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A 15 year review of visual indices of eye clinic attendees in Owerri, Nigeria

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Abstract
Background: This study on visual indices of eye clinic attendees in Owerri, Imo State, Nigeria is aimed at determining trends in Visual health in order to provide a data base for the state.
Methods: A total of 12,160 subjects comprising of 4230 males and 7930 females who met the inclusion criteria were seen between January, 2005 and December, 2019 from Eye clinic attendees in Owerri Imo State Nigeria. Of these, 2106 were visually impaired (VA <6/18). All the subjects underwent a complete ophthalmic examination. Standard procedures were used to determine visual indices of subjects.
Results: There were more females (65.2%) than males (34.8%). Majority of the subjects were aged ≥ 50 years (69.4%). The visual acuity (VA) in 2106 subjects (17.3%) was <6/8. There were more females (54.7%) than males (45.3%) among subjects with low vision. Majority of the subjects with VA <6/18 were aged ≥ 50 years (66.2%). Subjects with low vison aged ≥ 50 years (65.3%) were in the majority with more females (54.8%) than males (45.2%). There were more males (58.3%) than females (41.7%) among subjects who were blind. Subjects who were blind aged ≥ 50 years (73.1%) were in the majority with more males (58.8%) than females (41.2%). Eye conditions: lenticular opacities/cataract (28%) and glaucoma (16.5%); and non-ocular morbidities: cardiovascular disorders (26.3%) and metabolic abnormalities (13.3%) were in the majority.
Conclusion: This review has shown that the prevalence of risk factors of visual impairment namely: gender, age, drugs, trauma, cardiovascular and metabolic disorders have continued to be prominent. It has further provided a data base for the management of these impairments and therefore underscores the need for early preventive measures.

Keywords: visual acuity, visual impairment, low vision, blindness

Introduction

The eyes are sense organs and part of the Central Nervous System built along the principles of a camera. The eyes are of inestimable value to mankind. They perform the important function of visual perception or seeing (Borish, 1975; Emerole, C.G, 2015; Emerole, C.G *et al*., 2011) [4, 6, 8]. Vision is the faculty or state of being able to see the world around you. This is made possible through several components within the eye [cornea, pupil, iris, lens, retina, optic nerve, tears, etc] and the brain that work together to help an individual see (Borish, 1975; MacDonald *et al*., 2004; Ngondi *et al*., 2006) [4, 19, 21]. Vision is achieved by refraction of light rays by the cornea and the crystalline lens and focusing them on the retina. The retina receives the pictures formed by the light rays and sends image to the brain via the optic nerve for perception (Emerole, C.G, *et al*., 2013; Guyton and Hall, 2011) [7, 13].

Visual function can be tested and quantified as visual acuity and visual field. Colour vision, flicker sensitivity, contrast sensitivity, pupillary response and motion testing are some of the other methods of quantitating vision (Borish, 1975; Emerole, C.G *et al*., 2014) [4, 10].

Visual acuity test is a measure of central vision, a measure of sharpness of vision and an assessment of total visual system from cornea to the occipital cortex. Visual acuity (V.A) can be tested for both distant (far) and near vision. It is the most commonly used clinical measure of determining visual impairment (Borish, 1975) [4].

These modifiable and non-modifiable factors can impair visual function: Traumas, ageing; allergies; infections; systemic diseases; cancer of the eyes; nutritional deficiencies; drug abuse; environmental factors; occupational hazards; congenital disorders; uncorrected refractive errors (URE); gender influences; hereditary influences, etc (Emerole, C.G, 2015; Kashani *et al*., 2010; Wong *et al*., 2004) [6, 14, 27].

At present, at least 2.2 billion people worldwide have a visual impairment, of whom at least 1 billion have a visual impairment that could have been prevented or yet to be addressed (World Health Organization, 2019) [29]. The leading causes of visual impairment and blindness are uncorrected refractive errors and cataracts. This poses enormous global financial burden. The annual cost of productivity losses associated with visual impairment from uncorrected myopia and presbyopia alone estimated to be USD 244 billion and USD 25.4 billion (World Health Organisation, 2021) [28].

The leading causes of visual impairment globally are cataract and glaucoma. Other causes include age-related macular degeneration, retinitis pigmentosa and optic atrophy (Gilbert & Ellwein, 2008) [12]. About 90% of the world's visually impaired live in low and middle income countries (World Health Organization, 2019) [29]. In such countries like Nigeria, low vision and blindness constitute a major public health concern (Emerole, C.G *et al*., 2013) [7]. Also, the majority of population lives in the rural areas where blindness is associated with considerable disability and excess mortality resulting in huge economic and social

effect (Patel *et al*., 2006) [24] (World Health Organisation, 2021) [28].

This study, therefore, on visual indices of Eye clinic attendees in Owerri, Imo State, Nigeria is aimed at determining trends in visual health in order to provide database for the state.

Methods

Study settings and study population

A total of 12, 160 subjects comprising of 4,230 males and 7,930 females who met the inclusion criteria were seen between January, 2005 and December, 2019 from Eye Clinic attendees in Owerri, Imo State, Nigeria. Two thousand, one hundred and six were visually impaired (VA <6/18). In the course of consultation, history was obtained from subjects as to existence of possible risk factors to visual impairment. Blood pressure was measured routinely in adult subjects.

Data collection

All the subjects underwent a complete ophthalmic examination which included measurement of distant and near VA and Pin – hole visual acuity in subjects with VA less than 6/6 (with Snellen's chart, near reading chart and tumbling ''E'' chart for illiterate subjects). Visual acuity at distance or far is reported as Snellen fraction (ratio between the distance at which the test is done in meters or feet (numerator) to the distance at which the smallest letter read subtends an angle of 50^{o} (denominator) or with its decimal equivalent (e.g. 6/12; 20/40 or 0.5) and visually impaired ≤ 6/18. Reading fifty percent or more of the letters on a line correctly was regarded as the subject getting the VA level correct.

Improvement in visual acuity by two or more lines on the Snellen's chart when looking through the pin – hole was regarded as an indication of refractive errors or uncorrected refractive error (URE) when the patient was already wearing spectacles; tonometry (tonometric values of 9mmHg – 24mmHg were taken as normal while tonometric values >24mmHg were considered clinically significant); retinoscopy (refractive status was determined objectively with the streak retinoscope). Subjective refraction and perimetry was done to investigate other possible causes of impairment or reduction in vision.

Refractive errors (ametropia) in an eye were defined. Emmetropia was defined as spherical dioptri power between -0.50DS and +0.50DS. Refraction data are based on subjective refractions. Low vision in an eye was defined as visual acuity <6/18 and equal to or better than 3/60 in the better eye with best correction. Blindness in an eye was defined as visual acuity of less than 3/60 or corresponding visual field loss less than 10^{0} in the better eye with the best possible correction. Those whose history suggests the presence of diabetes mellitus had their fasting or random blood sugar checked as the case may be.

Data Analysis

The data obtained were reported as percentages, and statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 23.

Results

There were more females (65.2%) than males (34.8%) amongst the 12, 160 subjects (VA < 6/6). Majority of the subjects were aged 50 years and above (69.4%). There were differences between the male and female subjects as shown in table 1. The results were not statistically significant (p – value = 0.272). This shows that age and gender differences in visual acuity in the present study may have occurred by chance.

Table 1: Subjects by age and gender (N = 12,160)

Age group	Males (N= 4230)		Females (N = 7930)	
	N	%	N	%
0-9yrs	117	2.8	170	2.1
10-19yrs	322	7.6	579	7.3
20-29yrs	310	7.3	552	7.0
30-39yrs	219	5.2	372	4.7
40-49yrs	381	9.0	696	8.7
50-59yrs	626	14.8	1186	15.0
60-69yrs	936	22.1	1807	22.8
70yrs and above	1319	31.2	2568	32.4

$X^2 = 8.7403$

df = 7

p – value = 0.272 (Bivariate) [not significant]

The visual acuity (VA) in 1864 subjects was <6/18 in the better eye with best correction. Majority of the low vision subjects were female (54.7%). The subjects aged ≥50 years were in the majority (65.3%). The prevalence of low vision by age and gender was statistically significant (p – value = 0.004) as shown in table 2, indicating an association between low vision, age and gender among the subjects.

Table 2: Low vision by age and gender (N = 1864)

Age group	Males		Females	
	N= 845	%	N= 1019	%
0-9yrs	38	4.5	27	2.6
10-19yrs	84	9.9	99	10.0
20-29yrs	72	8.5	97	9.5
30-39yrs	47	5.6	59	5.7
40-49yrs	54	6.4	69	6.7
50-59yrs	91	10.8	146	14.3
60-69yrs	181	21.4	259	25.4
70yrs and above	278	32.9	263	25.8

$X^2 = 20.9237$

df = 7

p – value = 0.004* (Bivariate) [significant]

The visual acuity (VA) in 242 subjects was less than 3/60. Majority of the subjects who were blind were males (58.3%). Subjects, who were blind, aged 50 years and above (73.1%) were in the majority with more males (58.8%) than females (41.2%) as shown in table 3. In the present study, there was no statistically significant relationship (p – value = 0.405) between blindness, age and gender unlike the case in low vision (table 2).

Table 3: Blindness by age and gender (N = 242)

Age Group	Males		Females	
	N = 141	%	N = 101	%
0-9yrs	3	2.1	0	0.0
10-19yrs	6	4.2	5	5.0
20-29yrs	5	3.5	6	6.0
30-39yrs	8	6.0	5	5.0
40-49yrs	15	10.6	12	11.8
50-59yrs	25	17.7	17	16.8
60-69yrs	25	17.7	27	26.7
70yrs and above	54	38.2	29	28.7

$X^2 = 6.1645$

df =6

p – value = 0.405 (Bivariate) [not significant]

Lenticular opacities and cataract (28%); glaucoma (16.5%); corneal opacities (10%) and other visual conditions were associated with decline in vision in the subjects. The differences in the gender prevalence of visual conditions under reference was statistically significant (p – value = <0.001).

Subjects with Lenticular opacities and cataract were in the majority as shown in table 4.

Table 4: Visual condition by Gender

S/N	Visual condition	Males		Females		Total	
		N = 986	%	N = 1120	%	N = 2106	%
1	Crystalline lens Opacities	267	27.1	321	28.7	588	28.0
2	Glaucoma	147	14.9	201	17.9	348	16.5
3	Corneal Opacities	77	7.8	131	11.7	208	10.0
4	Retinal disorders	67	6.8	121	10.8	188	9.0
5	Ocular allergies	63	6.4	117	10.4	180	8.5
6	Ametropia	69	6.9	83	7.4	152	7.2
7	Congenital abnormalities	115	11.7	20	1.8	135	6.4
8	Ocular Trauma	51	5.2	30	2.6	81	3.8
9	Ocular deviations	47	4.8	32	2.9	79	3.7
10	Uveitis	32	3.2	32	2.9	64	3.0
11	Optic Nerve Abnormalities	37	3.8	20	1.8	57	2.7
12	Vitreous Degeneration	14	1.4	12	1.1	26	1.2

$X^2 = 121.412$
df =10
p – value = < 0.001* (Bivariate) [significant]

Cardiovascular disorders (26.3%); metabolic abnormalities (13.3%) and cancers (11.9%) were leading associated non – ocular morbidities among the subjects. The differences in the gender prevalence of associated non – ocular morbidities under reference was statistically significant (p – value = <0.001). Subjects with cardiovascular disorders (26.3%) among the subjects with visual impairment were in the majority as shown in table 5.

Table 5: Associated non – ocular morbidities by gender

S/N	Associated non–ocular morbidities	Males		Females		Total	
		N = 986	%	N = 1120	%	N= 2,106	%
1	Cardiovascular disorders	260	26.4	293	26.2	553	26.3
2	Metabolic abnormalities	170	17.2	110	9.8	280	13.3
3	Cancers	120	12.2	130	11.6	250	11.9
4	Central Nervous System Disorder	88	9.0	96	8.6	184	8.7
5	Trauma	97	9.8	71	6.3	168	8.0
6	Immune System Deficiencies	45	4.6	110	9.8	155	7.4
7	Allergies	58	5.9	77	6.9	135	6.4
8	Drug – induced	35	3.5	100	8.9	135	6.4
9	Renal abnormalities	86	8.7	38	3.4	124	5.9
10	Others	27	2.7	95	8.5	122	5.7

$X^2 = 129.306$
df =9
p – value = < 0.001* (Bivariate) [significant]

Discussion

In this study majority of the subjects with Visual Acuity (VA) < 6/6 were aged 50 years and above (69.4%). Age is a non – modifiable factor and of medical significance in determining management. The constant thing in life is change, thus aging in associated with changes in health and disease of an individual. Low vision is more common in older adults because many of the diseases that can cause visual impairment are more common in older adults. Ageing does not cause low vision on its own (Borish, 1975; Milton *et al*., 2005; Seidu *et al*., 2021) [4, 20, 26]. Similarly, there is decline in vision at near as the crystalline less becomes more rigid with increasing age and may explain the age prevalence (Borish, 1975; Emerole, C.G *et al*., 2011) [4]. Ageing also modifies a pre – existing error, making it more symptomatic (Borish, 1975; Milton *et al*., 2005; N. Patel *et al*., 2008; Seidu *et al*., 2021) [4, 20, 24, 26]

The gender differences amongst subjects with vision <6/6 were statistically significant. The female subjects (65%) were in the majority. Gender influences has been noted in visual health (Emerole, C.G *et al*., 2014; Kashani *et al*., 2010; Wong *et al*., 2004) [10, 14, 27]. Recent studies have shown that women had significantly thinner retinas and para foveal regions than men, with black women having the thinnest retinas. There are no reported gender – related differences in foveal pit diameter (Kashani *et al*., 2010; Wong *et al*., 2004) [14, 27]. The higher prevalence of females in the present study agrees with (Ezepue, 1997; Nwosu, 1994; Patel *et al*., 2006) [11, 22, 24]. Given the significant gender differences in many retinal conditions including age – related macular degeneration, it will be worthwhile to reconsider the general role of anatomy in susceptibility to retinal disease (Wong *et al*., 2004) [27]. In addition, to anatomical and physiological gender differences, the apparent higher visual demand on women from gender roles may explain why more females in this study sought intervention (Emerole, C.G *et al*., 2014) [10]. Higher prevalence of hyperopia in the female gender has been

associated with smaller axial length (Borish, 1975) [4]. It is reported that the amplitude of accommodation decreased more rapidly in women than in men particularly between ages 45 and 50 (Borish, 1975) [4].

There were also differences in gender prevalence with respect to low vision (more in female subjects) and blindness (more in male subjects). In the present study, 17.3% of the subjects had VA of < 6/18 with the best correction in the better eye. There were more females (10%) than males (7.3%). Majority of the subjects with VA <6/18 were aged ≥ 50 years (66.2%). In the 1864 subjects with VA < 6/18 but > 3/60, majority were females (54.7%); of these subjects aged ≥ 50 years (65.3%) were in the majority. In the 242 subjects with VA < 3/60, majority were males (58.3%); of these subjects aged ≥ 50 years (73.1%) were in the majority. The prevalence of VA < 6/18 was more in the left eye. Majority of the subjects with VA < 3/60 were males. Women as a result of pregnancy, childbirth, motherhood and menopause appear more aware and health conscious than men. There is also demand on women of their vision from domestic chores and peasant farming. Their higher attendance to visual health care facility may explain the higher prevalence of low vision among the female subjects (Emerole, C.G, 1992; Emerole, C.G *et al*., 2014; Ezepue, 1997) [5, 10, 11]. The higher prevalence of blindness among the male subjects in this study is probably due to the fact that men engage in more hazardous occupation and activities like welding, aggressive sports (boxing), armed forces, combat professions and carpentry. Culturally also it is not ''manly'' to seek medical attention at least medical challenge. Gender and age continue to be prominent as risk factors to visual impairment. The observations in the present study support the influence of anatomical location of the right and left eyes, ocular dominance, gender roles and age – related visual and non – ocular morbidities on vision (Borish, 1975; Emerole, C.G *et al*., 2011, 2014; Kyari *et al*., 2014; Wong *et al*., 2004) [4, 8, 10, 17, 27].

The modifiable and non – modifiable visual conditions more prevalent were crystalline lens opacities/disorders and cataract (28%); glaucoma (16.5%) and corneal opacities (10%). Cataract has been noted as leading cause of visual impairment. In the Nigerian National Blindness and Visual Impairment survey, cataract was the leading cause of blindness (41.2%). Cataract was also reported as leading cause of blindness and low vision in the point prevalence survey of Anambra state, 70.5%. The 1994 study on new patients seen in a 12 month period in a Teaching Hospital Eye clinic in Anambra state showed that cataract (33.3%) was cause of blindness and low vision impairment. In a similar study in Atakunmossa West Local Government Area of South Western Nigeria and in Dambatta Local Government Area, Kano State, Nigeria cataract was reported as cause of blindness and low vision in 57.7% and 54% respectively. In the study on prevalence and causes of low vision among school children in Kibaha district Tanzania, congenital anomalies (65%) was the leading cause of the low vision. The major causes of blindness in a study on children (<16 years) attending schools for the blind in Kenya, Malawi, Uganda and Tanzania include refractive errors, trachoma, cataract, glaucoma and age – related macular degeneration (Abdu, 2002; Adeoye, 1996; Emerole, C.G *et al*., 2013; Ezepue, 1997; Kingo & Ndawi, 2009; Ngondi *et al*., 2006; Nwosu, 1994; Onakpoya *et al*., 2007; Seidu *et al*., 2021) [1, 2, 9, 11, 15, 21, 22, 23, 26].

In the present study the leading associated morbidity with visual impairment amongst subjects (26.3%) was cardiovascular disorders (metabolic disorders, 13.3% and cancers, 11.8%). The differences in the gender prevalence of associated non – ocular morbidities under reference among the visually impaired subjects was statistically significant (p – value <0.001). In eye conditions like age – related macular degeneration, glaucoma, retinitis pigmentosa, hypertensive retinopathy and diabetic retinopathy, the retina becomes damaged or compromised and degenerative changes set in that eventually lead to visual impairment. It is believed that as much as 90% medical diseases either have a major genetic component or involve genetic factors that significantly influence the disease (Emerole, C.G *et al*., 2011; Emerole, C.G *et al*., 2013; MacDonald *et al*., 2004) [8, 7, 19]. The increase in incidence of non – communicable diseases has been associated with urbanisation and increasing life expectancy (Kyari *et al*., 2014; Lundeen *et al*., 2021) [17, 18]. In the United States, a cross– sectional nationally representative assessment of annual health survey of 23,071 adults aged ≥18 years old with self– reported data on cardiovascular disease risk factors and visual impairment, it was reported that cardiovascular diseases and its risk factors were more prevalent in patients suffering from visual impairment than among the general population (Lundeen *et al*., 2021) [18]. In a similar study in Nigeria with a nationally representative based sample of 13,511 participants aged ≥ 42 years were selected by multi – stage – stratified – cluster – random sampling and examined in 305 clusters between January 2005 to June 2007 showed that age –adjusted prevalence of diabetes in Nigeria was 3.25% (95% CI: 2.50 – 4.30) and over 10% of people with diabetes aged ≥40 years had sight – threatening diabetic retinopathy (Kyari *et al*., 2014) [17]. Visual loss from non – communicable diseases will increase unless mechanism for early detection and treatment improves (Kyari *et al*., 2009; Lundeen *et al*., 2021) [16, 18].

Conclusion and Recommendations

This review has shown that the prevalence of risk factors of visual impairments namely; gender, age, drugs, trauma, cardiovascular and metabolic disorders have continued to be prominent. It has further provided a data base for the management of these impairments and therefore underscored the need for early preventive measures.

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