

# Blindness and Visual Impairment

**Ragni Kumari<sup>1</sup>, Jamshed Ali<sup>1</sup>, Sunil Gupta<sup>1</sup>, Zainul Abedin<sup>2</sup>, Mohd Tausif Raza Khan<sup>3</sup>, Muneez Raza<sup>4</sup>, Akshaya Kumar<sup>5</sup> Vishwdeep Mishra\*<sup>1</sup>, Salal Khan<sup>1</sup>, Ramlah Akhtar<sup>1</sup>, Rajiv Janardhanan<sup>6</sup>**

1. Department of optometry, Era University Lucknow. U. P.

2. Department of Paramedical Sciences, IIAHSR, Integral University, Lucknow, U.P.

3. Department of Optometry, USAHS, Rayat Bahra University, Mohali, Punjab

4. Department of Optometry, IIMT College of Medical Sciences, Meerut, U.P.

5. Divya College of Health Sciences, Maharaj Ganj, U. P.

6. Dean (Research), Faculty of Medical & Health Sciences, SRM Institute of Science & Technology, Chennai.

\*Corresponding author: Vishwdeep Mishra.

## Abstract

Blindness and vision impairment pose significant global public health challenges. The impact of vision impairment extends beyond an individual and places a substantial financial burden on the entire world. It is estimated that the annual cost of productivity losses associated with vision impairment amounts to \$411 billion worldwide. Among adults globally, age-related or senile cataracts are the primary cause of visual impairment, accounting for 65% of cases. The causes of vision impairment vary significantly between and within countries, depending on factors such as the accessibility and cost of eye care services, as well as the level of eye care knowledge among the population. In low- and middle-income countries, cataracts contribute to a higher percentage of vision impairment compared to high-income countries. On the other hand, glaucoma and age-related macular degeneration are more prevalent in nations with higher incomes.

**Keywords:** cataract; blindness; visual impairment; glaucoma

## Introduction

Blindness and vision impairment pose significant global public health challenges. The financial burden caused by vision impairment affects not only individuals but also the entire world. The estimated annual cost of productivity losses related to vision impairment is a staggering \$411 billion worldwide. Vision loss can affect people of all ages, with at least 2.2 billion individuals worldwide experiencing near or farsightedness [WHO, October 2022].

Recent statistics reveal that a majority of individuals with vision impairment (65%) and blind individuals (82%) are over the age of 50. Alarmingly, approximately 1 billion cases of vision damage could have been prevented or remain unaddressed. The leading causes of visual impairment are cataracts (33%) and untreated refractive errors (43%). Other causes include glaucoma, diabetic retinopathy, trachoma, and childhood blindness.

Unfortunately, due to limited access to eye care services, 1.1 billion people worldwide suffer from the consequences of sight loss. These individuals are often among the most marginalized and impoverished in

society. To address this issue, the sector has developed a long-term strategic plan called "2030 IN SIGHT." This plan aims to integrate eye health into comprehensive healthcare systems, promote transformation in patient care, consumer behavior, and market dynamics, and recognize vision as a fundamental concern for economic, social, and overall development. These efforts are crucial for achieving the Sustainable Development Goals set by the United Nations [<https://www.iapb.org>, 2023].

We have the opportunity to put an end to preventable vision loss, and the 2030 IN SIGHT initiative demonstrates how we can intensify our efforts to make this goal a reality. While recognizing that circumstances have changed, 2030 IN SIGHT builds upon the exceptional work that has already been accomplished. We must adapt our approach to ensure that vision health receives the necessary attention and priority in political, healthcare, and developmental arenas [<https://www.iapb.org>, 2023]. Together, we must:

- Prioritize vision as a critical issue for economic, social, and developmental advancement;

- Integrate eye health into broader healthcare systems; and
- Drive change among patients, consumers, and the market.

Age-related or senile cataracts are the leading cause of visual impairment in adults worldwide (65%). The causes of visual impairment vary significantly between and within countries, depending on the accessibility of eye care services, their cost, and the population's level of eye care knowledge. In low- and middle-income countries, cataracts account for a higher percentage of vision impairment compared to high-income countries. Glaucoma and age-related macular degeneration are more prevalent in nations with higher incomes.

Cataracts are responsible for the majority of severe vision impairment (80.7%), moderate visual impairment (70.2%), and blindness (66.2%) in India. Other significant factors contributing to blindness include corneal opacity (7.4%), complications from cataract surgery (7.2%), diseases of the posterior segment other than DR (Diabetic Retinopathy) and ARMD (Age Related Macular Degeneration) (5.9%), and glaucoma (5.5%). Apart from cataracts, various posterior segment illnesses, excluding DR and ARMD (3.4%), play a significant role in causing vision impairment (8.3%). The highest prevalence of blindness is observed in the 80+ age group (11.6%), followed by the 70-79 age group (4.1%), the 60-69 age group (1.6%), and the 50-59 age group (0.5%). Bijnor in Uttar Pradesh has the highest population affected by blindness (3.67 percent) and visual impairment (21.82 percent) [National Programme for Control of Blindness & Visual Impairment, Directorate General of Health Services, MHFW, New Delhi, 2019].

The two main mechanisms for introducing cataracts by ocular UV (Ultraviolet) light exposure are oxidative stress and the resulting inflammation [Varma et al., 2011; Osnes-Ringen et al., 2013] and photooxidation, which may involve photosensitizers [Roberts, 2011]. These may be endogenous substances, such as metabolites of inert tryptophan that become enzymatically altered with age [Balasubramanian, 2000] or UV-absorbing advanced glycation end products [Ortwerth et al., 1997] or exogenous photosensitizers, such as phototoxic drugs (Roberts, 2002). All these mechanisms generate reactive oxygen species (singlet oxygen and superoxide) that oxidize lens proteins, gradually forming opacities that eventually develop into cataracts [Roberts, 2011]. The most diffuse source of human UV exposure is solar

radiation, including the entire spectrum of UV bands. However, UV-C and much of UV-B are absorbed in the atmosphere, mainly by ozone: current ozone depletion increases UV-B exposure. Other optical regions of the solar spectrum also have the potential to cause chronic photochemical lens damage, e.g., blue light, especially in the presence of phototoxic drugs, but their role in cataract pathogenesis is less clear [Taylor et al., 1992; Sliney, 2011].

## Global Scenario

At least 2.2 billion individuals worldwide struggle with near or distance vision. The WHO estimates that 1 billion people worldwide have moderate to severe distance vision impairment or blindness as a result of untreated refractive error (88.4 million), cataracts (94 million), age-related macular degeneration (8 million), glaucoma (7.7 million), diabetic retinopathy (3.9 million), and near vision impairment brought on by untreated presbyopia (826 million) [WHO, 2022]. Nearly half of these cases, or at least 1 billion, involved vision damage that either might have been avoided or is still unaddressed. Regionally, low- and middle-income regions are thought to have a four times higher prevalence of distance vision impairment than high-income regions (WHO, 2022).

Regionally, low- and middle-income regions are thought to have a four times higher prevalence of distance vision impairment than high-income regions (WHO, 2022). In western, eastern, and central sub-Saharan Africa, the rate of untreated near vision impairment is thought to be greater than 80%. Comparative rates, however, are said to be lower than 10% in high-income countries in Western Europe, North America, Australia, and Asia-Pacific (WHO, October 2022). It is predicted that aging and population growth will increase the likelihood that more people may get vision impairment.

As with blindness, the percentage of moderate to severe visual impairment caused by cataracts is smallest in higher socioeconomic regions (13.0–13.8%) and largest in south and southeast Asia (both >20%). Across all regions, women have more blindness (35.5% versus 30.1% in men) and moderate to severe visual impairment (20.2% versus 15.9% in men) caused by cataracts than men.

## Risk factors

An adult-onset cataract is primarily age-related [Bochow TW, 1989]. The most important factor

associated with cataracts is age; almost everyone living long enough will develop cataracts [Cruickshanks KJ, 1992]. The development of cataracts is accelerated by metabolic conditions such as diabetes mellitus [West SK, 1998]. Diabetic individuals develop cataracts approximately 20 years earlier. Other metabolic conditions that cause cataracts include hypocalcemia, Wilson disease, and myotonic dystrophy [Glynn RJ, 1995]. There is an increased incidence of cataracts in patients with pseudo-exfoliation syndrome and atopic dermatitis [Hiller R 1997, Cumming RG 1997]. Ischaemic ocular conditions such as pulseless disease, thromboangiitis obliterans, and anterior segment necrosis also lead to cataracts [Bochow TW, 1989]. Other causes for cataracts include systemic, topical, or inhaled corticosteroid use. Corticosteroids lead to dose- and duration-dependent cataracts (Klein BE, 2001). Other cataract drugs are phenothiazines, miotics, amiodarone, and statins.

Along with blunt trauma and perforating injuries, ionizing radiation, infrared radiation (to which glassblowers are frequently exposed), and microwave radiation can also cause cataracts [Chang JR, 2011]. Alkali burns are more likely to lead to cataracts than acid injuries. Exposure to sunlight and ultraviolet B (UVB) radiation accelerates cataract development, as do smoking and alcohol consumption [Chang JR, 2011]. Ocular conditions causing cataracts are uveitis, retinitis pigmentosa, essential iris atrophy, chronic hypotony, absolute glaucoma, and high Myopia. Cataract also occurs secondary to intra-ocular surgeries- glaucoma filtration surgery and vitrectomy. Furthermore, epidemiological studies have demonstrated that lower socioeconomic status, lower education level, and poorer overall nutrition are associated with an increased prevalence of age-related cataracts.

According to the accessibility of eye care services, their price, and the population's level of eye care

knowledge, there are significant differences in the causes between and within countries. For instance, compared to high-income countries, the share of vision impairment owing to cataracts is higher in low- and middle-income nations. Glaucoma and age-related macular degeneration are more prevalent in nations with high incomes.

## Indian Scenario

In India, cataract is the principal cause of curable blindness (66.2%), with visual impairment (80.7%) and moderate visual impairment (70.2%) (Table 1).

The other important causes of blindness include Glaucoma (5.5%), posterior segment abnormalities excluding DR and ARMD (5.9%), corneal opacity (7.4%), and complications from cataract surgery (7.2%). Other posterior segment illnesses excluding DR and ARMD (3.4%) and cataract surgical complications (8.3%), were the main causes of severe vision impairment (Table 2.1). The maximum prevalence of blindness has been in the 80+ age group (11.6%), followed by the 70-79 age group (4.1%), the 60-69 age group (1.6%), and the 50-59 age group (0.5%). Blindness is higher among illiterates (3.23%) than the literate population. It was only 0.43% among the 10th pass and above.

Blindness is more prevalent in rural than urban populations (2.14% vs 1.80%). Most blindness and visual impairment are due to avoidable causes (92.9% and 96.2%, respectively). Among avoidable causes, treatable causes of blindness and VI were 68.1% and 85.7%, respectively. In a study conducted by the National Programme for Control of Blindness & Visual Impairment (2019), the prevalence of bilateral cataract visual impairment was 5.09%. The prevalence of cataract blind eyes was 3.19%, and that of visually impaired eyes was 9.84% (Table 2.1).

**Table 1:** Causes of blindness & visual impairment in population aged  $\geq 50$  years (PVA) Blindness and Vision Impairment

Principal cause	Blindness (%)	SVI < 6/60-3/60 (%)	MVI < 6/18-6/60 (%)	MSVI < 6/18-3/60 (%)	EVI < 6/12-6/18 (%)	VI < 6/18 (%)
Refractive error	0.1	1.5	18.8	15.8	70.6	13.4
Aphakia uncorrected	1.7	1.4	0.8	0.9	0.6	1.0
Cataract untreated	66.2	80.7	70.2	72.0	23.9	71.2
Cataract surgical complications	7.2	8.3	5.2	5.7	2.9	5.9
Trachomatous corneal opacity	0.8	0.1	0.0	0.1	0.0	0.2
Non trachomatous corneal opacity	7.4	1.7	0.6	0.8	0.3	1.8
Phthisis	2.8	0.1	0.0	0.0	0.0	0.4
Glaucoma	5.5	0.8	0.7	0.8	0.3	1.4

Diabetic retinopathy	1.2	1.1	0.7	0.7	0.3	0.8
ARMD	0.7	0.7	0.8	0.8	0.3	0.8
Other posterior segment disease	5.9	3.4	2.0	2.2	0.7	2.8
All other globe /CNS abnormalities	0.5	0.2	0.2	0.2	0.1	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

PVA- Presenting Visual Acuity, SVI- Severe Visual Impairment, MVI- Moderate Visual Impairment, MSVI- Moderate Severe Visual Impairment, EVI- Early Visual Impairment, VI- Visual Impairment, ARMD- Age Related Macular Degeneration

## Initiatives To Combat Blindness

1. India was the first country to launch the NPCB in 1976.
2. In 1999, the WHO launched Vision 2020: The Right to Sight, a joint endeavor with IAPB to eliminate avoidable blindness by 2020.
3. In 2013, WHA adopted Universal Eye Health: Global Action Plan 2014-19 to reduce avoidable visual impairment by 25% by 2019 compared to the baseline prevalence in 2010.

## Impact Of Vision Impairment

### Personal impact

Young kids with early onset severe vision impairment may face lifelong implications due to delayed motor, verbal, emotional, social, and cognitive development. Children in school who have eye problems may also perform less well academically. Among adult populations, vision impairment significantly negatively impacts the quality of life. Visually impaired adults frequently have lower rates of labor force involvement and productivity and greater rates of anxiety and depression. Vision impairment in older people can increase their risk of falling and fractures, social isolation, difficulties walking, and early admission into nursing or care facilities.

### Economic impact

The anticipated yearly global productivity loss due to vision impairment is around US\$ 411 billion in purchasing power parity (WHO, October 2022). This sum substantially exceeds the predicted US\$ 25 billion cost gap to address the unmet requirement of vision impairment (WHO, October 2022). It is impossible to prevent all eye disorders, even though many of them are preventable (for example, infections, trauma, harmful traditional medicines, prenatal diseases, nutrition-related diseases, improper use, or self-administration of topical treatment). Different, prompt interventions are necessary for every eye ailment. The demands related to eye disorders and vision impairment can be met with effective interventions encompassing promotion,

prevention, treatment, and rehabilitation; some of these interventions rank among the most affordable and practicable healthcare solutions.

## Conclusion

As the world's population gets older, there is an expected increase in the occurrence of visual impairment and blindness caused by cataracts due to the age-related rise in cataract prevalence.

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