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# The Prevalence of Age-Related Eye Diseases and Geriatric Comorbidities

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## ABSTRACT

**Background:** Age related eye diseases (AREDs) are a major cause of visual impairment in older adults. These conditions often co-occur with systemic comorbidities such as hypertension, diabetes, cardiovascular diseases, obesity and arthritis complicating diagnosis and management. Understanding the overlap between ocular and systemic conditions is vital for effective care delivery. **Objective:** To determine the prevalence of AREDs among elderly individuals in Bangladesh and to examine their association with common geriatric comorbidities including hypertension, diabetes, cardiovascular diseases, obesity and arthritis. **Methods:** A cross- sectional study was conducted among 400 participants aged >_ 60 years in selected urban and rural healthcare facilities in Bangladesh. Data were obtained through structured interviews, comprehensive ophthalmic examinations, and medical record reviews. Statistical analyses assessed the relationships between AREDs and systemic comorbidities. **Results:** Cataract was the most common ARED (52%), followed by diabetic retinopathy (18%), glaucoma (14%) and age-related macular degeneration (AMD) (12%). Whereas hypertension (64%), diabetes (48%), cardiovascular diseases (21%), obesity (14%) and osteoarthritis about (7%) were the leading causes of comorbidities. Significant associations were observed between diabetic retinopathy and diabetes ($p < 0.001$) and between AMD and hypertension ($p = 0.03$). **Conclusion:** AREDs are highly prevalent among the elderly in Bangladesh and frequently coexist with systemic diseases. An integrated geriatric and ophthalmologic care model is essential to improve visual and overall health outcomes in this population.

**Keywords:** Prevalence, geriatric comorbidities, degeneration, incidence, metamorphopsia, scotoma, stereopsis, BADL, chronobiology, gonioscopy, MIGS, blue-turquoise light, antioxidants, ROIs, leptin, MSNA, baro-reflex, metabolic syndrome, melatonin, pineal gland, ipRGCs, pulvinar, enucleation, dyslipidemia, obstructive sleep apnea

## INTRODUCTION

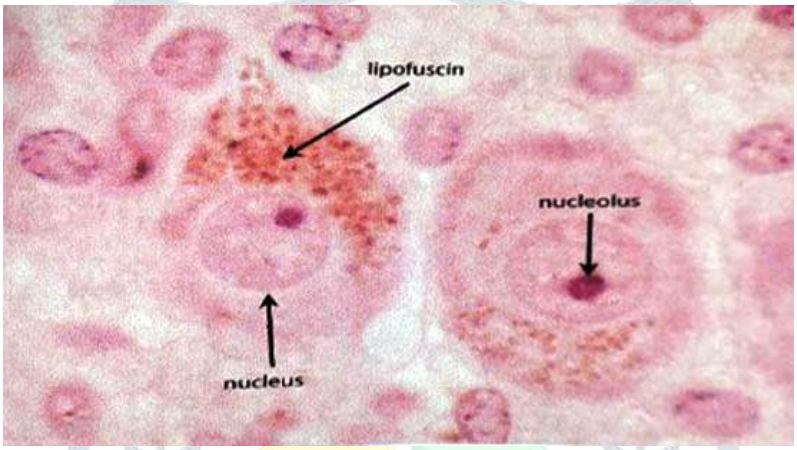
The population of Bangladesh is aging rapidly, with a significant proportion now above the age of 60 years. This demographic shift brings a parallel rise in age-related eye diseases (AREDs) is particularly prominent. Globally, AREDs such as cataract, diabetic retinopathy, glaucoma, and age-related macular degeneration (AMD) are leading causes of visual impairment and blindness among older adults. In low and middle-income groups of people's country like Bangladesh, the burden is even more pronounced due to limited access to specialized eye care and inadequate public health awareness.

Vision plays a vital role in maintaining functional independence and quality of life in elderly individuals. However, when eye diseases occur alongside chronic systemic conditions such as hypertension, diabetes mellitus, cardiovascular diseases, obesity and arthritis like diseases, the situation becomes more complex. These comorbidities not only increase the risk of developing certain eye problems (e.g., diabetic retinopathy in diabetics) but also complicate their management and prognosis. Vision impairment is a condition that encompasses the continuum from near normal vision with a slight deficit in visual acuity or visual field to low vision with significantly reduced vision to profound vision loss and blindness (no perception of light). Blindness is defined as no usable vision with exception of light perception. Legal blindness is defined as a visual acuity of 6/60 or vision less in better eye or a visual field of 20 degree or less in the better eye in the widest meridian. There are other common functional and physiologic changes that take place in the aging

visual system of the eyes are, the decrements in visual acuity, accommodation, visual field, lachrimation, contrast sensitivity, color vision, recovery from glare source and loss of depth perception (stereopsis).

Functional losses may ultimately affect the most basic activities of daily living (BADL). Onset of the human aging is indeterminable and its progression varied with period as age advances so, age-related eye diseases develops. In usual aging, pathology is absent but presence of decline in body functions. Indeed, it is obviously postulates that, when these aging seniors could have affluent in the prosperity of knowledge and experience at this stage of life by overcome the disabilities, still they can utilize it for any beneficial progression or development of the society or country. Without the breakthrough plan, the society and country ultimately deprived from it. Despite the growing prevalence of such conditions, there remains a lack of comprehensive data in Bangladesh that links age-related eye diseases with other common geriatric comorbidities. Understanding this inter-relationship is crucial for developing integrated care models that address both ocular and systemic health in elderly patients.

This study aims to fill that gap by exploring the prevalence of major AREDs in the elderly population of Bangladesh and identifying their associations with common chronic comorbid conditions. By doing so, it seeks to inform healthcare providers and policymakers on the need for holistic geriatric healthcare strategies.




**Nerve Cell of Autonomic Ganglion**

## OBJECTIVES

The primary goal of this study is to investigate the root cause and burden of age-related eye diseases among the elderly population in Bangladesh. It is intended to identify their association with common geriatric comorbidities. The specific objectives are:

- To determine the prevalence of major age-related eye diseases such as cataract, diabetic retinopathy, glaucoma, and age-related macular degeneration (AMD) among individuals aged 60 years and above in Bangladesh.
- To identify the most common geriatric comorbidities (e.g., hypertension, diabetes mellitus, cardiovascular diseases, obesity and arthritis) present in the elderly population.
- To examine the correlation between specific age-related eye diseases and systemic comorbidities.
- To assess the impact of multiple comorbid conditions on the management and progression of eye diseases in the elderly.
- To provide evidence-based recommendations for integrated geriatric and ophthalmologic care in the Bangladeshi healthcare setting.

## LITERATURE REVIEW

### Global burden of age-related eye diseases (AREDs)

Age-related eye diseases are a leading cause of visual impairment and blindness worldwide. According to the World Health Organization (WHO, 2023), more than 2.2 billion people globally have vision impairment, of which at least 1 billion cases could have been prevented or have yet to be addressed. Cataract remain the leading cause of blindness globally, followed by glaucoma, diabetic retinopathy and age-related macular degeneration (AMD). The burden of AREDs is expected to rise significantly with the increasing aging population, especially in low- and middle- income countries (LMICs).

**AREDs in South Asia and Bangladesh**

South Asia bears a significant portion of the global burden of avoidable blindness, with Bangladesh contributing substantially due to its large aging population and limited access to eye care services. The National Blindness and Low Vision Survey of Bangladesh (2000) reported that approximately 1.53% of the population was blind, with cataract responsible for 79.6% of all blindness. Although newer data are limited, recent hospital-based studies suggest a rising trend in diabetic retinopathy and glaucoma, likely due to increased life expectancy and lifestyle-related chronic diseases.

**Association with Geriatric Comorbidities**

Several studies have shown a strong association between age-related eye diseases and systemic conditions. Diabetes mellitus is the most significant risk factor for diabetic retinopathy. A study by Klein et al. (2010) found that nearly all individuals with type 1 diabetes and over 60% of those with type 2 diabetes developed some form of retinopathy within 20 years of diagnosis. Hypertension has been associated with both glaucoma and AMD. Cardiovascular disease and hypertension with obesity is common in the elderly. Obesity preponderate to ensue osteoarthritis. Therefore, these interrelated disparities in the elderly often complicate treatment options and reduce the effectiveness of ophthalmic interventions.

**Theoretical standpoints on aging**

Senescence (changes associated with aging) appears to be multifactorial process whose rate depends on both genetic (programmed) and environmental (damage or error) phenomena. The intend is not to suggest that any single theory explains the aging process, but rather to recognize that aging is a complex phenomenon orchestrated by events at several organizational levels in the body.

Somatic mutation theory is one of the genetic theories of aging states that radiation and other environmental mutagens alter the structure of genetic code of DNA in somatic cells of the body, the blueprint for protein synthesis. Over time, such minor alteration could in turn accumulate and have damaging effects on protein function and thus on body function. Differences in longevity among individuals might result from varying rates of mutagenesis and varying proficiencies of DNA repair.

Environmental theories i.e., the wear and tear theory of aging proposes that, aging is inevitable as cells, tissues and organs gradually wear out from continued use, but have several mechanisms to repair their injuries. With passage of time, the damage resulting from wear and tear might accumulate to a point at which it overcomes the body's capacity for maintenance and repair.

The free radical theory of aging which is a specific version of the wear and tear theory that attributes cellular (and therefore organismal) aging to random accumulating damage of macromolecules by the highly reactive by products of oxidative metabolism known as free radicals. Two other program-based theories endocrine and immunological focus on a gradual biological decline over time. In the former, biological clocks and hormones regulation control the rate of aging. In the latter, the immune system is "coded" to erode over time, thus enhancing the body's susceptibility to disease and death.

**The Biological Clocks**

Human beings have a daily rhythm of sleep and wakefulness, which in turn correlated with the corresponding rhythmic activities of the nervous, endocrine, digestive and excretory systems. The ubiquity of the rhythms and their importance for the survival of the individual and species.

The rhythms of organisms observed in their natural environment seem to be mere responses to the cyclic changes of the environmental factors such as light, temperature, humidity. Nonetheless, the organisms continue to exhibit rhythmic fluctuations with the same frequency even when the obvious environmental factors are kept constant. Evidently, the organisms have the innate ability to be periodic; this periodicity is not forced upon them by the periodic environmental factors. It is postulated that organisms have 'internal clocks' or 'biological clocks'.

According to this chronobiology concept and technique for resolving predictable rhythms in organisms and for isolating environmental effects from underlying endogenous mechanisms, increasing evidence suggests that disruption of this circadian rhythmic function either genetically or environmentally can exacerbate a wide range of age-related pathologies, ranging from cataract to cancer.

**Light, Radiation effects and the Ocular risks**

The eye is the only organ in the body that evolve to allow radiation to penetrate deep within it. In this process however the various ocular media- cornea, aqueous, lens and vitreous act as progressive wavelength selective filters.

The penetration of optical radiation is the first paradox as radiation is a biological hazard but light is an essential component in the process, we know as vision. The light, which is a part of electromagnetic spectrum of radiation, comes from sun, a single largest source. Visible light is not inherently different from the other part of the electromagnetic spectrum, with the exception that the human eye can detect visible waves. The human eye can see light of wavelengths ranging from 380-780 nm (visible spectrum of light). Shorter wavelengths than 380 nm are classified as ultraviolet (UV) light. While wavelengths longer than 780 nm are classified as infrared light. The sun is the single largest source of UV light. Short wavelength UV-C is effectively filtered out by the earth's ozone layer and atmosphere to reach its surface.

Short wave length visible light, the spectrum from 380 to 500 nm that include violet, indigo, blue and some blue-green light plays a paradoxal role in health and vision. Blue-violet wavelengths lie close to UV light and therefore have higher energy (being inversesely proportional to the wavelength). An excess of blue-violet is considered hazardous to the human retina if exposed for a long period as it radiates more energy than blue-turquoise and other visible light.

Not only blue light essential for color vision, recent finding is that, light in this band triggers critical physiological responses, such as pupil constriction and circadian rhythm synchronization, which in turn maintains and regulates non-visual functions by stimulation through non-visual pathways, such as memory, mood and hormonal balance.

**Quantification of Biological Aging**

The aging process can be quantified in people still young enough for prevention of age-related diseases. The science of health span extension may be focused on the wrong end of the life span; rather than only studying old humans. Gero-science should also study the young. Older life physiologies had actually been aging faster than their same chronologically aged peers retained younger physiologies.

Exhibited deficits or tested individual variation in biological age and the pace of aging related to differences in the biomarkers, personal slop of mixed growth effects and to differences in the functioning of study members bodies and brains, measured with the instruments commonly used in clinical settings.

Micron urography technique uses to record the postganglionic efferent nerve discharges leading to the skeletal muscle (the muscular bed) which is called muscle sympathetic nerve activity (MSNA). It is the potent and useful tool in clinical autonomic function assessment.

MSNA increases with age and the increment is greater in women than in men have a similar or greater basal MSNA and a greater increase in arterial pressure for a given increase in MSNA.

During mental stress similarly increases the arterial pressure. Obese normotensive women had a greater MSNA than lean women and in body weight reduction, results in decrease of blood pressure that was at least partially caused by reduction of MSNA. Which is enhanced by – (i) an improvement in baro reflex control, (ii) decreasing fatty acid levels in the blood, (iii) altering plasma leptin levels, (iv) an increasing in insulin sensitivity to the subjects.

**Impact on quality of life and health systems**

Visual impairment due to AREDs significantly reduces the quality of life in the elderly. Functional losses may ultimately affect the most basic activities of daily living (BADL) including feeding, toileting, bathing, dressing, reading, seeing steps-stairs-curbs, doing fine home works, ability to recognizing faces. It limits mobility, increases dependence, contributes sleep disorders to depression, and heightens the risk of falls and injuries. Individuals with multiple dysfunctions require significant in home support. Moreover, the presence of multiple comorbidities leads to complex care needs even on urgent basis to take nursing home admission; it is overburden to health systems, especially in resource-limited settings. There is a growing consensus on the need for integrated care models that simultaneously address both visual and systemic health conditions in the elderly.

**Research gaps in the Bangladesh context**

While some data exist on the individual prevalence of cataract or diabetic retinopathy, comprehensive studies examining their co-occurrence with chronic diseases in the elderly population of Bangladesh are scarce. Most studies are hospital- based and do not reflect the situation at the community level. This gap highlights the need for localized, community-based research to inform evidence-based interventions and policy-making.

## METHODOLOGY

**Study Design:** This was a cross-sectional descriptive study conducted to assess the prevalence of age-related eye diseases and their association with common geriatric comorbidities among elderly individuals in Bangladesh.

**Study Population:** The study population included elderly individuals aged 60 years and above, attending selected eye hospitals, geriatric clinics, and community health centers in both urban and rural areas of Bangladesh.

**Sample Size and Sampling Technique:** A total of 400 participants were selected using a purposive sampling technique, ensuring representation from both genders and diverse socioeconomic backgrounds. Sample size was calculated based on previous prevalence rates of major age-related eye conditions in Bangladesh, with a 95% confidence level and 5% margin of error.

**Inclusion Criteria:**

- Age ≥ 60 years
- Willing to participate and provide informed consent
- No history of recent ocular trauma or surgery (within last six months)

**Exclusion Criteria:**
- Individuals with cognitive impairments affecting communication
- Terminally ill patients
- Individuals refusing or unable to under**go ophthalmic evaluation**

**Data Collection Tools and Techniques:** Data were collected through the following methods:
- **Structured questionnaire:** Administered by trained interviewers to obtain demographic Information, medical history, and lifestyle data.

- **Clinical examination:** Comprehensive eye examination by qualified ophthalmologist, Including:
  * Visual acuity testing by Snellen's distant vision chart and near vision chart.
  * Contrast sensitivity test by Pelli-Robson chart.
  * Confrontation method for Visual field assessment
  * Gonioscopy by oblique illumination flashlight test
  * Test by Amsler grid
  * Slit lamp examination
  * Fundus copy
  * Intraocular pressure measurement (IOP) by Schiotz tonometer.

**Review of medical records:** Used to confirm diagnosis of systemic comorbidities such as diabetes, hypertension, cardiovascular disease, obesity and arthritis.

**Ethical considerations:** Ethical approval was obtained from Institutional Review Board (IRB) of the affiliated medical institution. Informed consent was obtained from all participants. Privacy and confidentiality were strictly maintained.

**Data analysis:** Data were entered and analyzed using SPSS version 25. Descriptive statistics (frequencies, percentages, mean, and standard deviation) were used to present demographic and clinical characteristics.
- Chi-square tests and logistic regression were performed to assess associations between eye diseases and comorbidities.
- A p-value $< 0.05$ was considered statistically significant.

**RESULT**

A total of 400 elderly participants (aged $\geq 60$ years) were included in the study. The mean age was $68.4 \pm 6.3$ years, with 52% females and 48% males. The following results summarize the prevalence of major age-related eye diseases and their association with common geriatric comorbidities.

**Table 1. Prevalence of major Age-Related Eye Diseases (N= 400)**

| Eye Diseases | Frequency (n ) | Prevalence (%) |
|---|---|---|
| Cataract | 208 | 52.0% |
| Diabetic Retinopathy | 72 | 18.0% |
| Glaucoma | 56 | 14.0% |
| Age-related Macular Degeneration ( AMD | 48 | 12.0% |
| Normal / No significant condition | 64 | 16.0% |

Table 1 presents the distribution of the major age-related eye diseases among 400 elderly participants in the study. The most prevalent condition was cataract, observed in 52% of the respondents. This high percentage aligns with global and national trends, as cataract remains the leading cause of reversible blindness in older populations.

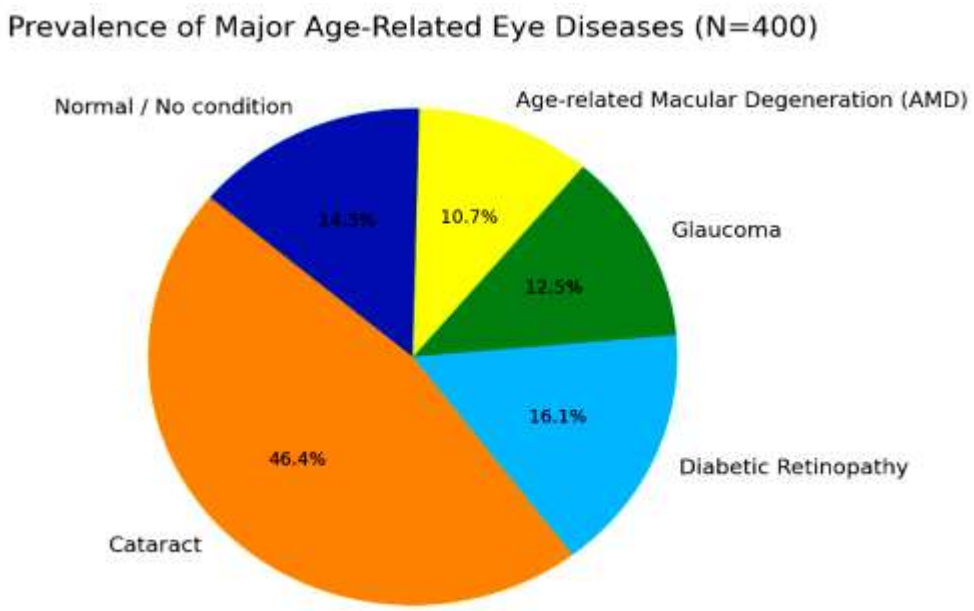



**Figure 1: Prevalence of major Age-Related Eye Diseases**

The second most prevalent condition was diabetic retinopathy (18%), which correlates with the increasing incidence of diabetes among the elderly in Bangladesh. Glaucoma affected 14% of the study population, reflecting the silent yet progressive nature of this optic neuropathy.

Age-related macular degeneration (AMD) was found in 12% of participants, typically among those over 70 years of age. Notably, 16% of the participants were found to have no significant eye diseases at the time of examination, though many had reduced visual acuity on near vision due to age-related changes such as presbyopia or dry eye syndrome.
The results indicate that a majority of elderly individuals suffer from at least one major eye disease, emphasizing the need for routine ophthalmic screening and timely intervention among the geriatric population.

**Table 2. Prevalence of common Geriatric Comorbidities (N = 400)**

| Comorbidities | Frequency (n) | Prevalence (%) |
|---|---|---|
| Hypertension | 256 | 64.0% |
| Diabetes Mellitus | 192 | 48.0% |
| Cardiovascular Disease | 84 | 21.0% |
| Obesity | 56 | 14.0% |
| Arthritis | 28 | 7.0% |
| Multiple Comorbidities | 180 | 45.0% |

Table 2 illustrates the distribution of common systemic comorbidities among the 400 elderly participants. The most prevalent condition was hypertension, reported in 64% of the study population. This aligns with national trends, as hypertension is a widespread chronic illness in older adults and known risk factor for several eye diseases, including glaucoma and age-related macular degeneration (AMD).

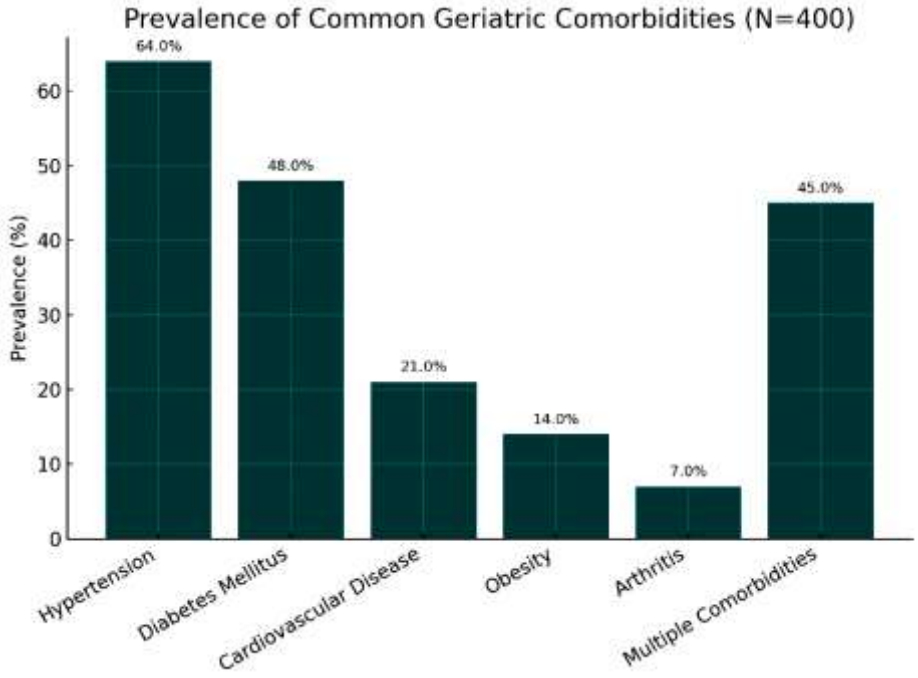



**Figure 2: Prevalence of common Geriatric Comorbidities**

The second most common comorbidity was diabetes mellitus, affecting 48% of the respondents. This finding is particularly significant as diabetes is directly linked to diabetic retinopathy, a major cause of vision loss in the elderly.

Obesity imposes the burden for health constituted 14% of the respondents. It enhances cardiovascular diseases and arthritis in the elderly. Arthritis was reported in 7% of the participants, affecting mobility and basic activity of daily living (BADL) and potentially limiting access to regular eye care services.

Cardiovascular diseases were present in 21% of individuals, leading causes of ischemic heart disease, cerebrovascular stroke or retinal vessel occlusion. Ironically, the fact is that, about 45% of the participants had multiple comorbidities, indicating a high burden of chronic diseases in this age group. The presence of multiple conditions significantly increases the risk of poor outcomes, delayed diagnosis and complications in the management of age-related eye diseases. Overall, the data highlight the need for integrated care strategies that simultaneously address both ocular and systemic health conditions in elderly patients in Bangladesh.

**Table 3: Association between Eye Diseases and Selected Comorbidities**

| Eye Diseases | Most Associated Comorbidities | P-value | Significance |
|---|---|---|---|
| Diabetic Retinopathy | Diabetes Mellitus | <0.001 | Significant |
| Glaucoma | Hypertension | 0.021 | Significant |
| AMD | Hypertension | 0.037 | Significant |
| Cataracts | Diabetes and Hypertension | 0.084 | Not Significant |

Table 3 presents the statistical associations between major age-related eye diseases and selected common geriatric comorbidities among the elderly participants.

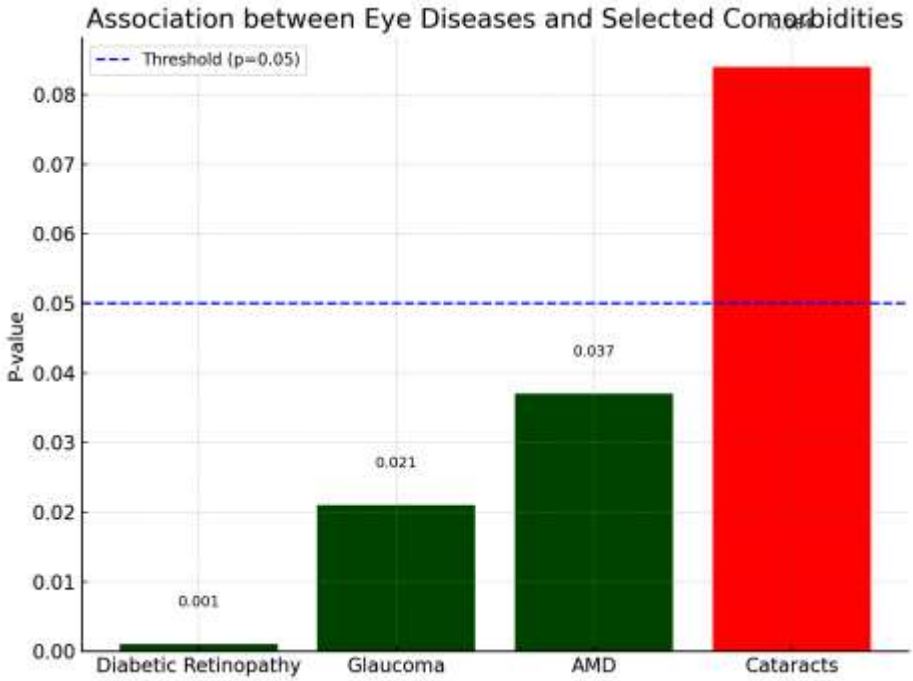



**Figure 3: Association between Eye Diseases and Selected Comorbidities**

A highly significant association was found between diabetic retinopathy and diabetes mellitus ($p<0.001$), confirming the well- established link that, diabetes is the primary risk factor for diabetic retinopathy. This underscores the importance of regular eye screening in diabetic patients to prevent vision loss. Both glaucoma and age-related macular degeneration (AMD) showed significant associations with hypertension ($p=0.021$ and $p= 0,037$, respectively). This finding suggests that elevated blood pressure may contribute to the pathogenesis or progression of these eye diseases, highlighting the need for effective blood pressure control in elderly patients to protect ocular health.

Although, cataract was highly prevalent among patients with diabetes and hypertension, the statistical analysis did not find a significant correlation in this study ($p =0.084$). This may be due to the multifactorial nature of cataract formation, influenced by aging and other genetic or environmental factors involve beyond the systemic comorbidities. These findings emphasize the importance of comprehensive geriatric assessments that include both ocular examinations and systemic health evaluations to improve disease management and prevent vision impairment in the elderly population.

**Table 4: Distribution of Age-Related Eye Diseases by Age Group**

| Age Group (Years) | Cataract (%) | Diabetic Retinopathy (%) | Glaucoma (%) | AMD (%) |
|---|---|---|---|---|
| 60-64 | 42 (40.4%) | 18 (17.3%) | 12 (11.5%) | 10 (9.6%) |
| 65-69 | 64 (53.3%) | 22 (18.3%) | 16 (13.3%) | 14 (11.6%) |
| 70-74 | 58 (59.2%) | 16 (16.3%) | 14 (14.3%) | 12 (12.2%) |
| 75+ | 44 (64.7%) | 16 (23.5%) | 14 (20.6%) | 12 (17.6%) |

Table 4 displays the distribution of major age-related eye diseases across different age groups among the elderly participants.

The data indicate a clear trend of increasing prevalence of all major eye diseases with advancing age. For example, the prevalence of cataract rises from approximately 40% in the 60-64 years age group to nearly 65% in those aged 75 years and above. This increase aligns with the natural progression of lens opacity due to aging. Similarly, glaucoma and age-related macular degeneration (AMD) show higher rates in older age groups, with glaucoma prevalence increasing from around 11.5% in the youngest group to over 20% in the oldest. AMD, a leading cause of central loss of vision, it also rises progressively from about 9.6% in the youngest elderly group to nearly 18% among those 75 years and older.

Diabetic retinopathy prevalence remains relatively steady across age groups, reflecting its close link to diabetes duration rather than age alone. However, there is a slight increase in the oldest group, likely due to

longer disease exposure. Overall, these findings highlight the importance of age as a critical risk factor for the involvement of most age-related eye diseases. This emphasizes the need for targeted eye screening programs focused on older elderly populations, particularly those aged 70 years and above.

**Table 5. Impact of Number of Comorbidities on Eye Disease Prevalence**

| No. of Comorbidities | No. of Participants | Eye Disease Present (%) | Most Common Eye Disease |
|---|---|---|---|
| 0 | 70 | 24 (34.3%) | Cataract (18%) |
| 1 | 150 | 96 (64.0%) | Cataract (36%), DR (12%) |
| 2 | 110 | 88 (80.0%) | DR (22%), Glaucoma (18%) |
| 3 or more | 70 | 64 (91.4%) | Cataract + Glaucoma +DR |

Table 5 explores how the number of systemic comorbidities affects the prevalence of age –related eye diseases among the elderly participants.

The data demonstrate a clear positive correlation between the number of comorbidities and the likelihood of having one or more age-related eye diseases. Among participants with no comorbidities, only 34.4% had an eye disease, primarily cataract. This suggests that while age alone is a risk factor, systemic health plays an additional significant role that is prevalence of diseases increases with age. For those with one comorbidity, the prevalence of eye diseases rose to 64%, indicating that even a single chronic condition substantially increases eye disease risk. Participants with two comorbidities had an even higher prevalence of eye diseases (80%), with diabetic retinopathy and glaucoma becoming more common. Most strikingly, individuals with three or more comorbidities exhibited the highest prevalence of eye disease (91.4%), often presenting with multiple coexisting eye problems such as cataract, glaucoma and diabetic retinopathy. These findings highlight the compounded risk posed by multiple chronic diseases on ocular health in elderly. They emphasize the critical need for holistic healthcare approaches that simultaneously address systemic conditions and regular eye screening to prevent or delay visual impairment.

## DISCUSSION

This study revealed that a high prevalence of age- related eye diseases (AREDs) among the elderly population in Bangladesh, with cataract being the most common condition, affecting over half of the participants. This finding is consistent with global trends and previous Bangladeshi studies, confirming the cataract remains the leading cause of visual impairment and blindness among older adults in low- and middle- income countries (LMICs). The significant presence of diabetic retinopathy, glaucoma and age-related macular degeneration (AMD) further underscores the growing burden of chronic ocular diseases in an aging society.

The study also identified a high prevalence of systemic comorbidities such as hypertension (64%), diabetes mellitus (48%), cardiovascular disease (21%), obesity (14%) and arthritis (7%), which were strongly associated with certain eye diseases. The statistically significant correlation between diabetic retinopathy and diabetes was expected, reflecting the natural disease progression in diabetic patients. Similarly, the associations between hypertension and both glaucoma and diabetic retinopathy highlight the importance of systemic vascular health in ocular disease development. These findings align with existing literature, which emphasizes the various theoretical and conceptual findings can interplay in the pathogenesis of these eye diseases.

Cataract is the opacity, which develops in the crystalline lens. When blood glucose level elevated beyond 11.1 mmol/l limit, then the enzyme hexokinase is saturated and remaining glucose is converted by aldose reeducates to sorbitol, which accumulates in the lens fibers causes osmotic stress and thus cataract is formed. Epidemiological, experimental and clinical studies have emphasized that, photo-peroxidation of lens constituents including amino acid residues, lipid moieties and other membrane components brought about by near UV light, infrared and microwaves via generation of free radicals play important role in the development of cataract. Surgical removal of cataract is the choice of option in treatment with suitable lens replacement. The need for cataract surgery is determined by the functional status of the patient. Other specific indications are lens induced glaucoma and visualization of the fundus in diabetic retinopathy. Diabetic retinopathy is the fourth most common cause of visual loss in the elderly age group. Good control

of blood glucose is important in the treatment and prevention of diabetic retinopathy. Comorbid conditions such as hypertension and hyperlipidemia worsen diabetic retinopathy and should be treated. The prevalence of diabetes is increasing worldwide probably as an effect of increase caloric consumption and decreased exercise. Multiple studies have demonstrated that, laser treatment significantly reduces the incidence and severity of visual loss and blindness due to proliferative diabetic retinopathy and macular edema. Other ocular problems more frequently occur in aging associated with diabetic eye disease are dry eyes, neovascular glaucoma, orbital infections and cranial nerve palsies.

The primary open angle glaucoma (POAG) is a type of glaucoma, which is more prevalent in the elderly so this type of glaucoma can be defined as a classical triad of raised intraocular pressure (IOP), optic nerve head damage and corresponding visual field defects in the presence of open angle on gonioscopy. Glaucoma is the second leading cause of blindness worldwide. Glaucoma is a group of disease rather than a single disease. A change in the resistance to aqueous outflow appears to be a primary causative factor in glaucoma that is associated with the natural aging changes. The aging changes include a loss of cells, an increase in pigment in the endothelial cells of the trabecular meshwork, an increase in thickening of the meshwork and deposition of plaque in key areas. A statistical association with diabetes mellitus and systemic hypertension to glaucoma has been reported in several case control studies. Maintaining target IOP by anti-glaucoma drug therapy to slow or halt progression of visual field loss to prevent further damage to optic nerve recommends the choice of treatment. Traditional treatment for glaucoma have included anti-glaucoma drug therapy as well as surgical or laser trabeculoplasty on MIGS.

Age-related macular degeneration (ARMD) is a disorder of macula of the retina that most often occurs in aging patients characterized by:
The presence of drusen, retinal pigment epithelial (RPE) hypopigmentation or hyperpigmentation; geographic atrophy of RPE and choriocapillaries, exudative neovascular maculopathy with choroidal neovascularization, serous or hemorrhagic detachment of the sensory retina or RPE, hard exudates, subretinal or sub RPE fibro vascular proliferation and disc form scar.

The initial workup for a patient suspected of having age-related macular degeneration (AMD) should consist of a detailed history including any new onset metamorphopsia (visual defect in which objects appear wavy and distorted) or central scotoma, ocular history and use of dietary supplements.

Most epidemiological evidence indicates that a higher incidence of AMD is associated with, smoking, hypertension, hyperlipidemia and obesity. Other possible risk factors include bright blue light exposure, light iris color and reactive oxygen intermediates (ROIs). In addition, the thinning of macular pigment with advancing age makes the central retina more vulnerable to these harmful effects of light.

Some antioxidants scavenger systems are also exist in the body mechanism , which may act as preventive purposes, e.g., glutathione, melatonin, ceruloplamin or transferrin and some apply to break reactive chain such as, superoxide dismutase, Vitamin E, Beta carotene, Vitamin C, urate. There is no other known effective medical or surgical treatment for the non-exudative form of AMD. Current research is going on the pathogenesis, prevention and treatment of AMD. The exudative form of AMD may benefit from laser therapy to treat the underlying sub-retinal neovascularization.

It has been observed that, direct inter neuronal recordings show a high level of sympathetic nerve activity in the muscles of hypertensive patients, who also have high levels of cardiac and renal nor- epinephrine " spillover"- i.e., the amount of the neurotransmitter that escapes neuronal uptake and local metabolism and spillover into the circulation. This circulatory amount of catecholamine is a considerable factor to enhance or raise the blood glucose level with impairment of glucose metabolism and causes insulin resistance to the aging elderly in developing diabetes mellitus. Chronic activation of the sympathetic nervous stimuli may contribute to either these conditions but stress induced cortisol release are not involved.

Body weight reduction in results, lead to decrease the blood pressure that was at least partially due to reduction of MSNA. However, it appears that older adults take longer time to reestablished normal blood cortisol levels following stressful events, possibly as a result of faulty negative feedback system. When cortisol level increased, then this persistently elevated condition of blood cortisol level might exacerbate or call a concomitant response to diabetes mellitus, hypertension and infectious diseases. Recent past, it has

been an established fact that, meditation and yoga plays the prominent role in relieving mental stress and ensures calmness of mind.

Obesity increases the likelihood of various diseases and problems, likely dyslipidemia, cardiovascular diseases, diabetes type 2, osteoarthritis, obstructive sleep apnea, depression and certain types of cancer. Comorbidities are most commonly seen in metabolic syndrome. Increase body fat alters the body's response to insulin potentially leading to insulin resistance. It also creates a pro-inflammatory and a pro-thrombotic state.

The investigators postulated that, leptin a satiety factor is involved in the development and maintenance of obesity. Longitudinal studies have since found obesity is to be a predictor for the development of osteoarthritis (OA). The stimulating effects of light through the retinohypothalamic tract suppresses the secretion of melatonin from pineal gland of the brain, causes altering signals to help maintain wakefulness. Melatonin is involved in photic regulation through retinohypothalamic tract to regulate the other hormones and maintains the body's circadian rhythms such as control the timing and release of reproductive hormones.

Various studies, it has been found that, maximum phase shifting occurs by the use of very bright light, whereas reduced phase shifting occurs in response to moderate or dim light exposure. These results can be generalized and remains to be an open question, because considerable reduction in lens transmission occurs with age. Certainly, melatonin production also shown in multiple studies to diminish with age, as the size and calcification of the pineal gland occurs with advancing years. Therefore, there is a correlation among variation of circadian amplitude, diminished melatonin production and lens transmission.

Since the discovery of a specialized ganglion, cells known as "ipRGCs" (intrinsically photosensitive retinal ganglion cells) or melanosis ganglion cells are located in the retinas layer of ganglion cells. At the outset, their axons takes the same path as follows towards the optic nerve and through the pulvinar a major center for the integration and modulation of sensory input, which is involved in the synchronization of the circadian rythms.

The eye is not for seeing organ only, it also involved in a range of non-visual functions directly stimulated by light. A number of pathologies lead to insults that initiate apoptosis in retinal ganglion cells-first ischemia, then oxidative- stress and alteration of trabecular meshwork in the anterior chamber angle occurs in age-related comorbid conditions. Thus, the main pathway of transmission of light stimuli is jeopardized through sensory activation of second order neuron, the ganglion cells. Therefore, we need to be able to develop a sophisticated lens filtering system to cut harmful short wave length UV and other blue light by either use preventive glass wear or replacing IOLs.
Besides these light effects consideration, all biological responses to photic stimulus show the way to clinical applications of light in a range of disorders and pathologies, from sleep to alertness, from cognition to memory and mood. In addition, in view of risk of adding a blind circadian system to a defective vision, the non-visual sensitivity to light should be evaluated prior to enucleation of a blind people. The prevalence of AREDs increased with advancing age, which reinforces the well-established link between aging and ocular degeneration, Older age groups (70 years and above) showed a higher burden of cataract, glaucoma and AMD. This trends calls for targeted screening and preventive measures in the oldest segments of the population to preserve vision and quality of life.

The impact of multiple comorbidities was especially significant. Elderly individuals with two or more chronic conditions had a markedly higher likelihood of having one or more age-related eye diseases. This highlights the complex interplay between systemic health and ocular conditions, and the compounded risk when multiple diseases coexist. Such multimorbidity presents challenges for healthcare providers in managing elderly patients, as it requires coordinated care across specialties. From a public health perspective, the findings emphasize the urgent need for integrated geriatric care programs that include routine ophthalmologic screening alongside management of systemic diseases like diabetes and hypertension. Strengthening primary healthcare services to provide such comprehensive care could prevent or delay vision loss, reduce disability and improve the overall wellbeing of elderly Bangladeshis. However, this study has limitations. The cross-sectional design limits causal interference, and the purposive sampling may affect generalizability. Future community- based longitudinal studies with larger and more representative samples are needed to confirm these associations and evaluate intervention outcomes.

## CONCLUSION

The study demonstrates a high prevalence of age-related eye diseases among the elderly population in Bangladesh, with cataract, diabetic retinopathy, glaucoma and age related macular degeneration being the most common. These ocular conditions are frequently accompaniedby systemic comorbidities such as hypertension, diabetes mellitus, cardiovascular diseases, obesity and arthritis. The presence of multiple comorbidities significantly increases the risk and complexity of managing age-related eye diseases. Therefore, an integrated approach involving ophthalmologists, geriatricians and primary health care providers is essential to address this growing public health challenge effectively.

Unanimously, it is true that, when these aging seniors could be affluent in prosperity of knowledge and experience at this stage of life by overcome the disabilities, still they can utilize it, for any beneficial progression or development of the society or country. Without the breakthrough plan, the society or country ultimately deprived from it. These findings underscore the critical need for complementary healthcare strategies that address both eye health and general geriatric care. Early detection, regular screening and comprehensive management of both eye diseases and systemic conditions are essential to reduce the burden of vision impairment and to improve the quality of life of elderly individuals in Bangladesh.

## RECOMMENDATIONs

- **Integrated Geriatric and Ophthalmic Care:** Develop and implement healthcare models that integrate routine eye examinations with the management of common geriatric comorbidities such as diabetes and hypertension, ensuring holistic care for the elderly.
- **Regular Screening programs:** Establish community-based screening programs targeting elderly populations, especially those aged 70 years and above, for early detection of cataract, diabetic retinopathy, glaucoma and AMD.
- **Awareness and Health Education:** Conduct public health campaigns to raise awareness among elderly individuals and caregivers about the importance of regular eye check-ups and management of systemic diseases to prevent vision loss.
- **Capacity Building for Healthcare Providers:** Train primary healthcare workers and general practitioners in basic ophthalmic screening and recognition of common eye diseases, facilitating timely referral to specialists.
- **Policy Support and Resource Allocation**: Encourage policymakers to allocate adequate resources for geriatric eye care services, including affordable treatment options and accessibility in rural and undeserved areas.
- **Research and Surveillance**: Promote further community-based longitudinal research to monitor trends in age-related eye diseases and comorbidities, evaluating the effectiveness of integrated care interventions.

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