Original Article

Rapid Assessment of Avoidable Blindness in Kurdistan, Iran

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Abstract

Purpose: To determine the magnitude and causes of blindness and visual impairment (VI) in Kurdistan, using the Rapid Assessment of Avoidable Blindness methodology.
Methods: In this population-based cross sectional study, 99 clusters were selected through probability proportional to size sampling. Visual acuity (VA) was measured using a standard tumbling "E" chart. Ophthalmologists examined participants with VA < 6/18 in both eyes. The cause of VI in the better eye or the most treatable cause was considered as the primary cause of VI.
Results: A total of 3203 (response rate: 92.4%) individuals aged 50 years and older participated, of whom 1657 (51.7%) were female. The standardized prevalence of blindness, severe visual impairment (SVI), and moderate visual impairment (MVI) based on available correction (presenting VA) were 2.1% (1.5-2.6), 1.7% (1.2-2.2), and 9.6%(8.4-10.8), respectively. The proportion of avoidable causes of blindness, SVI, and MVI were 58.1%, 78.4%, and 83.4%, respectively. The most common cause of blindness and SVI was cataract (27.4% and 60.8% respectively), followed

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by age-related macular degeneration (25.8% and 13.7%, respectively). The leading causes of MVI were uncorrected refractive errors (RE) (37.2%) and cataract (33.6%).
Conclusion: The prevalence of blindness in the study population seems comparable to the region. According to our results, blindness, SVI, and MVI were mostly due to avoidable causes. Cataract and refractive errors are the principal causes of blindness and VI in Kurdistan.

Keywords: Prevalence; Blindness; Visual Impairment; Iran; Kurdistan

INTRODUCTION

Awareness of the need for evidence in order to advocate and identify effective strategies for Vision 2020: The Right to Sight[1] has led to implementation of population-based surveys at periodic intervals globally. The Rapid Assessment of Avoidable Blindness (RAAB) survey has been successfully undertaken in different countries and is recognized as a straightforward, reasonably priced, rapid, and replicable methodological tool for providing essential need indicators regarding the extent and causes of visual impairment (VI).[2] In a previous RAAB performed in Tehran Province, Iran, the standardized prevalence of blindness, severe visual impairment (SVI), and moderate visual impairment (MVI) were reported as 1.33, 1.39, and 6.91, respectively.[3] Preventable causes of blindness and low vision account for more than 75% of the cases, suggesting a considerable concern.[3]

The results of a recent systematic review in the Iranian population aged 50 and over showed that more than half a million people ≥50 years of age have different levels of VI.[4] Considering the increased life expectancy, demographic transitions in the next decades, there will be more people with VI if appropriate preventive and curative interventions are not implemented.

Kurdistan is a mountainous province in the west of Iran with pure ethnicity and a population of about 1.6 million. Data on VI and eye diseases in this province are limited or not available. Therefore, a cross-sectional study using the RAAB methodology was performed from February to August 2014 with the aim to assess the prevalence and causes of VI in the Kurdistan Province.

METHODS

Sample Selection and Sampling

The protocol of the current study was approved by the Iran Eye Research Network and Tehran University of Medical Sciences (#27816). Considering the sample size (province population size: 1.6 million), estimated prevalence of blindness in the Middle East region (5.6%),[1] confidence interval (CI) of 95%, precision of 1%, expected design effect of 1.4 for clusters of 35 persons, and 80% response rate, the sample size was estimated at 3465 individuals from 99 clusters (33 rural and 66 urban clusters in the province). Multistage systematic cluster random sampling was applied using the population density in different urban and rural enumeration areas. Clusters were randomly selected from the sampling frame using updated data of the 2011 national census through probability proportionate to size sampling. According to the Kurdistan map, the population units were divided into segments with well-demarcated boundaries. Households in clusters were selected by a "compact segment sampling" method[5] sequentially until 35 individuals aged ≥50 years were identified. If the segment did not include 35 people, another segment was randomly selected and sampled. Then, 35 participants aged ≥50 years were selected sequentially from a starting point in each cluster. A person was considered a no responder if (s)he could not be examined after three repeated visits.

Training

Prior to the study, a research team including ophthalmologists, optometrists, epidemiologist and local health employees was formed and trained in a 3-day workshop according to the RAAB manual, under the supervision of a RAAB trainer and an expert ophthalmologist, to introduce RAAB instructions and methods. During field training, the inter-observer coefficient was assessed for vision assessment, lens examination and causes of visual impairment.

Definitions

According to the World Health Organization (WHO) definition, blindness was defined as visual acuity (VA) <3/60 in the better eye with available correction (presenting VA). SVI was defined as VA ≥3/60 and <6/60, and MVI was defined as VA ≥6/60 and <6/18 in the better eye with available correction.[6,7] Functional low vision was defined as VA <6/18 to light perception in the better eye, which cannot be treated anymore based on standard RAAB protocol. The causes of blindness, SVI, and MVI were classified into four groups: curable (cataract, refractive error, uncorrected aphakia), preventable (surgical complications, trachoma, phthisis, and other corneal scars), potentially preventable (diabetic retinopathy, glaucoma), and other causes (age-related macular degeneration [AMD], posterior segment

lesions, central nervous system defects). The first two categories (preventable and curable) were regarded as "avoidable causes."

Ophthalmic Examination

A survey record was completed for each eligible person based on the standard RAAB protocol, which included demographic information, VA with and without using a pinhole, lens examination, and principal cause of VI. Visual acuity was measured by an optometrist at the household's residence, using a Snellen tumbling "E" letter with optotype size 6/18 (20/60) on one side and 6/60 (20/200) on the other side at six and three meters. All measurements were made in full daylight using current spectacles. Pinhole vision was also measured when VA was <6/18 in either eye. Participants with no improvement in VA were referred to the ophthalmologist. One drop of tropicamide 1% was instilled into each eye to induce mydriasis for ocular examination if the cause of VI was not refractive error, cataract, aphakia, or corneal scar, and the anterior chamber depth was normal. In those with signs suggestive of glaucoma and posterior segment, intraocular pressure was measured by applanation tonometry. Finally, the fundus was examined by indirect ophthalmoscopy.

Cataract was diagnosed by observing opacity in red reflex on ophthalmoscopy not explained by other causes. A diagnosis of glaucoma was suspected by a history of the disease or use of anti-glaucoma medications, high IOP, or a cup/disc ratio >0.5.

The primary disorder was recorded as the principal cause of blindness or VI by the ophthalmologist. If there were multiple concurrent disorders, the one with the easiest treatment was selected.

Statistical Analysis

The RAAB version 5 was used for sample size calculation, cluster selection, data entry, and programmed standardized data analysis after data cleaning. The standardized prevalence of blindness, SVI, and VI with 95% confidence interval (CI) were calculated considering the age and sex structure in the Kurdistan province.

RESULTS

Of the 3465 eligible people, 53 (1.5%) were not available, 163 (4.7%) refused to participate, and 46 (0.3%) were not capable of participation (response rate = 92.4%). The mean age of the participants was 62.7 ± 10.1 (range: 50-99) years. Moreover, 1657 subjects were women (51.7%). The age and sex distributions of the sample population are shown in Table 1.

A total of 414 (12.9%) subjects had a presenting vision less than 6/18 in the better eye (standardized cumulative prevalence: 13.4 (95% CI: 11.8-15.0). Age and sex prevalence of blindness based on presenting VA was 2.1% (95% CI: 1.5-2.6), with 2.0% (95% CI: 1.4-2.7) in males and 2.1% (95% CI: 1.4-2.8) in females [Table 2]. The standardized prevalence of SVI and MVI were 1.5% (95% CI: 0.9-2.0) and 9.5% (95% CI: 7.9 – 11.0) in males, and 1.9% (95% CI: 1.1 – 2.7) and 9.8% (95%CI: 8.2 – 11.4) in females, respectively. The prevalence of blindness, SVI, and MVI based on available correction by age are shown in Table 3.

The prevalence of blindness was 2.1% (95% CI: 1.4-2.7) and 1.6% (95% CI: 0.9-2.3) in urban and rural areas, respectively [Table 4]. The prevalence of SVI was statistically higher in rural areas compared to urban areas (OR: 3.4 (95% CI: 1.9-6.2)).

Table 1. Age and gender distribution of examined people and Kurdistan population

Age groups	(Sample) Male *n* (%)	(Population) Male *n* (%)	(Sample) Female *n* (%)	(Population) Female *n* (%)	(Sample) Total *n* (%)	Total (Population) *n* (%)
50-59 years	653 (42.2)	59,408 (50)	826 (49.8)	59,094 (49.4)	1,479 (46)	118,502 (49.6)
60-69 years	509 (32.9)	29,372 (24.7)	513 (31)	33,470 (27.9)	1,022 (32)	62,842 (26.3)
70-79 years	245 (15.8)	20,332 (17.1)	221 (13.3)	18,962 (15.8)	466 (14.6)	392,93 (16.5)
80+ years	139 (9)	9,768 (8.2)	97 (5.9)	8,316 (6.9)	236 (7.5)	180,84 (7.6)
Total	1,546 (100)	118,880 (100)	1,657 (100)	119,842 (100)	3,203 (100)	238,722 (100)

Table 2. Standardized prevalence of blindness, Severe Visual Impairment (SVI) and Moderate Visual Impairment (MVI) - bilateral Presenting Visual Acuity (PVA)

	Male % (95% CI)		Female % (95% CI)		Total % (95% CI)		OR* (95% CI)**
	Adjusted Prevalence	Cumulative prevalence	Adjusted Prevalence	Cumulative prevalence	Adjusted Prevalence	Cumulative prevalence	
Blindness	2.0 (1.4-2.7)	2.0 (1.4-2.7)	2.1 (1.4-2.8)	2.1 (1.4-2.8)	2.1 (1.5-2.6)	2.1 (1.5-2.6)	1.01 (0.61-1.68)
SVI	1.5 (0.9-2.0)	3.5 (2.6-4.4)	1.9 (1.1-2.7)	4.0 (2.9-5.2)	1.7 (1.2-2.2)	3.8 (2.9-4.6)	0.83 (0.48-1.45)
MVI	9.5 (7.9-11.0)	12.9 (11.1-14.7)	9.8 (8.2-11.4)	13.8 (11.7-15.9)	9.6 (8.4-10.8)	13.8 (11.4-15)	0.99 (0.78-1.26)
Functional Low Vision		4.4 (3.4-5.4)		2.6 (1.9-3.3)		3.5 (2.8-4.1)	1.65 (1.12-2.43)

*OR, Odds Ratio Male/Female; **CI, confidence interval

Table 3. Blindness prevalence by age group and sex in studied sample

Age groups	Male		Female		Total	
	n	% (95% CI)	*n*	% (95% CI)	*n*	% (95% CI)
50-59 years	3	0.5 (0.0-1.0)	6	0.7 (0.2-1.3)	9	0.6 (0.2-1.0)
60-69 years	4	0.8 (0.0-1.5)	4	0.8 (0.0-1.5)	8	0.8 (0.2-1.4)
70-79 years	10	4.1 (1.7-6.5)	8	3.6 (1.0-6.2)	18	3.9 (2.0-5.7)
80+ years	14	10.1 (5.4-14.7)	13	13.4 (6.3-20.5)	27	11.4 (7.3-15.5)
Total	31	2.0 (1.3-2.7)	31	1.9 (1.1-2.6)	62	1.9 (1.4-2.5)

Table 4. Standardized prevalence of blindness, Severe Visual Impairment (SVI) and Moderate Visual Impairment (MVI) by Urban/Rural

	Urban		Rural		Total		OR*(95% CI)**
	n	% (95% CI)	*n*	% (95% CI)	*n*	% (95% CI)	
Blindness	44	2.1 (1.4-2.7)	18	1.6 (0.9-2.3)	62	1.9 (1.4-2.5)	1.2 (0.7-2.1)
SVI	19	0.9 (0.5-1.3)	32	2.9 (1.9-3.9)	51	1.6 (1.1-2.1)	0.3 (0.2-0.5)
MVI	194	9.2 (8.0-10.4)	107	9.8 (8.0-11.6)	301	9.4 (8.2-10.6)	0.9 (0.7-1.1)
Functional Low Vision	82	3.9 (2.7-4.3)	30	2.7 (1.7-3.7)	112	3.5 (2.8-4.1)	1.4 (0.9-2.1)

OR, Odds Ratio Urban/Rural; **CI, confidence interval

Table 5. Principal cause of blindness, Severe Visual Impairment (SVI) and Moderate Visual Impairment (MVI) in persons

	Blindness		SVI		MVI	
	n	%	*n*	%	*n*	%
Refractive error	1	1.6	2	3.9	112	37.2
Uncorrected Aphakia	0	0	0	0	0	0
Untreated Cataract	17	27.4	31	60.8	101	33.6
Cataract surgical complications	0	0	2	3.9	9	3
Trachomatous corneal opacity	6	9.7	2	3.9	5	1.7
Non Trachomatous corneal opacity	5	8.1	2	3.9	17	5.6
Phthisis	0	0	0	0	0	0
Glaucoma	5	8.1	1	2	1	0.3
Diabetic retinopathy	2	3.2	0	0	6	2
ARMD	16	25.8	7	13.7	39	13
Other posterior segment disease	8	12.9	4	7.8	10	3.3
All other globe/CNS abnormalities	2	3.2	0	0	1	0.3

ARMD, age related macular degeneration; CNS, central neural system; SVI, severe visual impairment; MVI, moderate visual impairment

The primary cause of blindness (27.4%) and SVI (60.8%) in majority of cases with blindness was cataract [Table 5]. Age-related macular degeneration (ARMD) was the second most common cause of blindness and SVI (25.8% and 13.7%), while refractive error was the primary cause in 37.7% of persons with MVI, followed by cataract. Untreated cataract was the main cause in 32.3% of women and 22.6% of men with blindness. Moreover, it was the main cause of blindness in rural (44.5%) and urban (20.5%) areas. ARMD was the second most frequent cause of blindness, that was more common cause in men (32.3%) than in women (19.4%) and in urban (68.8%) versus rural (31.2%) areas. The same pattern was seen for SVI, as untreated cataract was the most frequent cause of SVI and it was more common among women (67.9%) than men (52.2%) and in rural (68.4%) than urban (56.2%) areas. Refractive error was the most common cause of MVI in urban areas (42.3%) as compared to rural areas (28%) ($P = 0.04$). Overall, 58.1% (95% CI: 0.46-0.70), 78.4% (95% CI: 0.67-0.89), and 83.4% (95% CI: 0.79-0.87) of blindness, SVI and MVI were avoidable, respectively [Table 5 and Figure 1].

DISCUSSION

The prevalence of blindness in subjects aged 50 years and over was 2.1%, which is significantly higher than the prevalence reported in a previous RAAB study in Iran (1.5% blindness, 1.4% SVI, and 6.91% MVI).[3] The prevalence of blindness was lower than in some recent RAAB studies in Saudi Arabia (3.3%[8] and 2.6%[9]) and Latin America (2.3%),[10] and higher than in Eastern Europe (1.6%)[11] and Jordan (1.3%).[12] A recent systematic review on subjects aged 50 years and over in Iran showed an estimate of 1.3% and 4.2% for the prevalence of blindness and moderate to severe VI at the

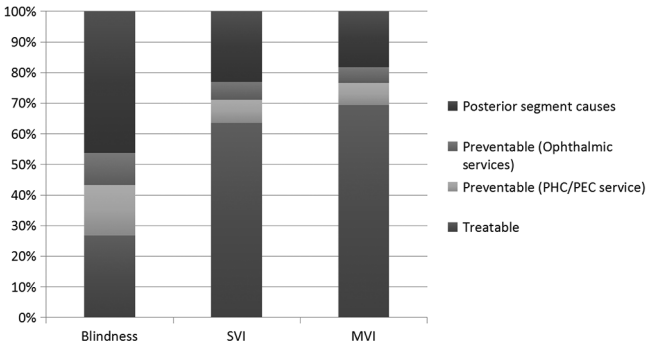

Figure 1. Distribution of avoidable causes of blindness, severe visual impairment (SVI), and moderate visual impairment (MVI).

national level, which is less than our study.[4] Women in the current study, like previous studies in Iran,[3,4,6-13] had a relatively higher prevalence of SVI than men, but the gender difference in the prevalence of blindness and VI was not statistically significant, which is contrary to the globally picture that overall women to men blindness ratio is more than 1.[14]

In the current study, almost 78% of the cases of SVI and 58% of the cases of blindness were avoidable, which is slightly higher than a previous RAAB in the Tehran Province and some other developing countries.[3,11,14-17] The high rate of avoidable blindness in Iran was attributed to the curable disease proportion, with higher contribution of cataract and lower magnitude of infection diseases such as trachoma. Untreated cataract is the major cause of blindness (27%) and SVI (61%), which is consistent with the results of other studies ranging from 58% in eastern Europe to 71% for SVI in neighboring countries.[17] Despite the increased cataract surgical rate (CSR) at the national level in recent decades,[18,19] the prevalence of CSR in Kurdistan showed no change (−1%) in 2010, even with an increase in the number of cataract operations (+2%) to 4375 operations (CSR: 2900).[20] Moreover, the adjusted number of ophthalmologists and optometrists in this province is 2.3 and 1.6 per 100 000 population respectively,[20] which is lower than the national median. Refractive errors and ARMD as the second leading causes of VI are similar to the trends in developed countries.[19] Since this survey is a rapid assessment of avoidable causes of blindness, the attributed quantity to posterior segment diseases such as glaucoma and diabetic retinopathy, may have been underreported, as seen in previous studies.[3,13]

SVI and functional low vision were significantly more frequent in rural areas and in men. Utilization of medical care services is generally higher in women and in urban areas as compared to men and rural areas, so uncorrected refractive errors and unmet needs for glasses are more frequent in men. In contrast, untreated cataract was the most frequent cause of blindness and SVI in rural area (44.5% and 68.4% respectively) and women (32.3% and 67.9% respectively). The urban-rural disparities in cataract surgical uptake was comparable to other studies,[3,13] but availability of cataract surgeries was not responsible for the disparity in area and gender differences in the current province. Lower surgical uptake in women and rural areas might be due to lack of awareness, high costs, and inefficient distribution of healthcare providers and equipment across the province, as well as the presence of the referral system. To minimize disparities in the distribution of eye care services, related resources should be redistributed according to the needs level in different geographical areas. Moreover, there should be specific policy reforms addressing financial, physical, cultural, and informational access. It has been demonstrated that respectively, 18%, 8%, and 7% of blindness, SVI, and MVI are preventable through improved access to health care services [Figure 1]. Along with global action plans for universal eye health, primary health care should be integrated into primary health care in order to improve accessibility and utilization of eye care services around the country.

RE was the most common cause of MVI in urban areas as compared to rural areas. The difference in RE between urban and rural areas may be due to lifestyle differences. Evidence suggests that RE is more frequent in individuals with visually intensive occupations which is consistent with urban standards of living. On the other hand, outdoor activities in rural areas are an independent protective factor.

A strength of our study was cooperation between local health care staff in the province and the research team, resulting in increased response rate (93%). Moreover, an experienced RAAB trainer supervised all study steps from sampling to data collection during the visits and data analysis.

In conclusion, the results showed that about 13% of Kurds aged ≥50 years have some degrees of VI. The prevalence of visual impairment seems comparable to or somehow better than other regions. Most cases of blindness, SVI, and MVI are due to avoidable causes. Cataract and refractive errors are the leading causes of blindness and VI in Iran. We recommend that a local plan for prevention of avoidable blindness be implemented based on current results.

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Conflicts of Interest

There are no conflicts of interest.

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