Causes of visual impairment among patients applying for the visual disability certificate in Upper Egypt: a retrospective study

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Aim
To explore the causes of visual impairment in patients applying for the visual disability certificate in Upper Egypt.
Patients and methods
This was a retrospective observational study that included patients referred to "The Ministry of Social Solidarity" with visual disability in Upper Egypt. The main outcome measures were the recording of causes of visual impairment as well as its subanalysis according to age and sex. The correlation between the degree of visual impairment in the better eye and the visual-evoked potential (VEP) and electroretinogram (ERG) abnormalities was also evaluated.
Results
The study included 4376 eyes of 2188 patients with a mean age of 44.76±18.78 years. The sex distribution was 1581 males and 607 females. Refractive errors (26.9%) followed by lens problems (19.7%) were the most common causes of visual impairment. The most common causes of visual impairment according to age were cataracts and glaucomas among the elderly, refractive errors among adults, and retinal and macular dystrophies among children. There was no significant difference between males and females except for refractive errors (significantly higher among males) and retinal dystrophies (significantly higher among females). A statistically significant moderate positive correlation between the degree of visual impairment in the better eye and the degree of VEP and ERG affection was observed.
Conclusion
Refractive errors and cataracts were the most common causes of visual impairment among individuals applying for the visual disability certificate in Upper Egypt. ERG and VEP proved to be valuable diagnostic tools for evaluating these patients.

Keywords:
certificate, Upper Egypt, visual disability screening program, visual disability

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Introduction

As the sociodemographic status and life expectancy improve, many countries are experiencing a rise in the average age of the population, and a shift in the disease burden toward noncommunicable diseases and disabilities [1]. Visual impairment is considered a leading cause of disability all over the world, many of these visual disabilities are believed to be preventable [2,3].

Cataracts and refractive errors were found to be the leading causes of visual impairment among adults aged 50 years and older. Diabetic retinopathy (DR), glaucoma, age-related macular degeneration (AMD), and corneal diseases were also considered main causes of visual impairment especially among the elderly [4]. The World Health Assembly introduced a new initiative titled "Towards universal eye health: a global action plan 2014–2019" (GAP) aiming to reduce the prevalence of avoidable visual impairment, mainly the prevalence of cataracts and uncorrected refractive errors, by 25% by the end of 2019 [5].

Vision impairment has a profound impact on the quality of life in different age groups. In children, visual impairment inversely impacts the child's mental and physical development. In adults, a higher prevalence of depression and lower employment rates were detected. In the elderly population, vision impairment can increase the risk of falls and fractures, walking difficulties, social isolation, and earlier placement in nursing homes [6].

This study aimed to highlight the common causes of visual impairment in Upper Egypt among the different age groups and to specifically focus on the preventable causes, which can be considered as a guide for future national programs targeting the reduction of the prevalence of visual impairment.

Patients and methods

Study design and ethical consideration

This study was a retrospective observational study conducted at Assiut University Hospital and Tiba Eye Center (private practice), Assiut, Egypt. Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, Assiut University (IRB local approval number: 04-2024-300416). An informed consent was waived based on the retrospective analytical nature of the study. The study adhered to the tenets of the Declaration of Helsinki and was registered at ClinicalTrials.gov ID: NCT06518148.

The study included all patients referred to "The Ministry of Social Solidarity" with visual disability in Upper Egypt, who were examined in a high-volume university hospital in Upper Egypt under the visual disability screening program (2020–2024). The medical records of patients who met the WHO criteria of visual disability [7] were evaluated retrospectively, and those with incomplete medical records were excluded from this study. History was taken to evaluate the etiology and duration of visual impairment. Clinical assessment of enrolled patients included anterior segment examination by slit-lamp bio microscopy (Haag-Streit GAT, Köniz, Switzerland) and intraocular pressure measurement (Goldmann Applanation tonometer, Haag-Streit GAT, Köniz, Switzerland). Corrected distance visual acuity was measured for all patients using Snellen's acuity chart and subsequently converted to decimal notation. The posterior segment was examined using an indirect ophthalmoscope (Keeler, UK) and a +90 D fundus lens (Volk, Germany). Electrophysiological testing [visual-evoked potential (VEP) and full-field electroretinogram (ERG)] was performed using the Metrovision system (Vision Monitor, Perenchies, France).

Causes of visual impairment were recorded and classified into untreatable, congenital, or correctable causes. Diseases with a small number of patients were grouped into one category named "miscellaneous," which included conditions such as tumors, retinopathy of prematurity, and other congenital eye anomalies, amblyopia, and atrophic globe. The information recorded was demographic data (age and sex), the cause of visual impairment, and visual acuity in the better eye. In patients with more than one ocular disease responsible for visual impairment, the untreatable cause or the more visually significant disease was recorded. Patients were stratified based on their degree of visual impairment in the better eye, according to WHO criteria [7] into mild visual impairment with visual acuity ranging between less than 0.5 and 0.3 (6/12–6/18), moderate visual impairment with visual acuity 0.3–0.1 (6/18–6/60) and severe visual impairment with visual acuity 0.1–0.05 (6/60–3/60). Patients were considered to have complete vision loss if the visual acuity was worse than 0.05 (3/60), or if they had a visual field of less than 10° around central fixation.

The classification of ERG abnormalities included the following severity levels: normal ERG response: normal a-wave and b-wave amplitudes, normal implicit times, and normal waveform morphology. Mild abnormality in ERG response: 20–40% reduction in amplitude, minimal delay in implicit time, preserved waveform morphology, often still within clinical normal limits. Moderate abnormality in ERG response: 40–70% reduction in amplitude, clear delay in implicit times, some waveform distortion, clearly abnormal but recordable responses. Severe abnormality in ERG response: more than 70% reduction in amplitude, significantly delayed implicit times, major waveform distortion, barely recordable responses. Extinguished/nonrecordable ERG response: no detectable response, complete loss of retinal function, flat line recording [8,9].

The degree of VEP abnormality was classified as: normal VEP response: (P100 latency: 95–115 ms, normal amplitude, and normal waveform morphology). Mild abnormality in VEP response (P100 latency delay <15 ms, amplitude reduction <30%, preserved waveform morphology). Moderate abnormality in VEP response: (P100 latency delay 15–30 ms, amplitude reduction 30–50%, some waveform distortion). Severe abnormality in VEP response: (P100 latency delay >30 ms, amplitude reduction >50%, significant waveform distortion). Nonrecordable VEP response: (absent response, no identifiable peaks) [10,11].

Statistical analysis

Data analysis was undertaken using SPSS, version 26 (IBM Corp, Armonk, NY, USA). Categorical data were presented in the form of frequencies and percentages. Age was presented by mean±SD and

range. The $\chi 2$ test was used to compare causes of visual impairment according to age and sex distribution. Spearman correlation was used to identify correlation between the degree of visual impairment in the better eye and degree of VEP and ERG affection. The level of significance was considered at P value less than 0.05.

Results

Demographics and baseline features

The study included 4376 eyes of 2188 patients (1581 males and 607 females), who were eligible to register for visual disability certificate in upper Egypt in the period from 2020 to 2024. The mean age of participants was 44.76±18.78 years. Table 1 summarizes the demographic data of the studied sample.

Etiologies of visual impairment

Refractive errors (myopia, hyperopia, and astigmatism) were the most common causes of visual impairment in this analytical study (26.9%) followed by lens problems (19.7%), while miscellaneous causes such as amblyopia and congenital anomalies were the least (2.1%). However, retinal and macular dystrophies constituted 19.1% (such as retinitis pigmentosa, Stargardt disease, progressive cone dystrophy, and best vitelliform macular dystrophy). Table 2 demonstrates the percentages and detailed description of causes of visual impairment among patients applying for the visual disability certificate in Upper Egypt.

The degree of visual impairment as well as VEP and ERG abnormalities in the better eye, among patients applying for the visual disability certificate clarify are detailed in Table 3.

Tables 4 and 5 show the distribution of causes of visual impairment among different age groups and sex, respectively. There was a statistically significant difference between different age groups among all causes of visual impairment ($\chi 2$ test, $P<0.05$), while there was no statistically significant difference between

Table 1 Age and sex distribution among patients applying for visual disability certificate, Upper Egypt

	No. of patients=2188 (%)
Age	
Mean±SE	44.76±18.78
Median (range)	46.0 (4–93)
<18 years	210 (9.6)
19–40 years	718 (32.8)
41–60 years	823 (37.6)
>60 years	437 (20.0)
Sex	
Males	1581 (72.3)
Females	607 (27.7)

Data expressed as mean±SE, median, range, and percentage.

Table 2 Causes of visual impairment among patients applying for the visual disability certificate in Upper Egypt

	No. of eyes=4376 (%)
Etiology of visual impairment	
Error of refraction	1178 (26.9)
Hyperopia	432 (9.9)
Myopia	746 (17.0)
Lens	862 (19.7)
Cataract	604 (13.8)
Complicated cataract	8 (0.2)
IOL complications and complicated surgery	250 (5.7)
Glaucoma	588 (13.4)
Cornea	312 (7.1)
Corneal opacity	110 (2.5)
Keratoconus	116 (2.7)
Previous corneal surgery	86 (2.0)
Retina	286 (6.5)
Retinal and macular dystrophies	836 (19.1)
Diabetic retinopathy	198 (4.5)
Retinal detachment	88 (2.0)
AMD	96 (2.2)
Optic nerve atrophy	128 (2.9)
Miscellaneous	90 (2.1)
Atrophic globe	4 (0.1)
Amblyopia	8 (0.2)
Eye trauma	6 (0.1)
Tumors, congenital anomalies	72 (1.6)
Correctable causes of visual impairment	
Correctable	830 (19.0)
Uncorrectable	3546 (81.0)

AMD, age-related macular degeneration; IOL, intraocular lens.

Table 3 The degree of visual impairment, visual-evoked potential abnormality, and electroretinogram abnormality in the better eye, among patients applying for the visual disability certificate in Upper Egypt

	No. of eyes=2188 (%)
Degree of visual impairment in the better eye	
Mild	212 (9.7)
Moderate	1235 (56.4)
Severe	368 (16.8)
Complete vision loss	373 (17.0)
Degree of VEP abnormality in the better eye	
Normal	1264 (57.8)
Moderate	311 (14.2)
Severe	613 (28.0)
Degree of ERG abnormality in the better eye	
Normal	1250 (57.1)
Moderate	211 (9.6)
Severe	727 (33.2)

ERG, electroretinogram; VEP, visual-evoked potential.

Table 4 Causes of visual impairment according to age groups among patients applying for the visual disability certificate in Upper Egypt

	Age groups/no. of eyes				
	<18 years (*N*=420)	18–40 years (*N*=1436)	41–60 years (*N*=1646)	>60 years (*N*=874)	*P* value*
Error of refraction	110 (26.2)	590 (41.1)	464 (28.2)	14 (1.6)	<0.001
Lens	4 (1.0)	30 (2.1)	438 (26.6)	390 (44.6)	<0.001
Glaucoma	18 (4.3)	66 (4.6)	264 (16.0)	240 (27.5)	<0.001
Cornea	20 (4.8)	172 (12.0)	86 (5.2)	34 (3.9)	<0.001
Retinal and macular dystrophies	222 (52.9)	410 (28.6)	196 (11.9)	8 (0.9)	<0.001
DR/RD	0	46 (3.2)	158 (9.6)	82 (9.4)	<0.001
AMD	0	2 (0.1)	4 (0.2)	90 (10.3)	<0.001
Optic nerve atrophy	28 (6.7)	76 (5.3)	16 (1.0)	8 (0.9)	<0.001
Miscellaneous	18 (4.3)	44 (3.1)	20 (1.2)	8 (0.9)	0.002

AMD, age-related macular degeneration; DR, diabetic retinopathy; RD, retinal detachment. *χ2 test was used to compare proportions between groups.

Table 5 Causes of visual impairment according to sex among patients applying for visual disability certificate

	Males (N=1581) (No. of eyes=3162)	Females (N=607) (No. of eyes=1214)	*P* value*
Errors of refraction	890 (28.1)	288 (23.7)	0.037
Lens	642 (20.3)	220 (18.1)	0.251
Retinal and macular dystrophies	548 (17.3)	288 (23.7)	0.001
Glaucoma	438 (13.9)	150 (12.4)	0.538
Cornea	216 (6.8)	96 (7.9)	0.381
DR/RD	200 (6.3)	86 (7.1)	0.520
Optic nerve atrophy	98 (3.1)	30 (2.5)	0.435
AMD	66 (2.1)	30 (2.5)	0.583
Miscellaneous	64 (2.0)	26 (2.1)	0.862

AMD, age-related macular degeneration; DR, diabetic retinopathy; RD, retinal detachment. *χ2 test was used to compare proportions between groups.

males and females except for errors of refraction and retinal dystrophies which showed a significant difference.

Regarding correlations, there was a statistically significant moderate positive correlation between the degree visual impairment in the better eye and the degree of VEP (Spearman correlation, r=0.617, P<0.001) and ERG (Spearman correlation, r=0.593, P<0.001) affection of the better eye, respectively, as given in Table 6.

Figure 1 shows a flash VEP report of a case diagnosed with advanced glaucomatous optic atrophy with severe VEP abnormality.

Figure 2 shows an ERG report of a case diagnosed with bilateral retinal dystrophy (advanced retinitis pigmentosa) demonstrating severe ERG abnormality.

Discussion

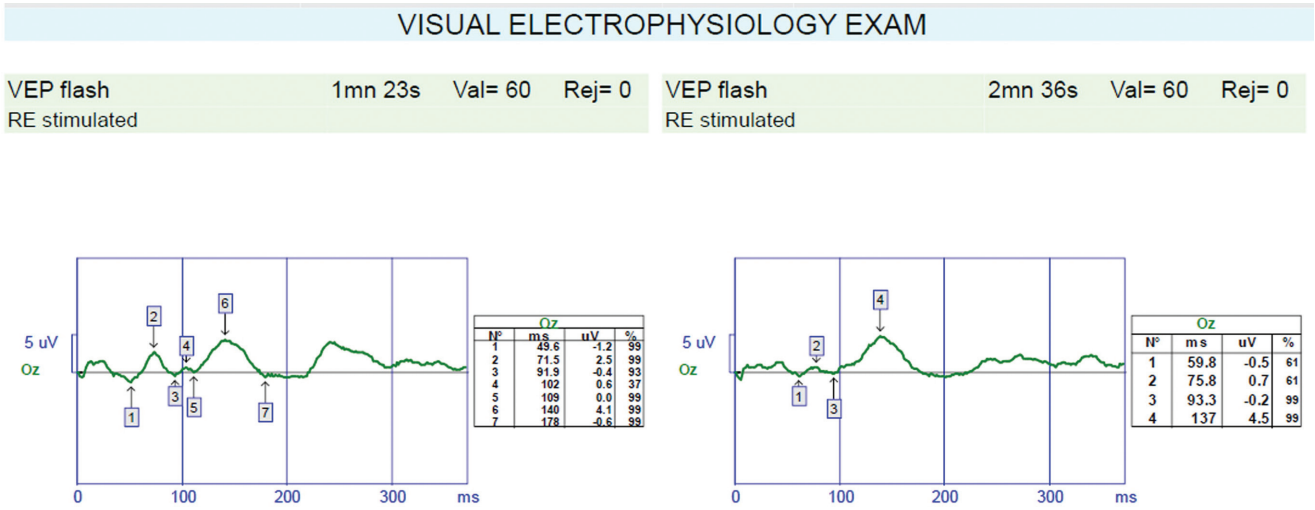
This study examined demographic, causal, and physical factors of visual impairment among patients in Upper Egypt. This involves conducting a thorough examination of patients referred for certification of visual disability within the region, with a focus on

Table 6 Correlation between the degree of visual impairment in the better eye and degree of visual-evoked potential, degree of electroretinogram abnormality among patients applying for the visual disability certificate in Upper Egypt

	Degree of visual impairment in the better eye					Correlation	
	Mild (*N*=212)	Moderate (*N*=1253)	Severe (*N*=368)	Complete vision loss (*N*=373)	*P* value*	*r*	*P* value**
Degree of VEP affection in the better eye							
Normal	191 (90.1)	919 (74.4)	116 (31.5)	38 (10.2)	<0.001	0.617	<0.001
Moderate	19 (9.0)	211 (17.1)	54 (14.7)	27 (7.2)	<0.001		
Severe	2 (0.9)	105 (8.5)	198 (53.8)	308 (82.6)	<0.001		
Degree of ERG affection in the better eye							
Normal	192 (90.6)	907 (73.4)	115 (31.3)	36 (9.7)	<0.001	0.593	<0.001
Moderate	9 (4.2)	154 (12.5)	32 (8.7)	16 (4.3)	<0.001		
Severe	11 (5.2)	174 (14.1)	221 (60.1)	321 (86.1)	<0.001		

ERG, electroretinogram; r, Spearman correlation coefficient; VEP, visual-evoked potential. *χ2 test was used to compare proportions between groups. **Spearman correlation.

Figure 1

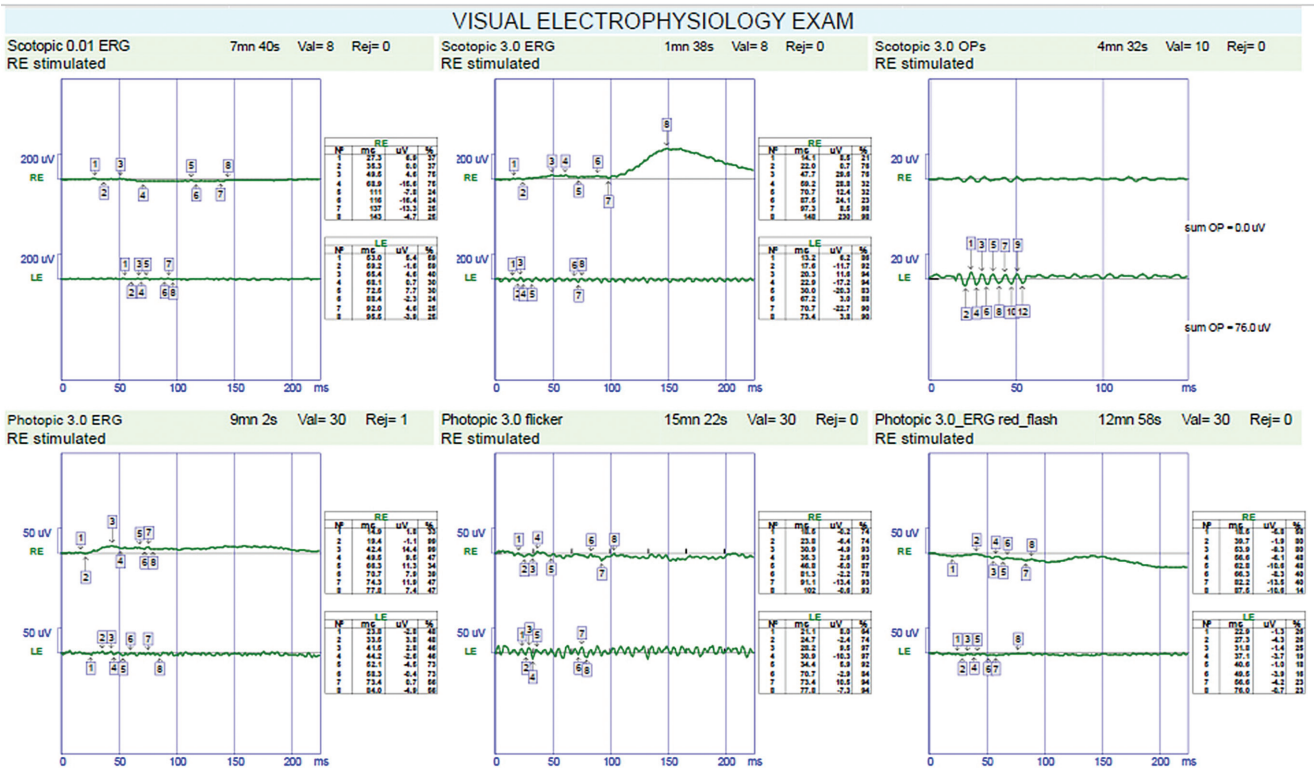


Flash visual-evoked potential (VEP) showing severe VEP affection due to glaucomatous optic atrophy.

age, sex distribution, and the underlying causes of visual impairment. This study also looks at the correlation between the level of visual impairment and abnormal electrophysiological abnormalities in eyes that have been affected.

Global differences in the frequency of eye-related diseases affect the reasons for vision loss. Differences also exist within the same nation at different time points. This is attributed to the widespread occurrence of systemic diseases and ocular conditions that affect vision. A range of factors, including access to health care, advancements in medical and surgical treatments for eye disorders, socioeconomic status, and public understanding, play a role in the occurrence of these conditions [12].

Figure 2



An electroretinogram (ERG) showing severe ERG affection due to advanced retinitis pigmentosa.

Identifying the impact of vision loss on individuals and society is crucial for understanding the significance of visual disability. Visual impairment impacts not only a person's quality of life, autonomy, and efficiency, but also exacts substantial economic burdens on health care systems and those providing care. Policymakers and health care providers can develop tailored programs by examining the demographics, causes, and extent of visual impairment to tackle avoidable or controllable causes of blindness such as refractive problems, cataracts, and DR.

Our research revealed that the average age of the patients was 44.76±18.78 years, indicating that most participants were in their mid-40s. Middle-aged individuals, specifically those between 41 and 60 years, comprised the largest demographic of patients seeking disability certification. This may be attributed to the increased prevalence of age-related eye conditions, such as cataracts and glaucoma, in this age group, which affect their ability to work and prompt the need for certification.

According to our research, males constituted the majority (72.3%) of the cases. Similar studies [12,13], conducted in Kuwait and Bahrain on the causes of visual impairment among registered individuals, reported comparable findings. In these studies, males accounted for 66 and 63% of visually disabled individuals, respectively. However, regional population-based studies have consistently indicated that visual impairment is more prevalent among women [14–17]. A potential explanation for this discrepancy is that the current study, as well as the Kuwaiti and Bahraini studies, focused on individuals officially registered as visually disabled – a status that made them eligible for government disability benefits. Males were more likely to register as disabled to secure financial assistance for their families [12]. In addition, delayed medical consultation among male patients may contribute to a higher incidence of severe visual impairment in male patients than in female patients. However, Mousa et al. [18] reported a higher prevalence of severe visual impairment among women in Upper Egypt. Future population-based studies could help clarify the validity of this sex pattern in broader contexts.

A previous study [18] that included patients older than 40 years reported that the major causes of blindness in Upper Egypt were cataracts (60%), uncorrected refractive errors (16%), and corneal opacities (12%). In 2020, cataract (15.2 million cases) was the leading cause of blindness in people aged 50 years worldwide [4]. Cataract is a leading cause of vision impairment in several parts of the Middle East, Eastern Taiwan, Saudi Arabia, Qatar, and Ethiopia [14,19–21].

In our study, refractive errors (26.9%) were followed by lens-related issues (19.7%) as the most common causes of visual impairment among registered visually disabled individuals. Less frequent but significant causes: glaucoma (13.4%) and DR/retinal detachment (6.5%). This finding can be attributed to the inclusion of patients aged 4 years and older rather than focusing solely on older age groups. In 2020, a study conducted globally considered refractive error (86.1 million cases) and cataracts (78.8 million cases) as the main causes of severe vision impairment [4].

Depending on the availability of basic health care and specialized ophthalmologic facilities, the prevalence of vision impairment and blindness can vary significantly among societies, even within the same nation [22].

Our research found that young adults aged 40 years predominantly suffer from refractive errors and hereditary retinal dystrophies, with corneal causes being the next most common in the 18–40 age group. This finding is consistent with the patterns observed in Bahrain and Saudi Arabia, which may be attributable to the prevalence of consanguineous marriages [12,23].

This study found that among patients aged more than 60 years, lens-related issues were the leading cause of visual disability, followed by glaucoma. This finding is consistent with other studies conducted in Saudi Arabia and Qatar, which identified glaucoma as the second most common cause of visual impairment after cataract [14,15]. The outcomes of these studies highlight the significance of implementing health care policies, including screening initiatives for older individuals, to facilitate early identification and halt the progression of these health issues.

An earlier study [24], conducted in Sohag (Upper Egypt), found that the prevalence of diabetes was 20.9% which is higher than in Bahrain (14.7%) [12]. In comparison to Europe and North America, this rate is notably higher at 8.5 and 10.5%, respectively [12,25]. Diabetes cases are increasing worldwide, and the Middle East has the second highest rate of increase in diabetes globally among all countries, primarily due to the adoption of modern lifestyles and poor dietary habits [26,27]. AlSawahli et al. [24] reported that the prevalence of DR in Upper Egypt was 17.9%, which is less than that reported in the UAE (19%) [28]. In our

study, the prevalence of visual impairment among patients with registered visual impairment due to DR was 6.5%, which was lower than that in a previous study conducted in Bahrain, in which DR was considered the most common cause of visual impairment (41.53%) [12].

Studies have shown significant variations in the prevalence of DR across different studies, even within the same country [28–31]. The discrepancy can be attributed to the different research methodologies and the distinct population samples used in each study [32]. In contrast, this study may have underestimated the prevalence of DR due to the potential for missing individuals with undiagnosed diabetes who have normal vision.

Previous studies, including systematic reviews and meta-analyses, have found that AMD is more common among Europeans than among Asians and Africans [33]. In our study, AMD was the least frequent cause of visual disturbance, accounting for 2.2% of all cases. This variability is caused by a combination of environmental, genetic, and racial factors [33–35].

This study demonstrated a statistically significant moderate positive correlation between the degree of visual impairment in the better eye and the degree of VEP affection as well as the degree of ERG affection. These findings suggest that VEP and ERG are valuable tools for detecting and confirming visual impairment and identifying individuals with malignancies.

Moreover, this study confirmed that not all cases of mild and moderate visual impairment are associated with significant changes in VEP and ERG. This highlights the importance of these tools in differentiating correctable and noncorrectable visual impairments.

This study has some limitations, including the exclusion of patients with missing diagnoses, which is a common challenge in retrospective studies. Furthermore, the findings may not fully represent the broader population of Upper Egypt.

In conclusion, this study underscored significant health and social factors contributing to visual impairment in Upper Egypt. Among adults, refractive errors and cataracts were identified as the leading causes, whereas hereditary conditions were the primary cause among children. Cataracts and glaucomas are the main causes of visual impairment in older individuals. Early detection programs are essential for addressing treatable conditions such as refractive errors and cataracts, as well as for the early diagnosis and management of progressive blinding diseases such as DR and glaucoma. In addition, advanced diagnostic tools, such as ERG and VEP, should be considered in routine evaluations. Further studies are needed to examine the socioeconomic and environmental factors influencing visual impairment in Upper Egypt.

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Conflicts of interest

There are no conflicts of interest.

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