opacities (10%) and diabetic retinopathy (4.92%). Table-3 details the causes of visual

Table-3: Causes of visual impairment with Mean Age in the studied population.

Cause	Mean age(SD)	Percent (95% confidence interval)		
		OD	OS	at least in one eye
Cataract	67.45(11.44)	35.20(29.30-41.0)	32.7(27.1-38.30)	33.90(29.90-37.90)
Amblyopia	45.39(18.17)	24.60(19.30-29.90)	21.0(16.10-25.80)	22.70(19.20-26.30)
Vitreo-retinal Diseases	55.78(24.53)	12.10(8.11-16.10)	12.50(8.57-16.40)	12.30(9.51-15.10)
Corneal blindness	57.91(18.95)	8.60(5.46-12.70)	11.40(7.62-15.20)	10.0(7.47-12.60)
Diabetic retinopathy	62.96(11.72)	4.69(2.45-8.05)	5.15(2.84-8.49)	4.92(3.24-7.14)
Surgical complications	72.41(12.37)	2.34(0.86-5.04)	2.94(1.28-5.71)	2.65(1.46-4.41)
Strabismus	25.00(13.86)	2.34(0.86-5.04)	2.21(0.81-4.74)	2.27(1.18-3.94)
AMD	62.56(10.08)	1.95(0.64-4.50)	1.47(0.40-3.72)	1.70(0.79-3.22)
Indefinite cause	64.22(23.16)	1.56(0.43-3.95)	1.84(0.60-4.24)	1.70(0.79-3.22)
Trauma	29.25(22.83)	0.80(0.10-2.79)	2.21(0.81-4.74)	1.52(0.65-2.96)
Congenital disease	20.50(17.83)	1.56(0.43-3.95)	1.47(0.40-3.72)	1.25(0.65-2.96)
Glaucoma	71.00(12.67)	0.80(0.10-2.80)	1.84(0.60-4.24)	1.33(0.53-2.72)
Refractive errors	9.57(6.58)	1.56(0.43-3.95)	1.10(0.23-3.19)	1.31(0.53-2.72)
Cortical blindness	1.00(0)	0.40(0.01-2.15)	0.40(0.01-2.03)	0.38(0.04-1.36)
Uveitis	26.0(0)	0.40(0.01-2.15)	0.40(0.01-2.03)	0.38(0.04-1.36)
Work associated	33(0)	-	0.40(0.01-2.03)	0.20(0.01-1.06)
Other causes	19.0(3.90)	1.17(0.24-3.39)	1.10(0.23-3.19)	1.14(0.42-2.46)

AMD: Age related macular degeneration; OD: Right eye; OS: Left eye.

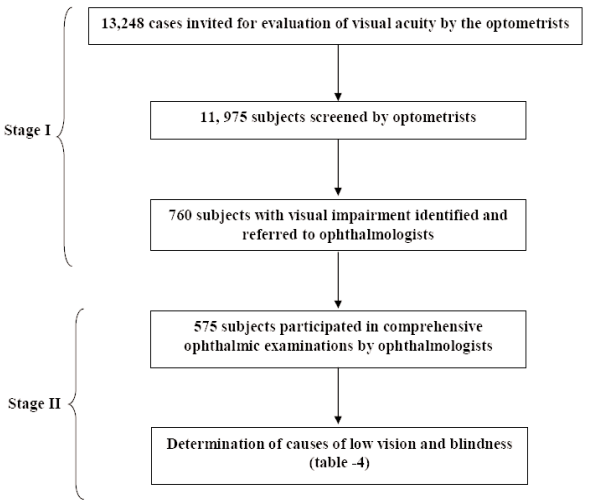

Figure: Details of the two stages of the study.

impairment in the study population.

Discussion

Visual impairment, defined by WHO as blindness (BSCVA<20/400) or low vision (BSCVA<20/60), is one of the most common disabilities worldwide with about 40 million cases of blindness and 110 million cases of low vision in the last decade.[1] Figures for the developing world, where approximately 90% of world blindness exists, are increasing. Corresponding figures for the developed world are also expected to increase significantly during the next decades as the world population ages.[2] There were 937,000 blind subjects and 2.4 million people with low vision in adults aged over 40 years in the United States in 2002.

This is the first epidemiologic study on blindness and low vision in Tehran province which covered a large population from different age groups applying WHO criteria for visual impairment. The burden of blindness as a public health problem was estimated in different rural and urban areas in Tehran province (bilateral low vision and blindness rates are 4.4% and 1.09%, respectively). The rate of bilateral blindness (1.09%) in this study is lower than similar rates from Bangladesh (1.52%),[8] Tunisia (1.2%),[9] Indonesia (2.2%),[10] and Pakistan (1.9%)[11] but higher than Saudi Arabia (0.7%),[12] Malaysia (0.2%),[13] Denmark (0.53%),[14] Italy (0.60%)[15] and Canada (0.038).[16] There was no significant difference in bilateral blindness between males and females.

In a study limited to the city of Tehran[6] the leading causes of low vision included uncorrected refractive errors (33.6%), cataract (25.4%), age related macular degeneration (12.7%) and amblyopia (8.2%), which is rather different from our findings. This discrepancy may be due to the limited nature of the mentioned study which was restricted to the urban population, the desired level of precision and the definition of causes of blindness.

A- Cataract blindness:

Age related cataract is the leading cause of visual impairment in developing countries.[1-10] In this study cataract was the cause of low vision in 33.9% of the study population and was the leading cause of visual impairment which is similar to other developing countries such as Indonesia,[10] Saudi Arabia,[12] Bangladesh,[8] Malaysia,[13] Pakistan[11] and India;[17] but is greater than the

prevalence seen in developed countries such as Italy,[15] Canada[16] and Scandinavian countries.[14] We hope to reduce this treatable cause of visual impairment by the help of better screening and appropriate low cost facilities for cataract surgery in our country. Barriers to cataract surgery such as distance, cost, awareness of the benefits of surgery and availability of tertiary ophthalmic facilities need to be identified and strategies implemented to improve access to cataract surgery and promote subsidies for those who cannot afford surgery.

B- Uncorrected refractive errors and amblyopia:

Uncorrected refractive error is a major cause of unilateral and bilateral visual impairment in developing countries.[5-13] The prevalence of amblyopia due to uncorrected refractive errors in the current study was (22.7%) which is similar to other developing populations.[5-13] Although most refractive errors may be fully corrected using spectacles with relatively low cost, a significant proportion of the population remains largely uncorrected. To address the need for refractive correction, the number of screening centers in both rural and urban areas should be increased. Adequate correction of refractive errors may lead to marked improvement in visual function and quality of life. Like cataract, this entity is also a preventable cause of low vision, however, it seems to be much more important because people with uncorrected refractive errors suffer from low vision since childhood and timely correction is usually simple and may provide many decades of active life.[18]

Regarding the above data, it can be concluded that over half of the number of people with visual impairment in Tehran province have a treatable or preventable cause, such as cataract or amblyopia.

C-Vitreo-retinal diseases:

This subgroup comprised 12.3% of cases with visual impairment. Corresponding figures are 10.4% in Southern India[19] and 9.9% in South Africa[20] which are fairly similar to our findings. The majority of our cases had age related macular degeneration, retinal detachment and retinal vascular accidents. Even in this category there are preventable and treatable underlying causes such as systemic hypertension.

D- Corneal blindness:

In our study corneal blindness comprised 10% of cases with visual impairment. In a recent study in China corneal opacities were 6.1% of the causes of visual impairment.[21] However it increases to 23.7% in areas where trachoma keratopathy is a common cause of visual impairment like Oman.[22]

Central corneal opacities may be due to infectious diseases such as trachoma keratopathy, herpetic keratitis, measles, or scar due to ocular trauma. The vast majority of them can be prevented or treated with appropriate prophylactic or therapeutic measures.

E- Diabetic Retinopathy:

In our study, diabetic retinopathy consisted of 4.9% of cases with visual impairment. A cross sectional study in Tehran province on diabetic retinopathy showed that among Iranian patients with diabetes aged 25 to 64 years, the overall standardized prevalence of any retinopathy is 37.0%.[23] Most of our patients with diabetic retinopathy were either due to lack of complete ophthalmic examinations or inappropriate treatment or irregular follow up. In one study in Southern India the prevalence of diabetic retinopathy was 0.50% in the general population and 10.5% in patients with diabetes mellitus. Only 6.7% of individuals with diabetic retinopathy had previous ophthalmic examinations that shows most of them had been neglected.[19]

It seems that good screening and prompt referral of diabetic patients for full-dilated ocular examinations, appropriate treatment and regular follow up examinations may significantly reduce blindness due to diabetic retinopathy.

Limitations of Study:

At the second stage of the study, about 24 percent of those who were screened by the optometrists considered having visual impairment did not participate for examination by the ophthalmologists. The majority of non-responders were adult males and this may bias our findings. This problem is usually seen in other similar studies due to occupational status of males that make them out of home during the day time.[6,13,19]

In conclusion, the prevalence and causes of low vision and blindness in our country is similar to other developing countries and mainly consists of treatable and preventable causes such as cataract and amblyopia due to uncorrected refractive errors that may be significantly decreased by appropriate screening and treatment.

The findings of this study could be useful for the national prevention programmes for blindness and low vision to achieve the VISION 2020 goals as well as the right to sight.

Acknowledgement

This research project has been funded from a grant awarded by the Ministry of Health and Medical Education

of I.R. Iran. The authors would like to thank all those who supported us and participated in this study.

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