

# **PREVALENCE AND CAUSES OF BLINDNESS AND VISUAL IMPAIRMENT IN AWKA, SOUTH-EAST NIGERIA: A TERTIARY HOSPITAL STUDY**

## **Abstract**

Background: 10 years prior to this study period (2017) the Nigerian National Blindness and Visual Impairment Survey (2007) obtained data from all states and regions of Nigeria to enable for effective planning and provision of eye care. 10 years later on update of the statistics is most desirable especially with local studies. This is a preliminary study and the data obtained will act as template for effective formulation/planning on management of visual impairment and blinding ocular problems.

### **Objective:**

- i. To determine the prevalence and causes of blindness and visual impairment in Awka, South East Nigeria.
- ii. To provide data-base for effective eye care delivery.

Methodology: A retrospective, hospital-based study of new patients seen over a 12 months period from January to December 2017 at the Eye Clinic Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka.

Result: A total of 1,776 patients were seen in the 12 months period. 737 (41.5%) were males, and 1039 (58.5%) females with ratio of 1:1.4 respectively. The most frequently occurring age group was 21-30 years, followed by 11-20 years. Out of the patients reviewed 185 (10.4%) had visual impairment (presenting VA < 6/18) in at least one eye. 72(4.1%) had blindness (presenting VA<3/60) in at least one eye. 113(6.4%) had low vision or moderate and severe visual impairment (MSVI) (presenting VA< 6/18 to 3/60) in at least one eye. 59 patients (3.3%) had visual impairment in both eyes. 16 (0.9%) were blind in both eyes whilst 43 (2.4%) had low vision in both eyes. The prevalence of blindness, low vision and visual impairment was 0.9%, 2.4%, 3.3% respectively. Major causes of blindness were Glaucoma (26%), Cataract (23.3%), Trauma (13.3%). For visual impairment it was cataract (24%) glaucoma (22%) and refractive Error (21.2%).

Conclusion: The common causes of blindness are avoidable. More robust eye care systems involving promotion, preventive and curative measures should be developed to address the identified common causes of blindness and visual impairment.

Keywords: Blindness, Visual Impairment, hospital, planning.

## **Introduction**

The World Health Organization (ICD-10) defines visual impairment as presenting visual acuity less than 6/18. Low vision (Moderate and severe visual impairment) is defined as presenting visual acuity less than 6/18 to 3/60 while blindness is defined as presenting visual acuity less than 3/60 in the better eye of an individual or visual field less than 10° from fixation<sup>1</sup>.

Globally it is estimated that 285 million people have visual impairment and out of them 246 million have low vision, of whom 39 million people are blind.<sup>1</sup> 75% of blindness burden is in Africa and Asia with 80% of it being avoidable.<sup>1</sup> Blindness and visual impairment burdens not only the individuals but also impacts negatively on communal economy. Unless steps are taken to reduce prevalence through prevention and treatment this burden will increase alongside global population growth.

The Global initiative, vision 2020: the right to sight has a mission to eliminate the main causes of avoidable blindness in order to give all the peoples of the world, particularly the millions of needlessly blind the right to sight by the year 2020.<sup>2</sup> To achieve this there must be reliable statistics in order to provide effective eye care in Nigeria. The Nigerian National Blindness and visual impairment survey<sup>3</sup> ending in 2007 particularly accomplished this National task in which Statistics was obtained from all states and geopolitical zones of Nigeria. However ten years later, (2017) an update of the statistics is most desirable especially with local studies. Strategic planning should be decentralized as there are significant differences across the geopolitical zones (GPZs) in Nigeria<sup>4</sup>. Hence this preliminary study was carried out in 2017 to determine at present the prevalence and causes of blindness and visual impairment in Awka, Anambra State, South-East Nigeria.

Awka is the capital of Anambra State with the tertiary teaching hospital located at Amaku along the only interstates express way easily accessible to Awka indigenes people of the state, their neighbouring states in South-East Nigeria. This study will provide a solid database

needed for effective formulation of policy on management of visual impairment and blinding ocular problems in the hospital, state level and South-East Zone Nigeria.

## **Methodology**

Ethical clearance was obtained from the institution's Ethical and Research Committee. It was a retrospective study of all registered patients who presented to the Eye clinic of Chukwuemeka Odumegwu Ojukwu University Teaching hospital over a 12 months period, between January to December 2017. Patients presenting to the eye clinic routinely undergo preliminary visual acuity assessment by the trained ophthalmic nurses. Refraction was carried out by the optometrists. Cross checking of the visual acuity, reviewing of all refraction and detailed eye examination was done by the Ophthalmologists who made the diagnosis and instituted appropriate management. Data on age, sex, presenting visual acuity, was obtained from the eye clinic registers compiled by the ophthalmic nurses using patients medical case folders. Case folders of patients with visual acuity less than 6/18 were retrieved from the medical records and further reviewed. Where 2 or more disorders co-exist in a patient the most significant cause of visual impairment was recorded.

Where more than one significant cause was documented the one most amenable to treatment and hence prevention was recorded.<sup>3</sup> WHO definition of blindness and visual impairment as used in the Nigerian National Blindness Survey was used to categorize patients. Statistical analysis was done using a scientific calculator. The results were presented in tables.

## **Results**

A total of 1,776 patients were seen during the 12 months period of study. 737 (41.5%) were males while 1,039 (58.5%) were females. Male: female ratio of 1:1.4. Table I shows the age group and gender distribution of the patients seen. More patients were seen in the 21-30 years age group (19.8%), followed by 11-20 years age group (14.5%). Thereafter the number of patients seen progressively declined with increasing age with least number being in the 81-90years group (2.2%). 725 (40.8%) were above 40 years of age. Out of the total number of patients seen 185 (10.4%) had visual impairment (presenting visual acuity <6/18) in at least one eye, 72 (4.1%) had blindness (presenting visual acuity < 3/60) in at least one eye. 113 (6.4%) had low vision or moderate and severe visual impairment (MSVI) (presenting visual acuity < 6/18 to 3/60) in at least one eye. 59 patients (3.3%) had visual

impairment in both eyes: out of these 16 (0.9%) were blind in both eyes whilst 43 (2.4%) had low vision (MSVI) in both eyes. The prevalence of blindness and visual impairment is shown in table II.

Table III shows the prevalence of blindness, low vision (MSVI), visual impairment taking into consideration unilateral and bilateral cases, age, and gender. Prevalence of blindness and visual impairment in persons > 40 years of age is 1.7% (12 patients) and 5.7% (41 patients) respectively.

30 persons were doubly represented in unilateral blindness (UB) group and then also in unilateral low vision (ULV) group being that in these persons one eye was blind and the fellow eye of same person had low vision. In all age groups bilateral blindness and bilateral visual impairment were commonest in age group 71-80 years. It was 6% and 16% respectively of all cases seen in this age group. Between 31-60years no case of bilateral blindness was recorded. 61-70years age range recorded the highest number of unilateral blindness (7.2% of all cases seen in this age group). This age group also had the highest number of unilateral low vision (11.8%) and unilateral visual impairment (19%) of all cases seen. Females had the greatest blindness and visual impairment burden with male: female ratios of 1:3 and 1:2.1 respectively.

From table IV top 3 causes of blindness recorded were glaucoma (26%), cataract (23.3%), Trauma (13.7%). For low vision causes were refractive error (29.6%), cataract (25.2%), glaucoma (20%). Top 3 causes of visual impairment were cataract (24%), glaucoma (22%), and refractive error (21.2%).

**Table I: Age Group and Gender Distribution**

Age	Male %	Female %	Total %
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group			
0.-10	119 (6.7%)	97 (5.5%)	216 (12.2%)
11-20	98 (5.5%)	160 (9.0%)	258 (14.5%)
21-30	125 (7.0%)	226 (12.7%)	351 (19.8%)
31-40	116 (6.5%)	110 (6.2%)	226 (12.7%)
41-50	53 (3.0%)	119 (6.7%)	172 (12.7%)
51-60	71 (4.0%)	148 (8.3%)	219 (12.3%)
61-70	87 (4.9%)	108 (6.1%)	195 (11.0%)
71-80	49 (2.8%)	51 (2.9%)	100 (5.6%)
81-90	19 (1.1%)	20 (1.1%)	39 (2.2%)
91-100	-	-	-
Total	737 (41.5%)	1039 (58.5%)	1776 (100%)

Persons > 40 years = 725 (40.8%)

**TABLE II: Prevalence of Blindness, Low vision (MSVI) and Visual Impairment**

Category of visual loss	No of persons			Prevalence %		
	Male	Female	Total	Male	Female	Total
Blindness VA < 3/60	4	12	16	0.225%	0.675%	0.9%
Low vision (MSVI) VA < 6/18 to 3/60	15	28	43	0.844%	1.576%	2.4%
Visual impairment (VA < 6/18)	19	40	59	1.063%	2.237%	3.3%

VA – visual acuity

MSVI - moderate and severe visual impairment

Visually impaired = No of Persons blind + No with low vision (MSVI)

**Table III: Prevalence of blindness, Low vision and Visual impairment considering unilateral, bilateral cases, age and gender distribution**

Age	BB(persons)			UB			BLV(persons)			ULV			BVI(persons)		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
0 -10	–	1	1	1	1	2	1	–	1	2	–	2	1	1	2
11-20	–	2	2	2	4	6	–	5	5	1	2	3	–	7	7
21-30	–	1	1	4	1	5	2	5	7	2	5	7	2	6	8
31-40	–	–	–	1	2	3	–	1	1	3	1	4	–	1	1
41-50	–	–	–	2	1	3	1	–	1	3	4	7	1	–	1
51-60	–	–	–	3	6	9	1	4	5	3	7	10	1	4	5
61-70	–	3	3	6	8	14	5	5	10	8	15	23	5	8	13
71-80	3	3	6	3	8	11	4	6	10	5	6	11	7	9	16
81-90	1	2	3	2	1	3	1	2	3	2	1	3	2	4	6
91-100	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<b>Total</b>	<b>4</b>	<b>12</b>	<b>16</b>	<b>24</b>	<b>32</b>	<b>56</b>	<b>15</b>	<b>28</b>	<b>43</b>	<b>29</b>	<b>41</b>	<b>70</b>	<b>19</b>	<b>40</b>	<b>59</b>

Blindness (persons) - M: F ratio : 1:3  
 Low vision (persons) - M:F ratio : 1:1.9  
 Visual impairment (person) - M:F ratio : 1:2.1  
 Prevalence of blindness in > 40years age : 12 (1.7%)  
 Prevalence of low vision in > 40years age : 29 (4%)  
 Prevalence of visual impairment in > 40years age : 41 (5.7%)

BB = Bilateral blindness, UB = Unilateral blindness  
 BLV = Bilateral low vision, ULV = Unilateral low vision  
 BVI = Bilateral visual impairment  
 M = Male, F = Female

**Table IV: Causes of Blindness, Low vision, Visual impairment bilaterally and unilaterally**

Cause	BB	UB	Total blind cases %	BLV	ULV	Total low vision cases %	Total visual impairment cases %
Cataract	3	14	17 (23.3%)	13	16	29 (25.2%)	46 (24%)
Glaucoma	4	15	19 (26.0%)	6	17	23 (20.0%)	42 (22%)
Trauma	-	10	10 (13.7%)	1	6	7 (6.1%)	17 (9.0%)
Corneal disease	2	4	6 (8.2%)	-	2	2 (1.7%)	8 (4.2%)
Refractive error	6	-	6 (8.2%)	17	17	34 (29.6%)	40 (21.2%)
Phthisis bulbi	1	1	2 (2.7%)	-	-	-	2 (1.1%)
Optic neuropathy/atrophy	-	2	2 (2.7%)	-	1	1 (0.9%)	3 (1.6%)
Uveitis	-	3	3 (4.1%)	-	-	-	3 (1.6%)
Couching	1	2	3 (4.1%)	-	-	-	3 (1.6%)
Age-related macular degeneration	-	2	2 (2.7%)	-	2	2 (1.7%)	4 (2.1%)
Pseudophakia	-	1	1 (1.4%)	3	5	8 (7.0%)	9 (4.8%)
Endophthalmitis	1	-	1 (1.4%)	-	-	-	1 (0.5%)
Diabetic retinopathy	-	-		2	-	2 (1.7%)	2 (1.1%)
Pterygium	-	-		-	1	1 (0.9%)	1 (0.5%)
Retinitis pigmentosa	-	-		2	-	2 (1.7%)	2 (1.1%)
Aphakia	-	1		-	-	-	1 (0.5%)
Maculopathy	-	1	1 (1.4%)	-	3	3 (2.6%)	4 (2.1%)
Branch retinal vein occlusion	-	-		-	1	1 (0.9%)	1 (0.5%)

In Persons with bilateral blindness, low vision, and visual impairment the cause of blindness, low vision and visual impairment may be different in both eyes.

## Discussion

This hospital - based survey where all attending age groups were included showed that more females than males were seen in 1.4:1 ratio. Similar reports were seen in hospital based studies<sup>5,6</sup> and community based studies.<sup>7,8</sup> The Nigerian National Survey which included age group 40 years and above showed that more than half examined were females.<sup>9</sup> It is likely that females are either more ready to seek for medical help regarding ocular health issues or they are more prone to eye problems.

This inclination having more females visiting our eye care facility more than males will most likely affect the gender distribution of blindness and visual impairment.

The 21-30 years and then 11-20 years age groups were highest in attendance. Eye diseases are reported to be common among Nigerian students.<sup>10</sup> The least number of patients in attendance were in 81-90 years age group.

This may likely be due to paucity of longevity, the average life expectancy (2017) of a Nigerian being 53-73 years.<sup>11</sup> Also among other unique challenges of the elderly this age group needs relatives to accompany them to health facilities and most adult relatives are either not around or gainfully occupied. As this is a hospital based study many more cases may likely be hidden away in their homes. One should be mindful of the fact that the ageing population is increasing overtime.<sup>12</sup> Presumably when better national policies are created for care and welfare of elderly persons more patients in this age group would present in the eye care facilities with their accompanying ocular conditions related to ageing. Retinal morbidity may then be more obvious as causes of visual impairment.<sup>13,14,15,16</sup>

In this study prevalence of blindness (4.1%), low vision (6.4%), visual impairment (10.4%) in at least one eye is markedly lower when compared to a previous hospital based study done more than 15 years ago in the same state with prevalence of blindness recorded as 27.6%), low vision 31.3% and visual impairment 70%.<sup>17</sup> Our values are also lower when compared to other similar retrospective hospital based studies across Nigeria,<sup>18,19,20,21</sup> So also in Nigerian community based studies.<sup>7,22</sup> A community based study by Fasina et al recorded lower values than ours.<sup>23</sup> Global blindness and visual impairment according to data published 2017 by P Ackland et al was 0.49% and 3.44% respectively<sup>24</sup> , and our



values are higher. When we considered persons aged > 40 years the prevalence of blindness was 1.7%. The Nigerian National Blindness and Visual Impairment Survey (NNBVIS) had an average of 4.2% as prevalence for persons  $\geq$  40 years.<sup>4</sup> This national survey recorded varied blindness prevalence in the different geopolitical zones (GPZ) of Nigeria with the South-East GPZ having 4.6%. It was highest in North East GPZ (6.1%) and lowest in South-West GPZ (2.8%).<sup>25</sup>

The general awakened interest in eye care following Vision 2020 initiative (1999-2013) to eliminate the main causes of avoidable blindness and Global Action Plan (2014-2019) to reduce avoidable visual impairment is likely to have contributed to the reduction in blindness prevalence in Anambra state. Vision loss experts actually noted a global decline in prevalence of blindness from 1990 (4.58%) to 2015 (3.38%).<sup>24</sup> Studies and interventions in South East GPZ<sup>26,27,28,29,30</sup> (only some documented & published) covering promotion prevention, treatment with improved access, utilization and development of eye care services were beneficial.

Our study showed glaucoma as the leading cause of blindness followed by cataract and then trauma. The 2007 (NNBVIS) survey reported cataract as the commonest cause of blindness nationwide with glaucoma being second.<sup>31</sup> Some other studies in Nigeria had cataract as the leading cause of blindness.<sup>17,32,33,34,35</sup>

The finding of glaucoma as the commonest cause of blindness in this study done in Igbo land is not farfetched since in the NNBVIS the Igbos had the highest prevalence of glaucoma which may reflect genetic susceptibility.<sup>37</sup> Worldwide, glaucoma is the leading cause of irreversible blindness<sup>1</sup> and Africa has the highest incidence and prevalence of glaucoma most of which is open angle glaucoma.<sup>37,38</sup> In West Africa it is more difficult to treat,<sup>39,40,41</sup> thus enabling the ocular morbidity from glaucoma. The NNBVIS reports glaucoma as the leading cause of functional low vision<sup>42</sup>, while in this study refractive error was the leading cause of low vision. Similar results with ours was obtained in previous studies in Nigeria.<sup>43,44,45</sup>

Surprisingly ocular trauma was the 3<sup>rd</sup> commonest cause of blindness in this study. It is an avoidable cause of blindness and visual impairment. It has been described as a neglected issue<sup>46</sup> but it was highlighted as a major cause of visual morbidity.<sup>47</sup> Umeh et al found delay in seeking specialist attention and lack of sophistication of treatment especially in severe

cases led to worse visual outcome compared with reports in developed countries.<sup>48</sup> Perhaps these could be the main reasons or maybe in part for its prominence in causing blindness in our environment. Further studies are required to ascertain pattern of eye injuries, factors causing prominence of ocular trauma as a blinding condition in our environment.

As other hospital based studies this study has some limitations such as selection bias since more patients with visual impairment and blindness are likely to have reported to the hospital and so may not reflect what is exactly happening in the community at large.

## **Conclusion**

The prevalence of blindness, low vision and visual impairment in this study is lower than what was reported in previous similar hospital based studies and the 2007 Nigerian blindness & visual impairment survey.

The common causes of blindness and visual impairment in this study (glaucoma, cataract, trauma, refractive error) are avoidable. To go with the global trend of reduction of avoidable blindness and visual impairment there is need to further do same in our local environment. Addressing this requires more robust eye care system such as: 1. Improving glaucoma awareness and screening in the general public to ensure early detection and early treatment 2. Upgrading cataract surgical services by provision of standard equipment/instruments/consumables, manpower 3. Making the hospital fees and dispensing of spectacles more affordable. 4. Preventive measures, timely and adequate treatment of ocular trauma should be encouraged. 5. Providing logistics for supplementary community outreaches.

## **Ethical Approval:**

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

## **Consent**

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

## REFERENCES

1. Pascolini D, Mariotti SPM. Global estimates of visual impairment 2010. *Br J Ophthalmol*. 2012; 96(5): 614-618 (pubmed) (Google scholar)
2. Gordois A, Cutler H, Pezzullo L, Gordon K, Cruess A, Winyard S, et al. An estimation of the worldwide economic and health burden of visual impairment. *Glob public health* 2012; 7 (5): 465-81.
3. Dineen B, Gilbert C E, Rabiou MM, Kyari F, Abdull MM, Abubakar T. The Nigerian National Blindness and visual impairment survey: Rationale, objectives and detailed methodology. *Bmc ophthalmol*. 2018; 8:17. (PMC free article) (pubmed) (Google scholar)
4. Kyari F, Gudlavalleti MVS, Sivsubramaniam S, Gilbert CE, Abdull MM, Enekume G, et al. The Nigerian National Blindness & visual impairment study group. *Investigative Ophthalmology and visual science* May 2009; 50 (5): 2033-2039.
5. Otulana TO. Blindness and visual impairment in Remo, Ogun State, Nigeria: a hospital based study. *Niger postgrad med J*, 2012 Sept; 19(3): 153-6.
6. Isawumi MA, Uba JN, Olomola BV, Afolobi OM. Blindness and visual impairment among adults in a tertiary eye clinic in Osogbo SW Nigeria. *Ann med health sci Res*. 2014; 4:594-7.
7. Achigbu EO, Ezeanosike E. Visual impairment and blindness in 5 communities in Imo State, South East Nigeria. *Ann med Health Scie Res* 2017;7 (2): 106-110.
8. Fasina FO, Ajaiyeoba AI. The prevalence and causes of blindness and low vision in Ogun State, Nigeria. *African Journal of Biomedical Research*. 2013; 6:63-67.
9. Rabiou MM, Kyari F, Ezelum C, Elhassan E, Sanda S, Murthy GV, et al. Review of the publications of the Nigeria National blindness survey: methodology, prevalence, causes of blindness and visual impairment and outcome of cataract surgery. *Ann Afr. Med*. 2012 Jul-Sep; 11(3): 125-30.
10. Ajaiyeoba AI, Isawumi MA, Adeoye AO, Oluleye TS. Pattern of eye diseases and visual impairment among students in south western Nigeria. *Int ophthalmol*. 2007 Oct; 27(5): 287-92.
11. United Nations. World population prospects.  
<a href='https://www.macrotrends.net/countries/NGA/nigeria/lifeexpectancy'>Nigeria life Expectanc

12. Perpetua Lum Tanyi, Pelse Andre', Peter Mbah. Care of the elderly in Nigeria: Implications for policy. <https://doi.org/10.1080/23311886.2018.1555201>.
13. Age specific prevalence and causes of blindness and visual impairment in an older population. The Rotterdam study. Arch ophthalmol. 1998;116(5):653-658.
14. Nwosu S. Age-related macular degeneration in Onitsha, Nigeria. Niger J clin Pract 2011;14:327-31
15. Borazon mehmet, Gunduz Abuzer. Results of cataract surgery in very elderly population. Journal of Optometry 2009; 2(3): 138-141
16. C Mpyet. Retinal diseases: The need to be better prepared. West Afr coll surg.2015 Apr-Jun; 5 (2): X-XII.
17. Nwosu SN. Blindness and visual impairment in Anambra State. Nigeria. Trop Geogr med. 1994; 46(6):346-9
18. AE Omoti. Aetiology of Blindness in Benin city, Nigeria. Ann Afr Med 2004; 3(2) 87-89
19. OA Dawodu, AI Osahon, E Enifoniye. Blindness in Otiabor Okhae Teaching Hospital, Irrua, Edo State, Nigeria. Ophthalmic Epidemiol. 2003 Dec; 10(5): 323-30.
20. Sijuwola OO, Fasina O. Etiology of visual impairment among ophthalmic patients at federal medical center, Abeokuta, Nigeria. J West Afr Coll surg. 2012 Oct – Dec; 2 (4): 38-50.
21. KN Malu. Blindness and visual impairment in North Central Nigeria: a hospital based study. The Nigerian Post Graduate Medical Journal 20(2): 98-103.
22. Ajibode A. The prevalence of blindness and visual impairment in Ikenne local government Area of Ogun State. Nigerian journal of Ophthalmology. 1999;7:23-27.
23. Fasina FO, Ajaiyeaba AI. The Prevalence and Causes of Blindness and low vision in Ogun State, Nigeria. African journal of Biomedical Research. 2003; 6:63-67.
24. P Ackland, S Resnikoff, R Bourne. World blindness and visual impairment: despite many successes, the problem is growing. Community eye health 2017; 30(100): 71-73.
25. The Nigeria National blindness and visual impairment survey.  
[http://pbunion.org/countriessurvey\\_summary\\_report](http://pbunion.org/countriessurvey_summary_report)
26. Okoye RS, Bell L, Padadopoulos L. Barriers to Access good eye care services in Nigeria: A focus on Anambra State. J Nigerian Optometric Association JNOA. 2018; 20(1): 30-37.

27. OC Arinze, BI Eze, NN Udeh, SN Onwubiko, CN Ezisi, CM Chuka-Okosa. Determinants of eye care utilization in rural south-eastern Nigeria. *J Community health* 2015; 40:881-890.
28. Onwubiko SN, Eze B, Udeh N, Arinze O, Okoloagu MN, Chuka-Okosa CM. Mapping the pathways to Eye care in a rural south-east Nigerian population: any implications for practice, eye care programs and policy? *Rural and remote health* 2014; 14:2729.
29. SNN Nwosu, CU Akudinobi, JK Ndulue. Extending eye care services into Rural Nigeria: The vision 2020 Eye clinic Ukpok experience. *Nigerian Journal of ophthalmology/supplement 1-2014-vol 22*.  
[<http://www.Nigerianjournalofophthalmology.com> on Friday, November 04, 2016, ip:165.255.149.185]
30. Okoye O, Eze BI, Chuka-Okosa CM. Eliminating the barriers to uptake of cataract surgery in a resource-poor setting: A focus on direct surgical cost. *Niger J Clin pract* 2015; 18:333-6.
31. Abdul MM, Sivasubramaniam S, Murthy GV, Gilbert C, Tafida A, Ezelum C et al. Causes of blindness & visual impairment in Nigeria. The Nigeria National blindness and visual impairment survey. *Invest ophthalmol vis sci*. 2009; 50:414-20.
32. Adeoti CO. Prevalence and causes of blindness in a tropical African population. *West Afri J Med*. 2004; 23(3): 249-252
33. AE Omoti. Aetiology of Blindness in Benin City, Nigeria. *Ann Afr Med*. 2004; 3(2): 87-89
34. Onokpoya OH, Adeoye AO, Akinsola FB, Adegbotungbe BO. Prevalence of blindness and visual impairment in Atakunmosa west local government area of south western Nigeria. *Tanzania Health Res Bull*. 2007;9 (2): 126-131
35. Oluleye TS, Ajaiyeoba AI, Akinwale MO, Olusanya BA. Causes of blindness in south western Nigeria: a general hospital clinic study. *Eur J ophthalmol*. 2006; 16 (4): 604-607.
36. Kyari F, Entekume G, Rabi M, Spry P, Wormaid R, Nolan W et al. Nigeria National Blindness and visual impairment study group. A population based survey of the prevalence and types of glaucoma in Nigeria: results from the Nigeria National blindness and visual impairment survey. *BMC ophthalmol* 15, article number: 176 (2015) <http://doi.org/10.1186/s12886-015-0160-6>
37. Quigley HA, Broman AT. The number of people with Glaucoma worldwide in 2012 and 2020 *Br J ophthalmol* 2006; 90:262-7.

38. Tham YC, LI X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of Glaucoma and projections of Glaucoma burden through 2040: a systematic review and meta-anlaysis. *Ophthalmology*. 2014; 121:2081-90.
39. Cook C. Glaucoma in Africa: Size of the problem and possible solutions. *J Glaucoma*-2009; 18:124-8.
40. Kyari F, Abdull MM, Bastawrous A, Gilbert CE, Faal H. Epidemiology of Glaucoma in Subsaharan Africa: prevalence, incidence and risk factors. *Middle East Afr J ophthalmol*-2013;20:111-25.
41. Egbert PR. Glaucoma in West Africa Neglected problem. *Br j ophthalmol*. 2002; 86:131-2
42. Entekume G, Patel J, sivasubramariam S, Gilbert CE, Ezelum CC, Murthy GV et al. Prevalence, causes and risk factors for functional low vision in Nigeria:results from the national survey of blindness and visual impairment. *Invest ophthamol vis sci*. 2011Aug; 52(9):6714-9
43. OO Sijuwola, O Fasina. Etiology of visual impairment among ophthalmic patients at federal medical center Abeokuta Nigeria. *J West Afr coll surg*. 2012 Oct-Dec; 2(4): 38-50.
44. Oladigbolu KK, Abah ER, Chinda D, Anyebe EE.. Pattern of eye diseases in a university health service clinic in northern Nigeria. *Niger J med*. 2012 Jul-Sep; 21(3):334-7.
45. Bagaiya T, Pam V. Refractive errors in Kaduna Nigeria. *Niger J Med*. 2003; 5:106-109.
46. Parver L. Eye trauma. The neglected disorder. *Arch Ophthalmol*, 1986; 104: 1455-1453.
47. MacEwen CJ, ocular injuries. *J R coll surg Edinb*. 1999; 44:317-323
48. Umeh RE, Umeh OC. Causes and visual outcome of childhood eye injuries in Nigeria. *Eye (lond)*. 1997; 11:489-495.

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