Prevalence of Refractive Error Among the People of Tembisa Township, South Africa

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ABSTRACT

Purpose: To determine the prevalence and types of refractive errors in persons aged 11 years and older in the Tembisa Township, Gauteng Province, South Africa.

Methods: This cross-sectional study was based at the private optometry practice in Thembisa township, Gauteng province of South Africa. A total of 72 patients were found to have refractive errors out of the 100 patients who were screened, the other 28 patients were found to be emmetropes. Refractive error data were obtained by performing a comprehensive eye examination using an autorefractor & keratometer, fundus camera, slit lamp, retinoscopy, and subjective refraction. Unaided and aided visual acuity were assessed from Snellen chart 3M (projector illuminated chart).

Results: A sample comprised of 100 eligible persons who were screened and thoroughly examined. The ages varied from 11 to 82 years, with a mean age of 38.87. The study discovered 72% overall prevalence of refractive error, out of the 100 participants that were examined, 28% of the participants were emmetropes who did not need any optical correction. An important finding is that an alarming proportion (86.11%) of these refractive errors were not corrected, and only 13,89% had their old pair of spectacle correction. From the 72%, the most common refractive error was presbyopia (43%), followed by hyperopic astigmatism (19.44%), myopia astigmatism (13.90%), simple astigmatism (11.11%), myopia (6.95%), and hyperopia was the lowest refractive error at 5.60%. There was a remarkable number of 65.30% of females and 34.70% was males. Lack of awareness was reported among 58% as the hindrance to correcting refractive errors.

Conclusion: A significant finding is that most of the refractive errors were uncorrected because these people were not addressing eye care as part of priority to their health program as it is supposed to be done. This should be enforced. Most of them upon screening, they looked surprised that they had uncorrected refractive errors. This study showed that there is a need for interventions to reduce refractive error in the Tembisa township as well as in other surrounding areas affected by the lack of access to affordable eye care services.

Keywords: *Uncorrected refractive errors, refractive errors, lack of awareness,*

INTRODUCTION

Most people in townships or semi-urban areas also have eye problems but some do not seem to address or correct the refractive errors immediately, unless they are confronted, or an opportunity is afforded to them. For disadvantaged communities, affordability and accessibility for eye care facilities seem to be the hindrance to correcting the refractive errors. The prevalence of uncorrected refractive errors in urban areas should be well recorded in South Africa in order to provide more information for future researchers, as uncorrected refractive errors still remain a challenge globally.

Naidoo et al. (2014) mentions that refractive error affects people of all ages, socio-economic status and ethnic groups. His research continues to indicate that worldwide, 32.4 million people are blind, and 191 million people have vision impairment. The definition of vision impairment is based on distance visual acuity only, and uncorrected distance refractive error (mainly myopia) is the main leading cause of vision impairment globally. However, considering near visual impairment, it is also showing that even more people are affected. It is estimated that the number of people affected with vision impairment which is caused by uncorrected hyperopia to have been 107.8 million (Bourne et al., 2013), and the number of people affected by uncorrected myopia was 517 million (Holden et al., 2008), giving a total of 624.8 million affected people.

Research Problem Statement

There has been a shortage of refractive error data in South Africa despite the Vision 2020 more than 15 years ago and during the 2007 Durban declaration on refractive error and service development (International Centre for Eye care Education, 2007). Nationally, very few studies have been reported on refractive errors. There are no reported refractive error studies among the townships of Johannesburg, where most middle to low income groups are located.

Research questions

– What is the prevalence of uncorrected refractive errors among the people of Tembisa, in Gauteng province, South Africa?

– What is the distribution of uncorrected refractive errors among the people of Tembisa, in the Gauteng province of South Africa?

– Is there any relationship between uncorrected refractive errors and demographic variables (sex and age) among the people of Tembisa, in the Gauteng of South Africa?

– What is the proportion of people who have visual/ocular complaints among the people who have uncorrected refractive errors in Tembisa, in the Gauteng of South Africa?

– What are the possible hindrances for not using optical corrections among the people who have uncorrected refractive errors in Tembisa, in the Gauteng province of South Africa?

Research objectives

To investigate the prevalence of uncorrected refractive error among the people of Tembisa, in the Gauteng province of South Africa.

To determine the distribution of uncorrected refractive errors among this group of population.

To determine the relationship between uncorrected refractive errors and demographic variables (sex and age) among said group of people.

To evaluate the proportion of people who have visual/ocular complaints among the people who have uncorrected refractive errors in the population mentioned above.

To determine possible hindrances for not using optical corrections among the said group of people.

LITERATURE REVIEW

According to Adigun et al. (2014), the prevalence of refractive errors and vision impairment can affect a person's ability to perform daily activities and also be a hindrance to social livelihood like sports and leisure in general. Naidoo and Jaggernath (2012) also discovered that distance refractive error which is not corrected can make a person not to participate in outdoor activities which mostly requires visual use. Vu et al. (2005) states that poor near vision can also affects an individual's school and work performance. Refractive errors which are not corrected has direct impact on local and global communities (Holden, Sulaiman and Knox, 2000). According to Fricke et al. (2012), uncorrected refractive error can lead to a loss of productivity which is around US $268.8 billion per year. Other factors that contribute to the rise in global vision impairment is: a lack of skilled eye health workers who can assist to address the current refractive challenges, poor integration of eye care services into existing eye health services and a limited number of good quality training programmes (Naidoo, Govender, Holden, 2014).

Refractive errors

Emmetropia is defined as an eye with no refractive error, whereas ametropia is referred to an eye with any refractive error. Refractive error/ametropia is an eye disorder that occurs when parallel rays of light entering a non-accommodating eye are not clearly focused on the retina. actually, ocular refractive errors refer to myopia, hyperopia, astigmatism and presbyopia. Myopia is also known as shortsightedness which is when a myopic eye struggles to see distance objects clearly. Hyperopia is also referred to as farsightedness. A hyperopic eye accommodates/focus in excess in order to keep the images of near or close-range objects clearer.

People affected with hyperopia can be subjected to headaches and eye strain. Astigmatism is known to cause to distorted blurry vision caused by an irregularity of the refractive media of the eye. Presbyopia is a gradual loss of the eye's ability to focus and perceive small prints at near, this is due to the intraocular lens which slowly loses its accommodative characteristics. Thus, this type of refractive error is related to the advanced age and mostly manifest around the age of 40 years. People with refractive errors might be affected by one or a combination of these conditions. It might be a simple myopia,

hyperopia, astigmatism, compound and/or mixed refractive errors. For example, an eye may have both myopia and astigmatism, and this combined is called myopic-astigmatism, and a person can have myopic-astigmatism and/or hyperopic astigmatism concurrently instead of having a simple myopia, hyperopia or astigmatism. A person can be affected by unequal and/or two differing refractive errors; thus, the condition is called anisometropia.

Refractive error measure

The distance visual acuity (VA) is based on an evaluation of the ability to perceive letters, numbers or figures on an eye chart at specified distances (O'Connor & Keeffe, 2007). Visual acuity of 6/6 is regarded as normal vision – and it actually means that a person with normal vision can see at 6 meters a letter on an eye chart which is made to be seen at 6 meters. Visual acuity can also be measured at near distance in inches. For example, with visual acuity of 20/40 a person is only able to perceive at 20 inches a letter on an eye chart that is made to be seen at 40 inches, and a visual acuity of 6/6 is considered an equivalent with that of 20/20.

Visual impairment due to refractive errors

Globally, refractive errors are accountable for an estimation of 153 million people who are visual impaired – meaning that they present with visual acuity of less than 6/18 in the better eye (WHO, 2006). Of those, 12.8 million are reported to be 5 to 15-year-old children (Ovenseri-Ogbomo and Omuemu, 2010). Many individuals with poor vision have a refractive error that can be corrected or improved by using spectacles, contact lenses or even laser surgery; however, low vision is another kind of vision impairment that entails irreversible vision loss (O'Connor and Keeffe, 2007). An uncorrected refractive error can lead to amblyopia and/or strabismus (Murthy, 2000).

Ovenseri-Ogbomo and Omuemu (2010) state that blindness is described in terms of visual acuity of less than 6/30 in the better eye, and low vision defined as visual acuity from 6/18 to 6/30 in the better eye. Without refractive error correction, distance vision impairment (presenting with visual acuity of less than 6/18) may limit visual function/performance (Smith et al., 2009). In South Africa, a driver's license cannot be issued to individuals with a visual acuity of 6/18 or less on the better eye. WHO (2001) recommends that in adult population, a visual impairment should be a visual acuity of less than 6/18 and in children a binocular vision with visual acuity of less than 6/12 to be considered significant.

Correction of Refractive Errors

According to WHO (2006), spectacles are the most commonly used optical devices to correct refractive errors, since they are cost effective, accessible and easy to manage compared to contact lenses and laser surgery. Al Rowaily and Alanizi (2010) emphasize that using optical devices like spectacles, contact lenses and even laser surgery can prevent vision loss.

Prevalence and distribution of refractive errors

Literature on refractive errors, uncorrected refractive errors as well as the distribution of such refractive errors were checked and studied in order to acquire more knowledge on the subjects. According to Naidoo et al. (2003), in South Africa, 4890 individuals

ranging from 5-15 years of age were tested during the Refractive Error Study in Children conducted in Durban. Following the RESC protocol, the testing of this "Refractive Error and Visual Impairment in South African children" door-to-door survey involved visual acuity measurements, cycloplegic auto-refraction and retinoscopy which are important to assess the presence of the refractive error and to recognize the kind of refractive errors; and the anterior segments, ocular media and the fundus were evaluated and the ocular motility were examined to establish any other possible causes of visual impairment. In this survey, the authors mentioned above estimated that of 191 eyes with reduced vision, 63.6% had refractive errors. Actually, from the 1.4% participants found with refractive errors, only 1.2% of individuals had refractive correction and 0.32% had best-corrected visual acuities of 20/40 or less, hence they were found to be visually impaired. They also noted that there was 7.3% amblyopia prevalence, retinal disorders in 9.9% and 3.7% prevalence of corneal opacity. It was therefore concluded that although reduced vision is low, most of it was as a result of the uncorrected refractive error.

Obstacles to correcting refractive errors

It has been indicated in the introductory chapter that most of the individuals have uncorrected refractive errors. Since knowledge on the obstacles is necessary in planning for eye care service delivery; the focus of this section will be to assess prior researchers' study on possible reasons for the refractive errors to stay uncorrected. On the topic of hindrances to refractive error correction, He et al. (2005) had noticed that although uncorrected refractive error is identified as the main cause of visual impairment in some individuals; and that correction of refractive error is easy, safe and effective, yet many people remain without necessary spectacles or other kinds of optical devices. Below are some of the possible barriers which might hinder the correction of refractive errors –and lead to visual impairment.

Lack of awareness

While investigating the global magnitude of visual impairment due to uncorrected refractive errors, Resnikoff et al. (2008) noticed that even among the wealthy societies, refractive errors still remained unnoticed or uncorrected, especially in children. The World Health Organization (2001) mentions lack of public awareness on the importance of eye care and of the availability of optical correction as a possible obstacle – which leads to uncorrected refractive errors. Resnikoff et al., (2008) explained that the lack of awareness and recognition of eye problem is at personal and family levels, as well as at community and public health levels.

Refractive service availability, accessibility and affordability

Dandona and Dandona (2001) recorded on the World Health Organization bulletin that giving spectacles seem difficult in several developing countries because of matters related to affordability and availability; which also to add that there were inequalities in the availability of optical services in urban and rural areas. It is also noted by the World Health Organization (2001) that most areas do not have sufficient eye care staff and/or the equipments required to perform eye examinations are unavailable. It is also estimated by Naidoo et al. (2010) that only 20% of those in need of distance visual

correction have access to spectacles in the developing countries.

Cultural-inclined issues and lack of compliance

WHO (2001) and the SFLRP working group had reported that, in some countries, there are cultural stigmas that discourage wearing spectacles; which may lead to noncompliance.

Ntsoane et al. (2012) studied about using public eye care services from the rural areas around the Capricorn district in the province of Limpopo in South Africa, where the study agreed with the international researchers who indicated that the barriers preventing people from using the eye care services is non-availability, poor accessibility of services, non-affordability, poor knowledge of available services as well as cultural-inclined issues.

METHODS AND MATERIAL

Research Methodology

This cross-sectional study was based at the private optometry practice in Thembisa township, Gauteng province of South Africa. A total of 72 patients were found to have refractive errors out of the 100 patients who were screened. The other 28 patients were found to be emmetropes. Refractive error data were obtained by performing a comprehensive eye examination using an autorefractor and keratometer, fundus camera, slit lamp, retinoscopy, and subjective refraction. Unaided and aided visual acuity were assessed from Snellen chart 6M (projector illuminated chart). The equipments used were the phoropter with LED chart.

The comprehensive eye examination was done to see the difference between participants having poor eyesight caused by uncorrected refractive errors instead of those with poor eyesight caused by other eye abnormalities. The intensive eye examination was also used as a procedure to establish and evaluate the amount of different kinds of refractive errors; as this was mandatory to identify the distribution of these refractive errors. The procedure started by screening the patient on the auto-keratorefractor and the fundoscopy. Then, the patient was given a brief explanation about the full procedure before taking their detailed case history. From the case history, the practitioner would then probe questions to establish the chief complaint and the general family health history. A full subjective refraction aided on the best distance and near visual acuity. Refractive error was then defined using spherical equivalents as myopia (<-0.5D), hyperopia (>+0.5D) and astigmatism was defined as cylindrical power equivalent to or greater than -0.5D in either eye. For mild to moderate cases spectacles were prescribed.

Inclusion and Exclusion criteria

Participants that were entering the testing facility who showed the prevalence of refractive errors after the vision screening (using the autorefractor) were considered for a comprehensive eye examination, and optical correction like spectacles or contact lenses were prescribed in order to correct the refractive error. Participants who had their previous eye test done for the past six months, or those who were discovered not to have eye problems or even those who were already wearing current spectacles were excluded from this study.

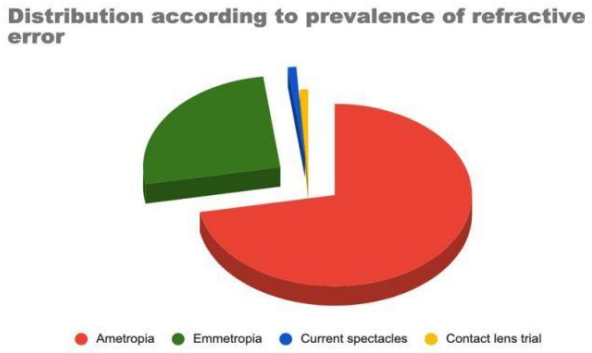
RESULTS

A sample comprised of 100 eligible persons who were screened and thoroughly examined. The ages varied from 11 to 82 years, with a mean age of 38.87. The study discovered 72% overall prevalence of refractive error, out of the 100 participants that were examined, 28% of the participants were emmetropes who did not need any optical correction. An important finding is that an alarming proportion (86.11%) of these refractive errors were not corrected, and only 13,89% had their old pair of spectacle correction. From that 72%, the most common refractive error was presbyopia (43%), followed by hyperopic astigmatism (19.44%), myopia astigmatism (13.90%), simple astigmatism (11.11%), myopia (6.95%), and hyperopia was the lowest refractive error at 5.60%. There was a remarkable number of 65.30% of females and 34.70% was males. There was a 52-year-old male patient who was further referred to an ophthalmologist due to a long-standing diabetic retinopathy, which was identified with a fundus camera.

Distribution of prevalence of the refractive error

Figure 1

Distribution of refractive error



The respondents of this study voluntarily entered the optometric practice as individuals and some as families who were visiting the shopping center, thus the sample frame composed of all ages. The randomly selected participants who made the sample frame were also individuals from both genders, i.e. female and male. The distribution of the gender between the participants showed that females were 69% (n=50) and the males were 34.7% (n=22).

The age of participants was ranging from 11 to 82 years old. As mentioned above, out of 100 participants, only 72 individuals participated in the vision screening. The response rate for study was only 72%; however, of those 28 participants that were not part of the refraction, 1 was only interested on contact lens trial, another 1 was already having spectacles which were recently made and the 26 participants did not have a significant need for spectacles; thus, the total number of willing and eligible participants was 72.

Distribution of refractive error by age

Figure 2

Distribution of refractive error by age

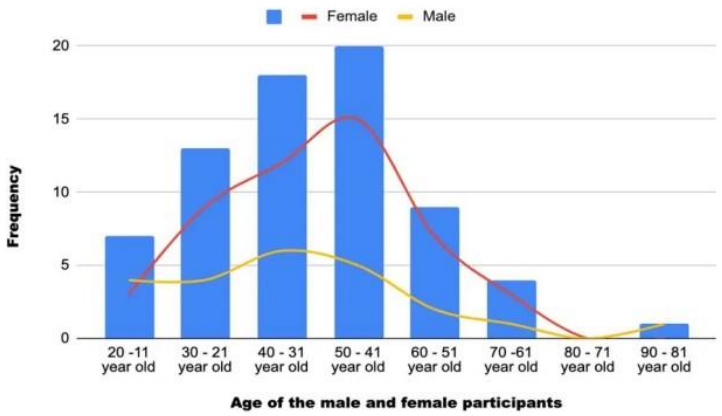
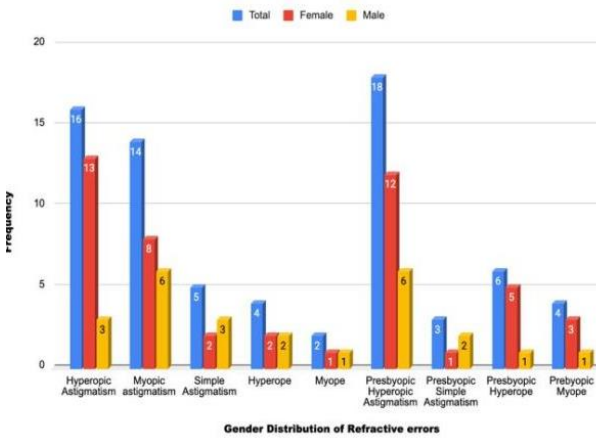


Figure 2 above displays the distribution of refractive errors by the ages of respondents and their genders. The age of each patient was recorded on the patient card. This was a very important requirement for the study in order to establish if age is associated with refractive error status between the patients. Their ages were recorded and evaluated in years. The patients ranged from 11 to 82 years in age, with the mean age of 38.87. The 82 years male was in the minority (n=1; 1.38%), yet those who were 40 to 50 years of age were in the majority (n=20; 27.77%), with 15 female (20.83%) and 5 (6.94%) male participants. The 31 to 40-year-olds were 18 (25%), with 12 (16,67%) female and 6 (8.33%) male participants, followed by those who are aged between 21 and 30 years who were 13 (18.05%), which had 9 females (12.50%) and 4 males (5.55%). Lastly, the youngest age group was between 11-20 years at 7 (9,72%), with 3 female (4,16%) and 4 male (5,55%).

Prevalence and distribution of uncorrected refractive errors

Figure 3

Distribution of refractive error according to gender

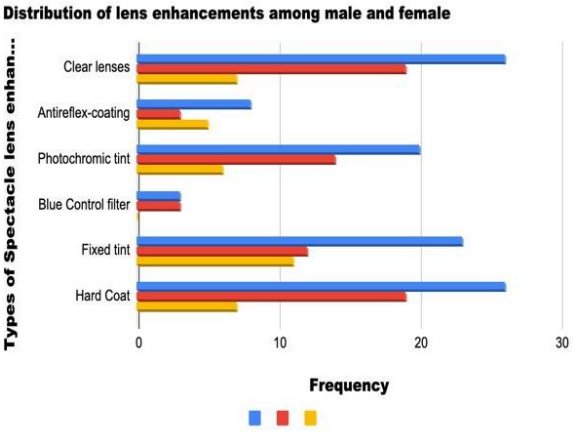


As shown on the graph in figure 3, data of all eligible participants were recorded during the eye examination and quantities on refractive status were established, and percentages were calculated. From the optometric practice, 100 participants were screened. Their ages varied from 11 to 82 years, with a mean age 38.87**.** The study discovered 72% overall prevalence of refractive error, out of the 100 participants that were examined, 28% of the participants were emmetropes who did not need any optical correction. An important finding is that an alarming proportion (86.11%) of these refractive errors were not corrected., and only 13,89% had their old pair of spectacle correction. From the 72%, the most common refractive error was presbyopia at 43.05%, overall myopia was at 30.55%, overall hyperopia was 27.22 %, followed by hyperopic astigmatism 19.44%, myopia astigmatism 13.90%, and simple astigmatism 11.11%. Lack of awareness was reported among 58% as the hindrance to correcting refractive errors.

Distribution of lens enhancements

Figure 4

Distribution of lens enhancements among the male and female participants

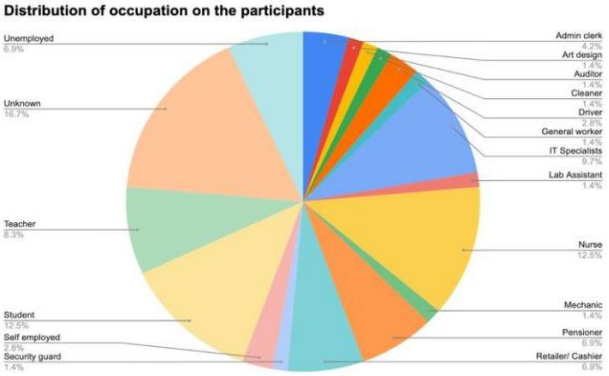


From the participants that were refracted and made spectacle correction, 25% (n=11 females and n=7 males) of them opted to have clear CR39 lenses and the other 75% of the participants who were in majority chose to have their optical lenses coated or tinted with lens enhancements. The distribution of the lens enhancement is as shown on figure 4 above, **Anti reflex coating** (n=8), **blue control filte**r (n=3), P**hotochromic** / sun active tint (n=20) and **fixed tints** (n=23). The orange bar represents the males, the red bar represents females and the blue is for total number per lens enhancements.

Distribution of refractive errors by occupation

Figure 5

Distribution of job occupation among participants

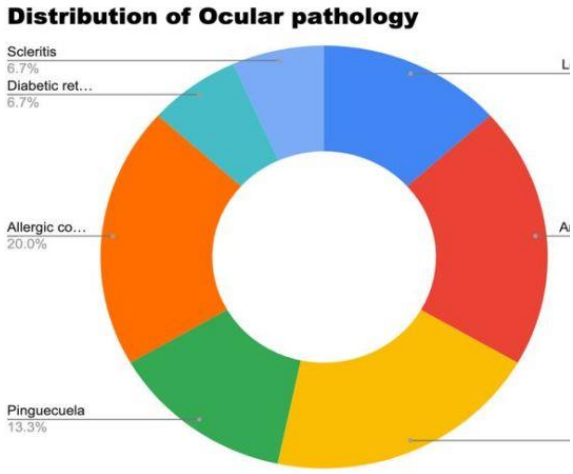


Analyzing the occupation of each individual is very important for the optometrist to best address their individual needs and correct their refractive errors according to the relevant ergonomics. From figure 5 above, the majority of the participants who were examined were nurses and students at 12.5%, followed by IT Specialists (computer users) and the teachers were 8.3% of the 72 participants. Retailer / cashiers, pensioners and the unemployed group made 6.9% each. This group was followed by admin clerks at 4.2%. The drivers and the self-employed were both at 2.8% followed by the auditor, art designer, mechanic, security guard, lab assistant, cleaner and general worker who were all in minority at 1.4% each.

Distribution of ocular pathology

Figure 6

Distribution of ocular pathology

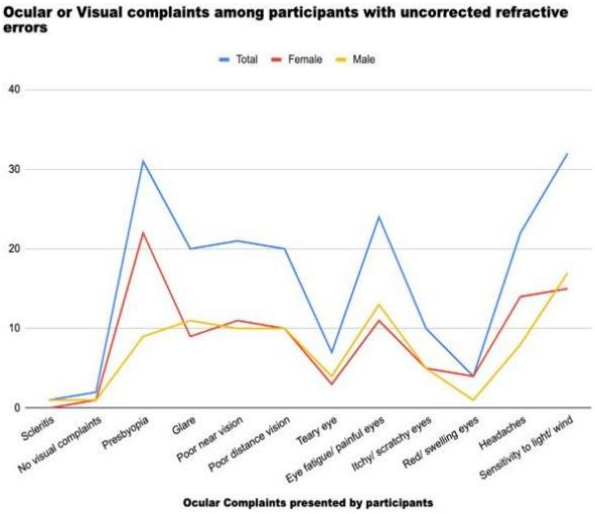


The dough nut chart above indicates different ocular pathologies which were observed and discovered during the comprehensive eye examination. A higher proportion of the participants presented with pterygium 20.0% (n=3 females), Arcus senilis 20.0% (n=1 female and n=2 males) and allergic conjunctivitis 20.0% (n=2 females and n=1 male). The other ocular abnormalities were lens opacities 13.3% (n=1 female and n=1 male) and pinguecula 13.3% (n=1 female and n=1). Lastly, a male participant presented with scleritis 6.7% (n=1) and another male participant who has been on diabetic medication for too long presented with early diabetic retinopathy, which we referred to the ophthalmologist. According to the case history, there were female participants who indicated that they are on chronic medication for Diabetes type I and II at 4.16% (n=3), Hypertensive at 5.55% (n=4) and anaemia 1.38% (n=1).

Visual/ocular complaints among respondents with uncorrected ametropia

Figure 7

Distribution of ocular or visual complaints among participants



To determine the number of participants who had visual/or ocular complaints, the participants

were questioned individually while recording their case history, this was done in order to self-report visual and/or ocular problems that they usually experience. The above graph presents the proportions of visual/ocular complaints among persons with uncorrected refractive errors. Some of these reported more than one complaint. Scleritis was reported to one main patient who presented with its symptoms. Poor vision was reported by 56.94% (n=41, 21 female and 20 males) ametropic respondents as a problem, while 33.3% (n=24, 11 females and 13 males) reported sore/fatigue/painful eyes, 9.7% (n=7, 3 female and 4 males) participants complained of watery eyes; 44.4% of sensitivity to sunlight (n=32, 15

females and 17 males); 30.55% (n=22, 14 females and 8 males) reported of having headaches; and 6.94 % (n=5, 4 females and 1 male) complained of red swelling eyes, and there were other respondents of 27.78 % (n=20, 9 females and 11 males) who were diagnosed with glare. These patients also mentioned that their eyes tend to be itching and/or scratchy eyes at 13.88% (n=10, 5 females and 5 males, however, two respondents at 2.77% (n=2, 1 male and 1 females) had no visual/ocular complaint. Lastly, 43.05% (n=31, 22 females and 9 males) we found to be having presbyopia.

REFERENCES

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Smith, J. A. (2005). *The Dynamics of Urbanization*. Academic Press.

Author, A. A. (Year of Publication). Title of book chapter. In B. B. Editor (Ed.), *Title of Book* (pp. xx-xx). Publisher.

Johnson, M. C. (2010). Urban trends in the 21st century. In S. R. Thompson (Ed.), *Cities: A Global Perspective* (pp. 45-67). Routledge.

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Williams, R. B., & Davis, C. D. (2018). Sustainable urban development: A comparative analysis. *Journal of Sustainable Cities*, *15*(2), 112-130. https://doi.org/10.1080/12345678.20

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APPENDIX