Original Research Article

Correlation of Ocular Onchocerciasis with the Refractive Status of the Eye among Selected Endemic Communities in Imo State, Nigeria

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Abstract

Background: The study was aimed at investigating the correlation between ocular onchocerciasis and refractive status of the eye among selected endemic communities in Imo State, Nigeria.

Methods: A total of 462 participants aged 5-84 (44.9 ±12.1) years and comprised of 238 (51.5%) males and 224 (48.5%) females were sampled. Blood-free skin snips were collected using the skin snip biopsy technique. Bloodless skin snips were extirpated from the iliac crest region using a sclera-corneal punch which resulted in the removal of around 2 mg of tissue. To allow the microfilariae emerge, the tissue removed was incubated in normal saline at room temperature for 24 hours. The emerging microfilariae were then identified under a high powered 40X microscope. Out of the 462 participants, 221 (47.8%) tested positive to *O. volvulus*. Of the 221 that tested positive, 104 (47.1%) (male, 69 and female, 35) had ocular manifestations. Ocular examination was performed on positive individuals using the slit lamp biomicroscope under retro illumination.

Results: Using the chi square statistical analysis, this study showed a statistically significant difference (P<0.05) between onchocerciasis and the refractive state of the eye in Amuro, Umulolo, Amano and Umuokpara community and odds ratio showed that onchocerciasis was more likely to cause these errors. There was no statistical significant difference (P>0.05) in the refractive state of the eye in Ihube.

Conclusions: The result suggested that presbyopia had a higher manifestation while hyperopia and astigmatism had the least manifestation than other refractive errors. The result from the study showed a decline in the 5 studied communities but the presence of positive diagnosis suggests of a continuous disease transmission and onchocerciasis is not yet fully eliminated in Okigwe. With sustained high coverage of ivermectin mass drug administration by African Programme for Onchocerciasis Control (APOC), onchocerciasis prevalence would be eliminated.

Keywords: Ocular onchocerciasis, Refractive status, Eye, Endemic communities.

Introduction

Onchocerciasis, also known as river blindness is a neglected tropical disease caused by the parasitic filarial nematode worm *Onchocerca volvulus* whose vector is the female blackfly (simulium species) that lives near fast-flowing and oxygenated streams and transmitted through repeated bites. It is a chronic and progressive skin, eye, and neurological disease and the second leading cause of preventable blindness worldwide after trachoma [1] . It is the most notable cause of blindness in Sub-saharan Africa, maily found in West Africa, Central and South America.

Onchocerca volvulus is transmitted through frequent or recurrent bites from an infected blackfly of the Simulium specie. Humans are the only known definitive host; It is spread from person to person via female biting blackflies of the genus Simulium [2]. *Onchocerca volvulus* parasites obtain nutrients from the human host by ingesting blood or by diffusion through their cuticle. *Onchocerca volvulus* has a complex life cycle involving a definitive and intermediate host. The only natural definitive host are humans. The intermediate host is a blackfly in the genus simulium. Adult worms typically live from 8-15 years in human

hosts, and microfilariae can live up to 2 years. Initially, the infestation may occur in childhood with no symptoms for long periods. However, the neurological manifestations mainly affect children. Symptoms often do not appear for up to one to two years after the individual has been infected. This is common in earlier stage.

While still alive, *O. volvulus* cause very little in terms of pathology. The adult worms are protected by the fibrous skin nodules in which they reside, and the microfilariae (through some unknown mechanism) are non-immunogenic. It is when they die that they cause an immune response. Antigens that are released by dead or dying organisms cause a T-helper cell (TH2) response, which leads to the release of interleukins, resulting in the influx of neutrophils and eosinophils, and the production of antibodies by plasma cells. These inflammatory responses lead to corneal opacification[3,4]. Specifically, it is thought that the sclerosing keratitis is an effect of modification of ICAM-1 expression and production of IL-4 and IL-14[5].

The most common method of diagnosis is the skin snip biopsy. Infections in the eye can be diagnosed using a Slit lamp biomicroscope to examine the anterior part

of the eye where the larvae are visible. The microfilariae can be seen using retro-illumination as S or C-shaped, fine motile elements. Patients are asked to sit with their head between their knees for at least 2 minutes in order to mobilize the microfilariae that are suspended in the anterior chamber, increasing the sensitivity of this test[4,6,7].

The standard treatment of onchocerciasis now utilizes the broad-spectrum antiparasitic ivermectin, given as a single dose and repeated every 6-12 months over a course of around 10 years. Ivermectin decreases the microfilarial load by paralyzing the microfilariae over a six-month period. It has no effect on the adult nematodes. Mono-therapy with ivermectin (150μg/kg) has been shown to mitigate the development of optic atrophy when treatment is started early in the course of the disease[7,8,9].

Ocular manifestations occur when microfilariae move from the conjunctiva through the cornea into the anterior and posterior chambers of the eye, leading to conjunctivitis, sclerosing keratitis, uveitis, chorioretinal lesions, optic atrophy, glaucoma, blindness. Onchocerciasis can affect the 4 refractive media of the eye, that is, the cornea, aqueous humour, lens and vitreous body. The strongest refractive media of the eye is the cornea and on slit lamp examination, microfilariae can be found on the cornea leading to cornea pathology hence, might as well affect the refractive state of positive individuals. The aim of this study is to assess the correlation between ocular onchocerciasis and refractive status of the eye among selected endemic communities in Imo State, Nigeria.

Methodology

Study Area

The study was conducted in Umulolo, Amuro, Ihube, Amano and Umuokpara communities in Okigwe Local Government Area of Imo State, Nigeria.

Okigwe is hilly and has a lot of undulating plains. The weather is consistently warm throughout the year, rarely falling below 58°F or rising beyond 90°F and the wet season is particularly gloomy and humid, according to data from the Imo State Meteorological Service, the annual rainfall in the area averages 2,840mm per annum, with most of the rainfall occurring in the months of June through October. The major crops grown in Okigwe are palm trees (palm oil and palm wine), cassava and vegetables. The soil is partly red clay and black or dark brown. Okigwe has geographical

coordinates of 5.483°N 7.55°E. There are a total of seven streams and three rivers in addition to the Imo River. Farming is the main occupation of the people, however, those who are into other occupations engage in part time farming such as fishing, clay mining, molding and trading. There are many fast flowing streams because of its hilly nature which favour the breeding and development of blackflies, the vector of onchocerciasis.

Study Population and Sample Size

The population size of the sampled communities is estimated to about 184,500 people based on 2006 census exercise. The sample size of 399 was drawn using the Taro Yamane formula. Considering the attrition factor (30% of the population size), the sample size was increased to 462. .

Ethical Considerations

The study complied with the Helsinki Declaration on Human Experiments. . Ethical approval for the study was obtained from the Imo State Ministry of Health, while oral informed consents of the participants were obtained before examinations.

Procedure for Data Collection

The demographic profile of each subject was recorded. It included age, sex and occupation.

Bloodless skin snips were extirpated from the iliac crest region using a sclera-corneal punch which resulted in the removal of around 2 mg of tissue. The tissue removed was then incubated in normal saline at room temperature for 24 hours to allow the microfilariae to emerge. The emerging microfilariae were then identified microscopically with a high powered 40X microscope.

The visual acuity of each subject was tested and recorded. It was done at distance (6m) using the Snellen's acuity chart. Illiterate E chart was used for illiterate subjects. The test was done monocularly and binocularly. Pinhole acuity was used to differentiate refractive problem from pathological problem. External examination of the eye was done using the penlight and slit lamp biomicroscope to assess the external part of the eye. Slit lamp examination was performed in dim illumination to examine the anterior and posterior part of the eye.

The intraocular pressure was measured using the Perkins applanation tonometer. The fundus was examined using the direct

ophthalmoscope. This test was performed in dim illumination.

Subjective refraction was done with prior information using the retinoscopic finding. The power that gave the best subjective visual acuity was prescribed.

Statistical analysis

Both descriptive and inferential statistics were used for data analysis. Data were presented on tables and graphs, while analysis was done using frequencies, percentages and Chi-square at 95% confidence interval. P<0.05 was considered significant. Odds ratio was used to determine the probability of refractive errors occurring as a result of ocular onchocerciasis.

Results

Table 1 represents the age distribution of participants in Amuro community. It can be seen that 0 (0%) of participants are between the age range of 5 – 14, 15 – 24 and 75 – 84, and the highest population 12 (35.3%) of participants aged 45 – 54. With the total number of participants being 34 (100%), Mean of 49.8, Standard deviation of +/- 12.7 years and a Standard error of 0.6. In Umulolo community, it can be seen that 0 participants were between the age range of 5-14, 65-74 and 75-84 and 10 (45.5%) of the

participants aged 45-54 years. With a total number of participants from Umulolo community being 22 (100%), Mean of 45.4, Standard deviation of +/- 10.7 years and a standard error of 0.7. In Amano community, the least population 0 (0%) of participants aged between 15 – 24, 55 – 64, 65 – 74, 75 – 84 and the highest population of participants 7 (58.3%) are within the age range of 35 – 44. With a total number of participants being 12, Mean of 38.7, Standard deviation of +/- 10.4 years and a Standard error of 0.9. In Umuokpara community, it is seen that 0 (0%) of participants are within the age range of 5 – 14 and 65 – 74 years and 6 (35.3%) of participants aged 55 – 64. With the total number of participants being 17 (100%), Mean of 48.9, Standard deviation of +/- 15.1 years and a Standard error of 0.9. In Ihube community, it can be seen that 0 (0%) of participants aged 5 – 14, 15 – 24, 75 – 84 and 7 (36.8%) of participants are within the age range of 35 – 44. With a total number of participants being 19, Mean of 41.6, Standard deviation of +/- 11.5 years and a Standard error of 0.8.

Table 2 represents the gender distribution of participants in Amuro community. Total number of male participants were 17 (50%) and that of female were 17 (50%). In Umulolo community, it showed that male

participants were a total number of 13 (59%) and that of female participants were 9 (41%). Amano community, comprises of males 10 (83%) and females 2 (17%). 17 participants in Umuokpara community comprising of males 14 (82%) and females 3 (18%) and 19 participants in Ihube community comprising of males 15 (79%) and females 4 (21%).

Table 3 shows the refractive error distribution in Onchocerciasis in Amuro community. 10 participants had myopia, 10 had hyperopia, 2 had astigmatism and 28 ad presbyopia. In Umulolo community, 8 participants had myopia, 4 had hyperopia, 3 had astigmatism, and 16 had presbyopia. In Amano community, 6 participants had myopia, 4 had hyperopia, 3 had astigmatism, and 8 had presbyopia. In Umuokpara community, 12 participants had myopia, 4 had hyperopia, 4 had astigmatism, and 12 had presbyopia. In Ihube community, 10 participants had myopia, 5 had hyperopia, 7 had astigmatism, and 11 had presbyopia.

Discussion

Okigwe is traversed by rivers and several fast flowing streams, and this is favorable for the transmission of onchocerciasis. The prevalence of clinical signs and manifestations was low in 5 of the studied communities as compared to baseline information in 1995. This agrees with previous studies [10,11,12] which showed a significant impact of the annual distribution of ivermectin in the sampled communities .

The present study showed a significant (P<0.05) difference in the refractive state of the eye in Amuro, Umulolo, Amano and Umuokpara community. This is contrary to the stipulations of a past study by Umeh, who said that refractive error was non-onchocerciasis related. This discrepancy can be due to the fact that the past study[13] did not pay sufficient attention to refractive error as a supposed ocular manifestation of onchocerciasis. It was observed that presbyopia had the highest occurrence; this can be as a result of the higher number of older adults than young adults and children in the study, followed by myopia, and hyperopia (in Amuro, Umulolo and Amano). Astigmatism had the least occurrence in Amuro, Umulolo and Amano community.

There was no statistical significant difference (P>0.05) in the refractive state of the eye in Ihube. Although it was observed that presbyopia had the highest prevalence and hyperopia had the least prevalence.

Though the present study correlated with previous studies[14,15] with regards to visual

impairment caused by onchocerciasis and sex-related prevalence showing that males were more exposed to the disease correlated with past studies[10,11,14,15,16,17,18,19], the current study focused and directly worked on refractive error and onchocerciasis. The prevalence of the disease increased steadily with increasing age. This agrees with past findings [14,15], this may be because older individuals have been exposed throughout their lives and that they are more exposed to the vectors because of their occupations, mostly as farmers in the fields and fishermen, as opposed to children who spent more time in school.

In the course of the study it was observed that the higher the microfilariae density, the higher the manifestation on the skin and therefore the higher the ocular manifestation. It was observed that occupation was a predisposing factor in onchocerciasis infection. It was observed that farmers had a higher prevalence of the infection than other occupation groups. This was in accordance with a previous study by [20].

Conclusion

The present study appears to be the first attempt to correlate ocular onchocerciasis with refractive errors. Although, the result from the study showed a decline in infection rate in the 5 studied communities but the presence of positive diagnosis suggests of a continuous disease transmission and onchocerciasis is not yet fully eliminated in Okigwe. With sustained high coverage of ivermectin mass drug administration by African Programme for Onchocerciasis Control (APOC), onchocerciasis prevalence would be eliminated. There was a higher prevalence of presbyopia in all five communities and the least prevalence of hyperopia in Ihube and Umuokpara and astigmatism in Amuro, Umulolo, Amano and Umuokpara. There was a statistically significant difference between the eye's refractive state in onchocerciasis in Amuro, Umuokpara and Umulolo. There was no statistical significant difference found in Ihube and Amano.

Acknowledgement

Conflict of Interest

The authors declare that there is no conflict of interest.

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Tables

TABLE 1: AGE DISTRIBUTION OF OCULAR ONCHOCERCIASIS

AMURO COMMUNITY

Age (Years)	No Examined	Frequency (+ve)	Frequency(Ocular +ve)	Percentage Frequency(Ocular +ve)
5 – 14	32	1	0	0%
15 - 24	14	0	0	0%
25 - 34	12	4	4	11.8%
35 – 44	15	10	8	23.5%
45 – 54	41	12	12	35.3%
55 - 64	24	5	3	8.8%
65 – 74	21	7	7	20.6%
75 – 84	0	0	0	0%
Total	**159**	**39**	**34**	**100%**

UMULOLO COMMUNITY

Age (Years)	No Examined	Frequency (+ve)	Frequency (Ocular +ve)	Percentage Frequency (Ocular +ve)
5 – 14	6	0	0	0%
15 – 24	9	1	1	4.5%
25 – 34	10	6	3	13.6%
35 – 44	10	4	4	18.2%
45 – 54	24	10	10	45.5%
55 – 64	14	5	4	18.2%
65 – 74	2	0	0	0%
75 – 84	0	0	0	0%
Total	**75**	**26**	**22**	**100%**

AMANO COMMUNITY

Age (Years)	No Examined	Frequency (+ve)	Frequency (Ocular +ve)	Percentage Frequency (Ocular +ve)
5 – 14	20	1	1	8.3%
15 – 24	0	0	0	0%
25 – 34	15	2	1	8.3%
35 – 44	19	7	7	58.3%
45 – 54	6	3	3	25.0%
55 – 64	0	0	0	0%
65 – 74	0	0	0	0%
75 – 84	0	0	0	0%
Total	**60**	**13**	**12**	**100%**

UMUOKPARA COMMUNITY

Age (Years)	No Examined	Frequency (+ve)	Frequency (Ocular +ve)	Percentage Frequency (Ocular +ve)
5 – 14	10	0	0	0%
15 – 24	19	2	2	11.8%
25 -34	15	1	1	5.9%
35 – 44	18	3	2	11.8%
45 – 54	17	6	5	29.4%
55 – 64	20	6	6	35.3%
65 – 74	0	0	0	0%
75 – 84	3	1	1	5.9%
Total	**102**	**19**	**17**	**100%**

IHUBE COMMUNITY

Age (Years)	No Examined	Frequency (+ve)	Frequency (Ocular +ve)	Percentage Frequency (Ocular +ve)
5 – 14	7	0	0	0%
15 – 24	1	0	0	0%
25 – 34	12	6	6	31.6%
35 – 44	15	7	7	36.8%
45 – 54	14	4	3	15.8%
55 – 64	10	2	2	10.5%
65 – 74	7	1	1	5.3%
75 – 84	0	0	0	0%
Total	**66**	**20**	**19**	**100%**

TABLE 2: AGE AND GENDER DISTRIBUTION OF OCULAR ONCHOCERCIASIS

AMURO COMMUNITY

Age (Years)	Male No Examined	Male No +ve (%)	Male No Ocular +ve (%)	Female No Examined	Female No +ve (%)	Female No Ocular +ve (%)
5 – 14	9	0(0%)	0(0%)	23	1(4.5%)	0(0%)
15 – 24	7	0(0%)	0(0%)	7	0(0%)	0(0%)
25 – 34	10	4(23.5%)	4(23.5%)	2	0(0%)	0(0%)
35 – 44	7	1(5.9%)	1(5.9%)	8	9((40.9%)	7(41.2%)
45 – 54	15	5(29.4%)	5(29.4%)	26	7(31.8%)	7(41.2%)
55 – 64	9	0(0%)	0(0%)	15	5(22.7%)	3(17.6%)
65 – 74	7	7((41.2%)	7(41.2%)	14	0(0%)	0(0%)
75 – 84	0	0(0%)	0(0%)	0	0(0%)	0(0%)
Total	**64**	**17 (100%)**	**17 (100%)**	**95**	**22 (100%)**	**17 (100%)**

UMULOLO COMMUNITY

Age (Years)	Male No Examined	Male No +ve (%)	Male No Ocular +ve (%)	Female No Examined	Female No +ve (%)	Female No Ocular +ve (%)
5 – 14	4	0(0%)	0 (0%)	2	0(0%)	0 (0%)
15 – 24	0	0(0%)	0 (0%)	9	1(8.3%)	1(11.1%)
25 – 34	6	2(14.3%)	2(15.4%)	4	4(33.3%)	1(11.1%)
35 – 44	6	4(28.6%)	4(30.8%)	4	0(0%)	0 (0%)
45 – 54	10	5(35.7%)	5(38.5%)	14	5(41.7%)	5(55.6%)
55 – 64	9	3(21.4%)	2(15.4%)	5	2(16.7%)	2(22.2%)
65 – 74	0	0(0%)	0 (0%)	2	0(0%)	0 (0%)
75 – 84	0	0(0%)	0 (0%)	0	0(0%)	0 (0%)
Total	35	14 (100%)	13 (100%)	40	12 (100%)	9 (100%)

AMANO COMMUNITY

Age (Years)	Male No Examined	Male No +ve (%)	Male No Ocular +ve (%)	Female No Examined	Female No +ve (%)	Female No Ocular +ve (%)
5 – 14	15	0(0%)	0 (0%)	5	1(33.3%)	1 (50%)
15 – 24	0	0(0%)	0 (0%)	0	0(0%)	0 (0%)
25 – 34	10	1(10%)	1(10%)	5	1(33.3%)	0 (0%)
35 – 44	16	6(60%)	6(60%)	3	1(33.3%)	1 (50%)
45 – 54	6	3(30%)	3 (30%)	0	0(0%)	0 (0%)
55 – 64	0	0(0%)	0 (0%)	0	0(0%)	0 (0%)
65 – 74	0	0(0%)	0 (0%)	0	0(0%)	0 (0%)
75 – 84	0	0(0%)	0 (0%)	0	0(0%)	0 (0%)
Total	47	10 (100%)	10 (100%)	13	3 (100%)	2 (100%)

UMUOKPARA COMMUNITY

Age (Years)	Male No Examined	Male No +ve (%)	Male No Ocular +ve (%)	Female No Examined	Female No +ve (%)	Female No Ocular +ve (%)
5 – 14	5	0(0%)	0(0%)	5	0(0%)	0(0%)
15 – 24	10	2(13.3%)	2(14.3%)	9	0(0%)	0(0%)
25 – 34	5	0(0%)	0(0%)	10	1(25%)	1(33%)
35 – 44	10	0(0%)	0(0%)	8	3(75%)	2(67%)
45 – 54	7	6(40%)	5(35.7%)	10	0(0%)	0(0%)
55 – 64	12	6(40%)	6(42.9%)	8	0(0%)	0(0%)
65 – 74	0	0(0%)	0(0%)	0	0(0%)	0(0%)
75 – 84	1	1(6.7%)	1(7.1%)	2	0(0%)	0(0%)
Total	50	15 (100%)	14 (100%)	52	4 (100%)	3 (100%)

IHUBE COMMUNITY

Age (Years)	Male No Examined	Male No +ve (%)	Male No Ocular +ve (%)	Female No Examined	Female No +ve (%)	Female No Ocular +ve (%)
5 – 14	5	0(0%)	0 (0%)	2	0(0%)	0 (0%)
15 – 24	0	0(0%)	0 (0%)	1	0(0%)	0 (0%)
25 – 34	7	5(33.3%)	5(33.3%)	5	1(20%)	1(25%)
35 – 44	11	5(33.3%)	5(33.3%)	4	2(40%)	2(50%)
45 – 54	4	2(13.3%)	2(13.3%)	10	2(40%)	1(25%)
55 – 64	8	2(13.3%)	2(13.3%)	2	0(0%)	0 (0%)
65 – 74	7	1(6.7%)	1(6.7%)	0	0(0%)	0 (0%)
75 – 84	0	0(0%)	0 (0%)	0	0(0%)	0 (0%)
Total	**42**	**15 (100%)**	**15 (100%)**	**24**	**5 (100%)**	**4 (100%)**

TABLE 3: DISTRIBUTION OF REFRACTIVE ERROR IN OCULAR ONCHOCERCIASIS

AMURO COMMUNITY

Age (Years)	No +ve	Myopia	Hyperopia	Astigmatism	Presbyopia
5 – 14	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
15 – 24	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
25 – 34	4 (12%)	2 (20%)	1 (10%)	1 (50%)	0 (0%)
35 – 44	8 (23%)	0 (0%)	3 (30%)	0 (0%)	6 (21%)
45 – 54	12 (35%)	7 (70%)	5 (50%)	0 (0%)	12 (43%)
55 – 64	3 (9%)	0 (0%)	1 (10%)	0 (0%)	3 (11%)
65 – 74	7 (21%)	1 (10%)	0 (0%)	1 (50%)	7 (25%)
75 – 84	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	**34 (100%)**	**10 (100%)**	**10 (100%)**	**2 (100%)**	**28 (100%)**

UMULOLO COMMUNITY

Age (Years)	No +ve	Myopia	Hyperopia	Astigmatism	Presbyopia
5 – 14	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
15 – 24	1 (5%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)
25 – 34	3 (14%)	1 (12.5%)	1 (25%)	0 (0%)	0 (0%)
35 – 44	4 (18%)	1 (12.5%)	0 (0%)	2 (67%)	3 (19%)
45 – 54	10 (45%)	4 (50%)	2 (50%)	0 (0%)	10 (62%)
55 – 64	4 (18%)	2 (25%)	0 (0%)	1 (33%)	3 (19%)
65 – 74	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
75 – 84	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	**22 (100%)**	**8 (100%)**	**4 (100%)**	**3 (100%)**	**16 (100%)**

AMANO COMMUNITY

Age (Years)	No +ve	Myopia	Hyperopia	Astigmatism	Presbyopia
5 – 14	1(8%)	0 (0%)	1 (25%)	1 (33.3%)	0 (0%)
15 – 24	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
25 – 34	1 (8%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)

Age (Years)	No +ve	Myopia	Hyperopia	Astigmatism	Presbyopia
35 – 44	7 (59%)	4 (67%)	2 (50%)	1 (33.3%)	5 (63%)
45 – 54	3 (25%)	2 (33)	0 (0%)	1 (33.3%)	3 (37%)
55 – 64	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
65 – 74	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
75 – 84	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	**12 (100%)**	**6 (100%)**	**4 (100%)**	**3 (100%)**	**8 (100%)**

UMUOKPARA COMMUNITY

Age (Years)	No +ve	Myopia	Hyperopia	Astigmatism	Presbyopia
5 – 14	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
15 – 24	2 (12%)	0 (0%)	1 (25%)	1 (25%)	0 (0%)
25 – 34	1 (6%)	1 (8%)	0 (0%)	1 (25%)	0 (0%)
35 – 44	2 (12%)	2 (17%)	0 (0%)	1 (25%)	0 (0%)
45 – 54	5 (29%)	3 (25%)	2 (50%)	0 (0%)	5 (42%)
55 – 64	6 (35%)	5 (42%)	1 (25%)	0 (0%)	6 (50%)
65 – 74	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
75 – 84	1 (6%)	1 (8%)	0 (0%)	1 (25%)	1 (8%)
Total	**17 (100%)**	**12 (100%)**	**4 (100%)**	**4 (100%)**	**12 (100%)**

IHUBE COMMUNITY

Age (Years)	No +ve	Myopia	Hyperopia	Astigmatism	Presbyopia
5 – 14	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
15 – 24	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
25 – 34	6 (32%)	3 (30%)	1 (20%)	2 (29%)	0 (0%)
35 – 44	7 (37%)	2 (20%)	3 (60%)	2 (29%)	5 (46%)
45 – 54	3 (16%)	3 (30%)	0 (0%)	1 (14%)	3 (27%)
55 – 64	2 (10%)	1 (10%)	1 (20%)	1 (14%)	2 (18%)
65 – 74	1 (5%)	1 (10%)	0 (0%)	1 (14%)	1 (9%)
75 – 84	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	**19 (100%)**	**10 (100%)**	**5 (100%)**	**7 (100%)**	**11 (100%)**