Iran J Public Health, Vol. 52, No. 10, Oct 2023, pp.2207-2215

Original Article

Economic Burden of Vision Loss and Eye Disorders in Iran

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(Received 10 Aug 2022; accepted 19 Oct 2022)

Abstract

Background: Globally, population growth and ageing are expected to increase the risk of vision impairment for more people. Eye disorders impose heavy social and economic burdens on communities through increased poverty, reduced quality of life, and decreased employment. Weaimed to calculate the economic burden of eye diseases in Iran.

Methods: Prevalence-based and top-down cost estimation methods were used with a sociological approach. Data were collected from the Northeastern Ophthalmology Center Institute for Health Assessment, and Evaluation, besides the 2017 census. Eye diseases were classified according to the ICD10. Data were analyzed using Excel 2016 software.

Results: Survey data were collected from 19,113 patients with vision loss and eye disorders. The average cost of vision loss/eye disorders was estimated to be $250.3. The findings indicated that the economic burden of visual diseases was $2,844 million a year, with direct medical costs comprising 87% (66% of inpatient and 21% of outpatient) and direct non-medical and indirect costs estimated at 6% and 7%, respectively. Furthermore, 72.8% of direct medical costs was paid by insurance companies, 20.6% by patients, and 6.6% by the government.

Conclusion: Eye diseases and vision loss in Iran, as in other countries, are costly for the health system and society. Instituting effective policies and measures to address this rising burden should be a national priority. Another suggestion in this area would be to focus on preventive care and policies such as health education, highlighting the role of reorientation of health services and advocacy (for policies that promote eye health), where relevant.

Keywords: Economic burden; Eye disorders; Iran

Introduction

In today's modern world, where healthcare coverage and costs are at the spearhead of public debate and concern, eye disorders (ED) and vision loss impose a significant economic as well as

social burden on global communities (1). EDs often lead to chronic, life-long direct and indirect costs, which are likely to continue to increase with an aging population and quickly rising healthcare expenses (2). Every five seconds, one person in the world goes blind. The World Health Organization (WHO) estimates that between 40,000 and 40 million people worldwide were blind in 2004, a figure projected to reach 76 million by 2020 if no further action was taken to control blindness (3). In 2010, visually impaired people worldwide totaled 285 million, 39 million of whom were blind and 246 million visually impaired. (4) Despite the fact that living standards have improved in most societies, the prevalence of avoidable ED is significantly high in many countries, while approximately 80% of global vision defects can be treated or prevented (5). Cataracts and unexplained refractive errors are considered to be the leading causes of eye disorders and vision loss, but the main cause of blindness is cataracts (4). Studies have shown that about 90% of VI patients live in developing countries (5-7).

The most common causes of VI in the elderly are cataracts and refractive errors, and the overall prevalence of the main causes of VI in the elderly is expected to increase (8).

More than half a million people aged ≥50 years have different levels of VI in Iran (8). Besides, more people would develop VIs if appropriate preventive and curative interventions were not implemented (9). A study on unavoidable blindness in people aged 50 years in Tehran, Iran estimated that the prevalence of standard blindness, severe VI, and VI to be 1.33%, 1.39%, and 6.91%, respectively, indicating that these rates were slightly higher than the standardized age prevalence (10). The study also reported that the age of blindness is 1.1% and moderate and severe VI is 4.5 percent in North Africa and the Middle East (11). However, the incurred cost of VI can be categorized as direct (e.g., medical treatment and medication fees) and indirect (e.g., unemployment, work absenteeism, and impaired productivity) costs. Cost-of-illness evaluation techniques would help health-care decision-makers establish and prioritize healthcare policies and interventions (12-15).

In the United States, the average annual cost of managing a dry eye patient from a payer's perspective is $783. When adjusted for the prevalence of dry eye nationwide, the total burden of dry eye disease on the US healthcare system was $3.84 billion. From a social perspective, the average cost of managing dry eye disease is estimated at $11,302 per patient and $55.4 billion for US society as a whole (16). Although several studies have reported the prevalence rates of vision and blindness disorders in Iran, few population-based studies are available to calculate the economic burden of these diseases (10, 17, 18).

We aimed to estimate the economical and societal burden of ED and vision loss in terms of direct healthcare costs and indirect non–healthcare costs.

Methods

The consent to participate was verbal. This study was approved by the Ethics Committee of the Research department of Mashhad University of Medical Sciences (ethical approval code: IR.MUMS.REC.1396.207).

The main approaches used in this study to estimate disease burden were prevalence-based methods, which estimate the cost of disease usually occurring in one year at the same time as the general outbreaks in a given period (19). These methods also estimate the cost of living per a given disease from symptom onset to recovery or death, including a discounted rate in the year of diagnosis (20). We used the friction cost and top-down cost methods to determine the economic burden of eye disorders and vision loss in Iran in 2019.

Based on data from the Institute for Health Assessment and Evaluation (21) and Iran's population according to the 2017 census, the prevalence of EDs in Iran in 2017 was 14.03% (22). The current study presents a social perspective of these illnesses, as the actual costs they imposed on society have been calculated (12, 13, 23). The

results include ED types sorted by gender, lengths of hospital stay, and patient costs. The costs of vision loss or impairment are divided into three groups: direct medical costs, direct non-medical costs imposed on the patient and their family, and indirect costs or costs resulting from lost productivity (24). Direct medical expenses for each type of ED were extracted from data from Northeastern Ophthalmology Center patient files (19,113 patients) from the year 2019. The types of eye- and vision-related diseases were classified according to the International Class of Diseases (ICD10) (Table 1). A descriptive analysis was performed using frequency and percentage counts, and data was analyzed using Excel 2016 software.

Table 1: ICD10 Eye Disorders and Vision Loss Classification (25)

Type of eye disease	Diagnosis code
Blindness and low vision	H53, H54
Cataract	H25, H26, H28, Q12
Disorders of conjunctiva	D31, H10, H11, H19
Disorders of lacrimal system	H04, Q10
Disorders of optic nerve and visual pathways	H46-H48
Disorders of the eyelids	C44, D22, D23, H00-H02, Q10
Disorders of the globe	H44, Q11
Disorders with eye complications	E11, E14
Glaucoma	H40, Q15
Injury and burns	S01, S02, S05, T26
Other eye disorders	B00, B58, D31, H06, H17, H22, H55-H59, Q15, T, Z
Retinal detachment, defects, and disorders	C69, H30, H30, H32-H36
Strabismus, binocular eye movements	H49, H50
Visual disturbances	C69, D09, D31, H05, H05, H15-H18, H20, H21, H27, H31, H43, H52, Q12,Q13, T85, Z96

The costs include laboratory, surgery, anesthesia, operating room, hoteling, nursing services, medical supplies, hospital visits, and other hospital fees as well as those for outpatient services (14, 26). To estimate the average cost of hospital care, patients' medical records were reviewed. The expense of outpatient care services was calculated using specialists' orders, clinical guidelines, and medical tariffs. It should be noted that the medical service tariff is the same throughout Iran. After identifying the direct medical costs of the patients, the total cost was divided by the number of patients to determine the average cost per patient. In this study, costs were reported from the perspective of the payers, including government, insurance, and patients. Indirect costs included lost productivity of manpower, which was calculated using the human capital approach (14). The number of days lost due to illness by the patient and/or their family was multiplied by the average daily income. As information about the non-medical costs of patients with ED was lacking, only transportation costs estimated based on data collected through interviews with 100 patients were considered. All costs were converted to US dollars based on the exchange rate of $1 = 130,000 Rials. To calculate the indirect costs, the average daily income of each Iranian was considered $10 per year (26). Because the tariff for medical services is the same throughout Iran, the results of this study can be generalized to the whole country. To calculate the economic burden, the average cost per patient was multiplied by the prevalence of the disease in Iran.

Results

Out of 19,113 patients with vision loss and EDs, 52% were women and 48% were men (Table 2). The majority of patients were in the age group of 61 to 65 years, and 84% of patients had basic health insurance. Out-of-pocket payments accounted for 20.6% of patient costs; the government paid 6.6% in total costs, and 72.8% of patient costs was covered by insurance companies.

Table 2: Demographic information of the studied patients

Types of eye disease	***Female***		***Male***		***Female and Male***	
	N	%	N	%	N	%
Blindness and low vision	18	0.182	17	0.184	35	0.183
Cataract	3999	40.43	3556	38.56	7555	39.53
Disorders of conjunctiva	182	1.84	188	2.04	370	1.94
Disorders of lacrimal system	458	4.63	261	2.83	719	3.76
Disorders of optic nerve and visual pathways	11	0.11	6	0.07	17	0.09
Disorders of the eyelids	623	6.30	244	2.65	867	4.54
Disorders of the globe	57	0.58	80	0.87	137	0.72
Disorders with eye complications	212	2.14	182	1.97	394	2.06
Glaucoma	303	3.06	386	4.19	689	3.60
Injury and burns	178	1.80	560	6.07	738	3.86
Other eye disorders	522	5.28	704	7.63	1226	6.41
Retinal detachment, defects, and disorders	1455	14.71	1516	16.44	2971	15.54
Strabismus, binocular eye movements	307	3.10	315	3.42	622	3.25
Visual disturbances	1565	15.82	1208	13.10	2773	14.51
Total	9890	100	9223	100	19113	100

Cataracts (40%) and visual disturbances (16%) were the most common diseases among the female subjects, and cataracts (39%) and retinal detachment, defects, and disorders (16%) were the most common among the males. The highest number of patients in both groups was related to cataract disease (40%).

The average length of stay in hospital was 1.4 days, and the highest length of stay were attributed to the patients with disorders of the ocular globe (4.1 days) and disorders of the optic nerve and visual pathways (3.6 days), respectively.

The direct cost of medical care for inpatients over one year was $3,167,678. The average cost of inpatient care was $166 per patient, with the highest cost being $274 for disorders of the ocular globe. Patients paid a higher share of the costs for disorders of the eyelids, visual disturbances, injuries, and burns than for other types of EDs (Table 3). The hospital costs of hospitalized patients were examined in 9 items, and the shares for each patient are shown in Fig. 1.

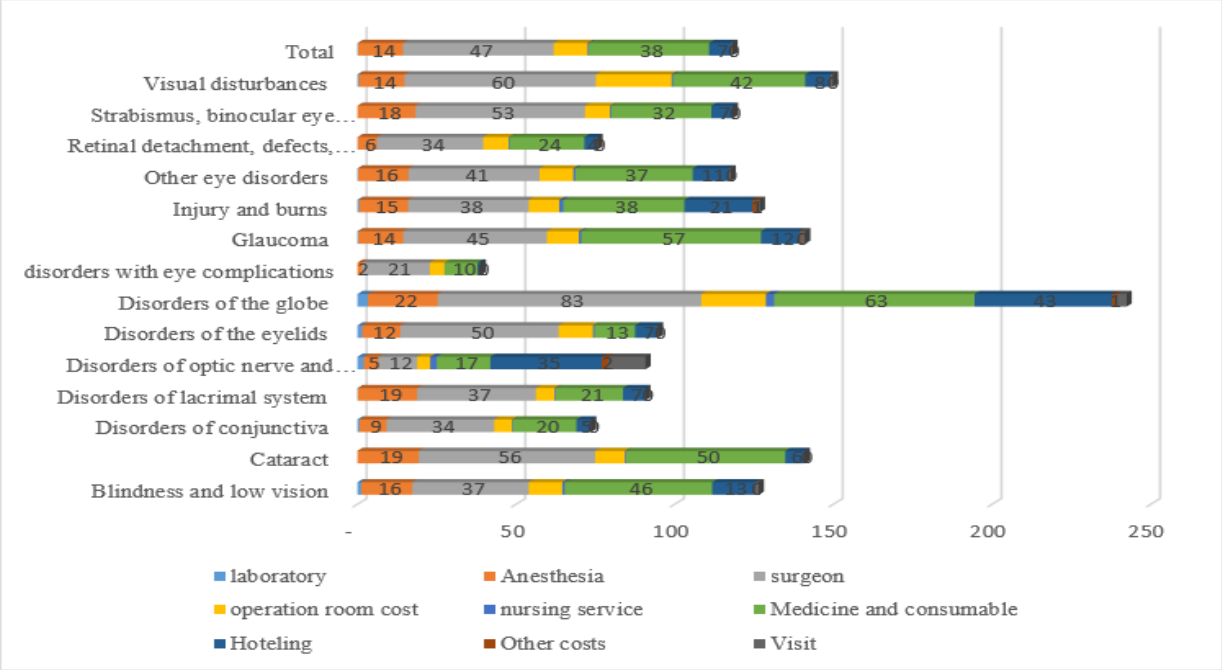

Fig. 1: Cost distribution in USD per eye disease patient

Table 3: The length of stay and hospital costs for vision loss and eye disorder patients

Type of eye disease	*LOS*		*Number of patients*	*Number of patient referrals*	*per capital cost*	*Share of patient cost payment (%)*		
	Average	SD				Insurance	Government	Patient
Blindness and low vision	1.7	1.2	35	36	133	67.4	12.3	20.3
Cataract	1.3	0.95	7555	8894	207	82.5	4.7	12.9
Disorders of conjunctiva	1.1	0.73	370	383	87	78.2	8.3	13.5
Disorders of lacrimal system	1.3	0.9	719	742	123	83.6	5.3	11.1
Disorders of optic nerve and visual pathways	3.6	0.91	17	19	100	76.9	3.2	19.9
Disorders of the eyelids	1.1	0.75	867	884	100	44.6	2.8	52.6
Disorders of the globe	4.1	1.1	137	148	274	69.5	6.1	24.4
Disorders with eye complications(Systemic diseases with ocular complications)	1.0	0.67	394	557	41	73.3	17.7	9.0
Glaucoma	1.7	1.01	689	836	172	70.3	13.2	16.5
Injury and burns	2.6	1.07	738	750	143	65.2	6.4	28.4
Other eye disorders	1.6	1.07	1226	1450	121	70.3	12.2	17.5
Retinal detachment, defects, and disorders	1.3	1.06	2971	4820	130	71.3	14.0	14.7
Strabismus, binocular eye movements	1.3	0.96	622	629	182	82.6	5.7	11.6
Visual disturbances	1.4	1.04	2773	3078	167	42.2	5.6	52.2
Total	1.4	1.09	19113	23226	166	72.8	6.6	20.6

OS: Length of Stay. SD: Standard Deviation

The main items contributing to costs for patients with vision loss or ED were related to surgery, medicine and consumables, and anesthesia, comprising 47%, 38%, and 14% of the total cost, respectively. The direct cost of medical care for outpatient services was $997,867, which was set at $52 per patient. Of this amount, 63% was paid by insurance and 37% by the patient. Indirect costs for patients totaled approximately $335,695 (Table 4).

Table 4: Lost time cost for studied eye disease patients in Iran, 2019

Status	*Number of patients*	*Mean of missed work days*	*Total of missed work days*	*Mean Cost per days, $US*	*Total cost, $US*
Employed patients	11118	1.36	15120.5	10	151,205
Unemployed Patients	7995	1.34	10713.3	5	53,567
Accompanies	19113	1.37	26184.81	5	130,924
Total					335,695

The direct non-medical (transportation) cost for patients was estimated at $286,695. Thus, the total patient costs identified in the present study were $4,783,984, and the cost per patient was estimated to be $250.30.

The present study showed that the economic burden of vision loss and eye disorders was $2,844 million, of which $2,474 million, or 87%, was direct medical expenses, with hospitalization and outpatient services constituting 66% and 21%, respectively; $ 200 million, 7% was the indirect costs, determined to be around $170 million, and the non-medical direct costs comprised 6% (Table 5).

Table 5: Total cost for studied patients with vision loss and eye disorders

Perspective	*Cost per patient ($)*	*Total costs ($)*
Direct medical costs		
Laboratory	0.3	3,409,290
Surgeon, operation room, Anesthesia	101.3	1,151,203,590
nursing services	0.6	6,818,580
Medicine and consumable	53.1	603,444,330
Inpatient Visit	0.3	3,409,290
Hoteling	9.9	112,506,570
other costs	0.2	2,272,860
Outpatient costs	52	590,943,600
Total direct medical costs	217.7	2,474,008,110
Indirect medical costs		
Employed patients	7.9	89,777,970
Unemployed Patients	2.8	31,820,040
Accompanies Patients	6.8	77,277,240
Total indirect medical costs	17.6	200,011,680
Direct non-medical costs		
transportation costs	15	170,464,500
Total direct non-medical costs	15	170,464,500
Total Economic Burden	250.3	2,844,484,290

Discussion

The current study estimated the financial burden of vision loss and EDs in Iran. Understanding the cost of disease can provide vital information for identifying gaps in knowledge to be addressed in future research as well as the information needed to invest in healthcare. The current results indicate that VIs and EDs appear to be among the diseases that place a large financial burden on the economy and health system of Iran. Given the growing costs of healthcare and the aging population (27), these costs are expected to grow. This study determined that the economic burden of eye disorders in a population of 19,000 in 2019 was about $4,783,984. Furthermore, on average, each patient with ED or vision loss spent about $250 in related healthcare costs.

The total financial burden of vision loss and ED in Iran, based on the reported statistics of 14% prevalence of ED as well as the country's 2019 population, is estimated to be about $2,844 million. This means that vision loss and ED have caused significant direct and indirect costs for communities. This finding is consistent with that of other studies which aimed to estimate the economic burden of glaucoma and cataract disease in Iran (28, 29), even though the current findings demonstrate much higher costs, possibly due to changes in the exchange rate used in the analysis or differences in methodology, data, costing approach, and cost items examined. Nonetheless, there have been studies to determine the costs of VI in specific countries around the world whose analyses have been conducted using different approaches, making it difficult to compare studies (23, 30, 31). In other countries, the financial burden of ED and VI is classified as very high due to their high prevalence. The financial burdens of eye diseases in the United States and Australia were reported to be $139 billion and $10 billion, respectively (2, 32). The prevalence of EDs has been steadily increasing from 1990 to 2015, and the burden of vision loss has increased for people aged 15 years and older, with the largest increases occurring among people 50 years and older (33). China has had an increasing burden of vision loss due to eye disease in the past two decades, and it is likely to experience an increase in the burden of vision loss in the future due to population growth and aging (33).

Health inequities are avoidable in health, and socioeconomic conditions are closely related to the prevention and treatment of diseases. Socioeconomic status could have a noticeable influence on health. A stepwise descent in socioeconomic status could predict increased risks of various diseases, and ocular disease incidences can often be higher at the lower end of the socioeconomic status spectrum. Moreover, different causes of preventable blindness in low-income countries are closely associated with poverty. Studies have highlighted the relationship between socioeconomic status, poverty, and health. Improved socioeconomic status could significantly decrease blindness due to preventable causes. Inequality in access to suitable eye care facilities could contribute to visual impairments in Iran, as in any society. The study failed to address this pivotal issue as a critical aspect of the healthcare system, and thus, it should be addressed in future studies (34, 35).

Eye diseases and vision loss are one of the most common diseases among Iranians. This is the first study that investigated this category of diseases using a social perspective in Iran. All direct medical costs, direct non-medical costs and indirect costs calculated. It is also for the first time that all diseases based on diagnostic codes are examined and compared. This study described the budgetary implications for better decision making by policy makers.

Certain limitations can be highlighted in the current study. First is the prevalence rate for eye disorders and vision loss in Iran; the difference between these amounts can change the results. Second, a sensitivity analysis was not performed in this study, which may affect the estimated financial burden of changes in some of the primary data used. Third, because of limitations and uncertainty in loss of quality of life due to eye disorders and vision loss, this value was not calculated in this study; future studies that could cover such costs, including new dimensions of the cost of the dis-

ease, are recommended. Finally, under-the-table payments were not measured in the calculations in this study.

Conclusion

Despite the diversity in approaches for research methodologies to estimate the financial burden of disease, it is agreed that eye diseases and vision loss, as in other countries, are costly for the Iranian health system and society. The situation may become even worse, as more serious population ageing challenges appear. Instituting effective policies and measures to address this rising burden should be a national priority. Other suggestions in this field would be to focus on preventive care and policies, such as health education, highlighting the role of reorientation of health services and advocacy (for policies that promote eye health) where relevant.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

This study was a part of a research project supported by Mashhad University of Medical Sciences (Grant no: 951108). The authors thank all the staff involved in the research department of Mashhad University of Medical Sciences and School of Health Management and Information Sciences in Iran University of Medical Sciences.

Competing interests

The authors declare that there is no conflict of interests.

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