

Epidemiological Patterns of Ocular Morbidity Among Under-Five Children in Khartoum State-Sudan 2020

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Research

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Abstract

Background

Development of the visual system begins prenatally and continues after birth. Visual impairment in early childhood can significantly impair development of visual, motor, and cognitive functions and lead to adverse psychosocial consequences. This research objective is to study the epidemiological patterns of ocular morbidity among children aged less than five years old aiming to reveal information for prevention and control.

Methods

The study is a retrospective patient's records study carried out in three tertiary eye care hospitals in Khartoum State- Sudan. Records of all children attended in 2019 amounting 10886 were reviewed. The data had been summarized and analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0. The prevalence of under-five children was estimated in contrast to the overall population and as a proportion from the total children number. The patterns of ocular morbidity were identified according to type, age groups and gender.

Results

The prevalence of under- five children with ocular morbidity was 5% and they represented 45% of the total children below 16 years. The predominant age group affected with ocular morbidity was (3-5 years old with 53%). Eye infections affected (19%), allergic eye diseases (16.8%), orbital diseases (12.4%), refractive errors (10.8%), squint (9.3%), corneal diseases (6.6%), cataract (6%), glaucoma (2.3%), neurogenic eye (2%) and tumors (0.23%). There were some variations in morbidities according to age groups and gender among the study participants.

Conclusions

The proportion of under-five children is high. The predominant ocular morbidity affecting children of this age is eye infections, followed by allergic eye diseases and refractive errors while other serious blinding eye diseases mounted a considerable percentage. Although of small percentage but worth mentioning that malignant eye tumors were one of the patterns of ocular morbidities affecting under-five children. Patterns of ocular morbidity showed some gender variations.

Background

Development of the visual system begins prenatally and continues after birth. However, owing to how personal and subjective a person's sight is, children may not realize they have a vision problem.

At the early three years of age, vision improves rapidly over the first few months of their life, with the ability to judge distance (depth perception) develops at around five months of age. By two years of age, a

child's hand-eye coordination and depth perception should be well developed [1].

Between the 3-5 years of age, development of accommodative facility (ability of the eye/s to focus on stimuli at various distances and in different sequences in a given period of time), vergence ability (movement of both eyes in opposite directions to obtain or maintain single binocular vision) and eye movements continues until the child is around five years of age. Toys, games and playtime activities help this by stimulating the process of vision development [2].

There are many different eye conditions and diseases that can affect a child's vision. If an [eye condition is suspected](#) or if a child fails a [vision screening](#), he or she should be referred to a [pediatric ophthalmologist](#) to further evaluation and diagnosis. Early detection and treatment is so important to avoid lifelong visual impairments [3].

Visual impairment (VI) in early childhood can significantly impair development of visual, motor, and cognitive function and leads to adverse psychosocial consequences. For example, the Vision in Preschoolers study reported that VI from uncorrected hyperopia was associated with deficits in early literacy and in other essential skills for school readiness. More importantly, interventions such as spectacle correction in preschool children, have been shown to restore the visual-motor function of affected ametropic preschool children back to emmetropic levels [4-8].

Methods

The overall objective of this research was to study the epidemiological patterns of ocular morbidity among under-five years of age children. Children defined in this study are any person aged less than 16 years of age.

The study is a retrospective patient's records study carried out in three tertiary eye care hospitals in Khartoum State- Sudan. Records of all children attended in 2019 and count 10886 were reviewed.

Selection of the hospitals:

The three selected hospitals are highly specialized and equipped hospitals with electronic records system located in Khartoum State- Sudan. These hospitals are tertiary eye care hospitals with pediatrics ophthalmology departments, nine pediatric consultants' ophthalmologists and considered referral hospitals for pediatric ophthalmology in the country. The average children outpatient number among these hospitals is about 1500 child per month, and 200 pediatric eye surgeries are performed monthly there.

Review process:

The hospitals have electronic records encompasses all patients personal and medical records. The records were reviewed in two stages; the first one to estimate the number of under-five children and the second stage to identify the types and patterns of ocular morbidities among this age group. Age group

and gender were considered as key factors in the review process to be related to the proportion and type of disease.

Data management and analysis:

The data were sorted, cleaned, categorized, and summarized on master sheet and then analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0. The proportions were estimated, patterns of ocular morbidity were identified according to age groups and gender. The data were then presented in form of figures.

Ethics and permissions:

The study was reviewed and approved by Albasar Institutional Review Board. Permissions were obtained from each hospital for research conduction and publication of the results.

In this study anonymity of hospitals and patients personal information were of utmost importance. All necessary measures were taken to ensure confidentiality of the collected information. During the data collection, the records were never left unattended and they were stored in a locked room. Data were directly entered into a password protected electronic database.

Results

The prevalence of under-five children with ocular morbidity was 5% of the total population (Figure I) and 45% of the total children below 16 years (figure II). The predominant age group affected with ocular morbidity was (3-5 years old with 53%) (Figure III). The commonest eye disorder affecting this age group were eye infections (19%), allergic eye diseases (16.8%), orbital diseases (12.4%), refractive errors (10.8%), squint (9.3%), corneal diseases (6.6%), cataract (6%), glaucoma (2.3%), neurogenic eye (2%) and tumors (0.23%) (Figure IV). There were some variations in morbidities according to age groups and gender (Figure V).

Discussion

This research was conducted to study the epidemiological patterns of eye diseases among children below five years of age.

The male participants were a little more than females as the ratio was 1.1:1. Out of 10886 records, the prevalence of children below five years of age out of the total population was 5%. This is a considerable percentage of affected children at this age group. The age group of this study mounted about 45% of the total children affected with eye disorders, thus the under-five group is almost half of the total affected children. These results are coincidentally matching the result of study conducted in Ethiopia in which it revealed a percentage of 50% of ocular morbidity affecting the older children (6-15 years) [9].

The study revealed that, there are different patterns of eye diseases affecting children under-five years of age; they vary from simple to blinding diseases. The predominant eye problem affecting those children was eye infections amounting to almost 19% of the total affected participants. This group of eye diseases includes bacterial, viral and fungal eye infections. Different types of allergies were the second type of eye problems affecting the participants of this study and mounted about 17% of the total. Myopia, hyperopia and astigmatism were the third commonest type of eye disorders affecting children of under- five years of age.

Diseases of the orbit comprising lids, tear canals and eye globe represented a substantial amount among under-five children, it amounted a little more than 10%. The commonest form of this group of disorders is naso-orbital canal obstruction that might lead to serious complications if left untreated. Infection remains the major concern in such circumstance which may lead to cellulites, abscesses and brain involvement if left untreated. The other form of this group of eye diseases is lids swellings, whether infectious based or inflammatory in nature in addition to tumors. Almost the same pattern of eye diseases in this study was reported in a study conducted in rural Egyptians pre-school children. Their study found the highest percentage of ocular morbidity was refractive errors, unlike in this study where it was the third in order. Otherwise their study was matching the finding of this research ^[10].

More than 9% of the children under-five years of age were affected with squint disorders and 2.8% were affected with neurologically related eye disorders.

Cerebral visual impairment (due to damage to the visual pathways in the brain) is the leading cause of severe visual impairment and blindness in children in high-income countries. It is also an emerging cause in low-income countries, where a relatively high proportion is attributable to perinatal factors and so potentially avoidable through better perinatal care. Cerebral visual impairment may be missed because it usually affects children who also have other disabilities such as cerebral palsy or learning difficulties. A community-based study of cerebral palsy in Bangladesh showed that a third of children had reduced visual acuity and over half had visual perception problems which adversely affected their quality of life ^[11].

The study divulged that other serious eye problems that may cause some form of blindness; including corneal diseases, cataract retinal, glaucoma and retinal diseases were more than 15%. Among these blindness leading disorders, corneal diseases were on top representing 6.6%. Diseases affecting the cornea are considered serious as it is one of the most sensitive and exposed parts of the eye, it highly prone to trauma and infections which in some cases might lead to legal blindness. Therefore, cornea diseases are of concern to all ophthalmologists especially when occurred to this young group of patients. Following cornea diseases, cataract counted 6% of the total affected children of this study. Cataract, the commonest eye disease of all ages is as well has it's percentage among the young ages. Although cataract is a leading cause of blindness when affects both eyes, or one eye in case the other one affected with other blinding diseases, but the good thing is that it can be treated with relatively simple procedure and the outcome is usually satisfying. Studies discussed that congenital cataract and Retinopathy of

Prematurity (ROP) affect visual functions in very early ages and they can be prevented or treated. Modalities to prevent, diagnose and manage these conditions are available. Visual prognosis after cataract surgery in young children has improved considerably. But, congenital and infantile cataracts are still responsible for 10% of global childhood blindness and the leading cause of blindness in many countries of Africa [12, 13].

Glaucoma affected 2.3% of the under-five children in this study. In term of numbers, more than 250 children at this young age were at risk to serious vision loss. Glaucoma in children is a rare disease with variable incidence across countries and ethnic groups. The incidence of primary congenital glaucoma (PCG) in western countries, such as Ireland, Britain, and the USA, lies within 1 per 10–20,000 live births [14–18]. However, the incidence of glaucoma is higher in the Middle East, including Saudi Arabia, where consanguineous marriages are more prevalent. The estimated incidence of PCG in Saudi Arabia is 1 per 2500 live births [19, 20]. According to the congenital glaucoma registry at King Khaled Eye Specialist Hospital, the Southern region of Saudi Arabia has the highest prevalence rate of glaucoma (27.8%), followed by the Western province (23.6%) and the Central region (22.2%). However, the lowest prevalence was recorded in the Eastern province (11.1%) and the Northern Province (9%).

Although it might sound small amount, but it worth mentioning that 0.23% of the under- five children in this study were affected with eye malignant tumors with the predominant type of retinoblastoma. The eye tumors are very risky due to the link and narrow distance between the eye globes and brain that is already connected with the eye through the optic nerve and the retina making a good chance secondary involvement. Fabian and et al stated that retinoblastoma is the most common eye cancer of childhood. However, it is a relatively rare disease, occurring in approximately one out of every 16,000–18,000 live births in the global population. Its incidence is similar across populations, and does not vary according to gender, ethnicity or socio-economic status. Worldwide, approximately 8,000 children develop retinoblastoma each year, with the vast majority presenting with the disease before the age of 5 years [21].

The patterns of eye diseases according to child gender as yielded in this study showed some variations. The majority of eye diseases affected males more than females, including cataract, glaucoma, orbital diseases, infections, allergies, tumors and neurogenic eye disorders. Diseases that affected females more than males were retinal diseases, refractive errors and squint disorders. Although the males in this study were more than females but still from percentage point of view we will find that males were more affected with eye disease than females after considering the proportion of both genders. Males were more affected than females with ocular disorder in other study conducted by Demissie and et al as well [22].

Conclusions

The prevalence of under-five children affected with eye diseases was 5% of the total population and 45% of the total children. The predominant ocular morbidity affected this age group of children was eye infections, followed by allergic eye diseases and refractive errors while other serious and blinding eye

diseases mounted a considerable percentage. These serious diseases include orbital diseases, corneal diseases, cataract and glaucoma. Although of small percentage but worth mentioning that malignant eye tumors were one of the patterns of ocular morbidities affecting under-five children. Patterns of ocular morbidities showed some age and gender variations.

Abbreviations

VI: Visual impairment

SPSS: Statistical Package for the Social Sciences

ROP: Retinopathy of Prematurity

PCG: Primary Congenital Glaucoma

Declarations

Ethics approval and consent to participate

This research was reviewed and approved by Al-basar Institutional Review Board.

Ethical permissions were obtained from the hospitals administration.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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None.

Authors' contributions

MI collected, analyzed and interpreted the data and he wrote this manuscript.

HI reviewed the article and added valuable comments

AM reviewed the article and added valuable comments

All authors have read and approved the manuscript

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References

1. American Optometric Association. Infant vision: birth to 24 months of age. 2008: retrieved from: <https://www.aoa.org/patients-and-public/good-vision-throughout-life/childrens-vision/infant-vision-birth-to-24-months-of-age#1>. Accessed 2 January 2020.
2. The Pharmaceutical Journal. Vision and eye health in children. 2018: retrieved from: <https://www.pharmaceutical-journal.com/learning/learning-article/vision-and-eye-health-in-children/20205821.article?firstPass=false>. Accessed 2 January 2020.
3. American Academy of Pediatrics. Specific eye problems in children. 2017. retrieved from: <https://www.healthychildren.org/English/health-issues/conditions/eyes/Pages/Specific-Eye-Problems.aspx>. Accessed 10 January 2020.
4. Atkinson J, Anker S, Nardini M, et al. Infant vision screening predicts failures on motor and cognitive tests up to school age. *Strabismus*. 2002;10(3):187-198.
5. Ibironke JO, Friedman DS, Repka MX, et al. Child development and refractive errors in preschool children. *Optom Vis Sci*. 2011;88(2):181-187.
6. Roch-Levecq AC, Brody BL, Thomas RG, Brown SI. Ametropia, preschoolers' cognitive abilities, and effects of spectacle correction. *Arch Ophthalmol*. 2008;126(2):252-258.
7. Menon V, Saha J, Tandon R, Mehta M, Khokhar S. Study of the psychosocial aspects of strabismus. *J Pediatr Ophthalmol Strabismus*. 2002;39(4):203-208.
8. Kulp MT, Ciner E, Maguire M, et al; VIP-HIP Study Group. Uncorrected hyperopia and preschool early literacy: results of the Vision in Preschoolers-Hyperopia in Preschoolers (VIP-HIP) Study. *Ophthalmology*. 2016;123(4):681-689.
9. Mehari, Z. Pattern of childhood ocular morbidity in rural eye hospital, Central Ethiopia. *BMC Ophthalmology*. 2014: [org/10.1186/1471-2415-14-50](https://doi.org/10.1186/1471-2415-14-50)
10. Abuelela M, Aleieldin A, Aboelyamin H. Prevalence of eye and vision problems among rural Egyptian preschooler. *World Journal of Ophthalmology and Vision Research*. 2018: 1(1);doi:10.33552/WJOVR.2018.01.000504
11. Gillbert C, Bowman R, Malik A. The epidemiology of blindness in children: changing priorities. *Community Eye Health*. 2017: 30(100); 74-77.
12. Dobson V, Quinn GE, Summers CG, Hardy RJ, et al. Visual acuity at 10 years in Cryotherapy for Retinopathy of Prema-turity (CRYO-ROP) study eyes: effect of retinal residua of retinopathy of

- prematurity. *Arch Ophthalmol*. 2006 Feb;124(2):199–202.
13. Grant MB, Hansen R, Hauswirth WW, Hardy RJ, et al. Proceedings of the Third International Symposium on Retinopathy of Prematurity: an update on ROP from the lab to the nursery (November 2003, Anaheim, California) *Mol Vis*. 2006 May;23(12):532–580.
 14. Gencik A. Epidemiology and genetics of primary congenital glaucoma in Slovakia: description of a form of primary congenital glaucoma in gypsies with autosomal recessive inheritance and complete penetrance. *Dev Ophthalmol*. 1989;16:76–115.
 15. Gencik A., Gencikova A., Ferák V. Population genetical aspects of primary congenital glaucoma: I. Incidence, prevalence, gene frequency, and age of onset. *Hum Genet*. 1982;61:193–197.
 16. MacKinnon J.R., Giubilato A., Elder J.E., Craig J.E., Mackey D.A. Primary infantile glaucoma in an Australian population. *Clin Experiment Ophthalmol*. 2004;32(1):14–18.
 17. Sarfarazi M., Stoilov I., Schenkman J.B. Genetics and biochemistry of primary congenital glaucoma. *Ophthalmol Clin North Am*. 2003;16(4):543–554.
 18. Tamcelik N., Atalay E., Bolukbasi S., Capar O., Ozkok A. Demographic features of subjects with congenital glaucoma. *Indian J Ophthalmol*. 2014;62(5):565–569.
 19. Jaffar M.S. Raven Press; New York, NY:Care of the Infantile Glaucoma Patient. *Ophthalmology Annual*. 1988: pp. 15–37.
 20. Al-Rajhi A., Awad A., Badeeb O. Causes of blindness in students attending school for the blind in Saudi Arabia. *Saudi J Ophthalmol*. 2003;17:276–280.
 21. Fabian L, Sagoo M. Understanding retinoblastoma: epidemiology and genetics. *Community Eye Health*. 2018: 31(101); 7.
 22. Demissie B, Demissie B. Patterns of Eye Diseases in Children Visiting a Tertiary Teaching Hospital: South-western Ethiopia. *Ethiopian Journal of Health Sciences*. 2014: 24(1); 69-74

Figures

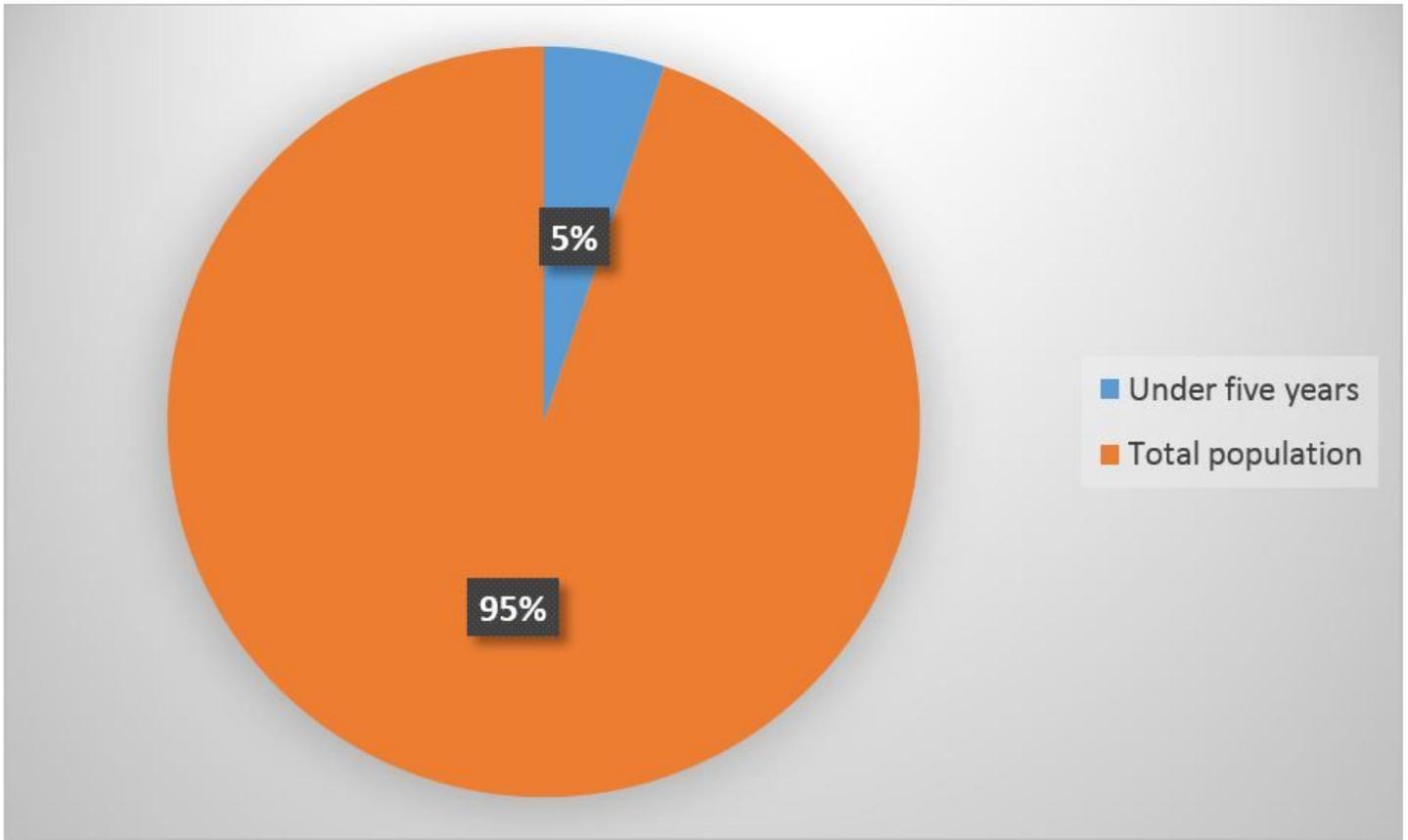


Figure 1

Proportion of under-five children in comparison to total population

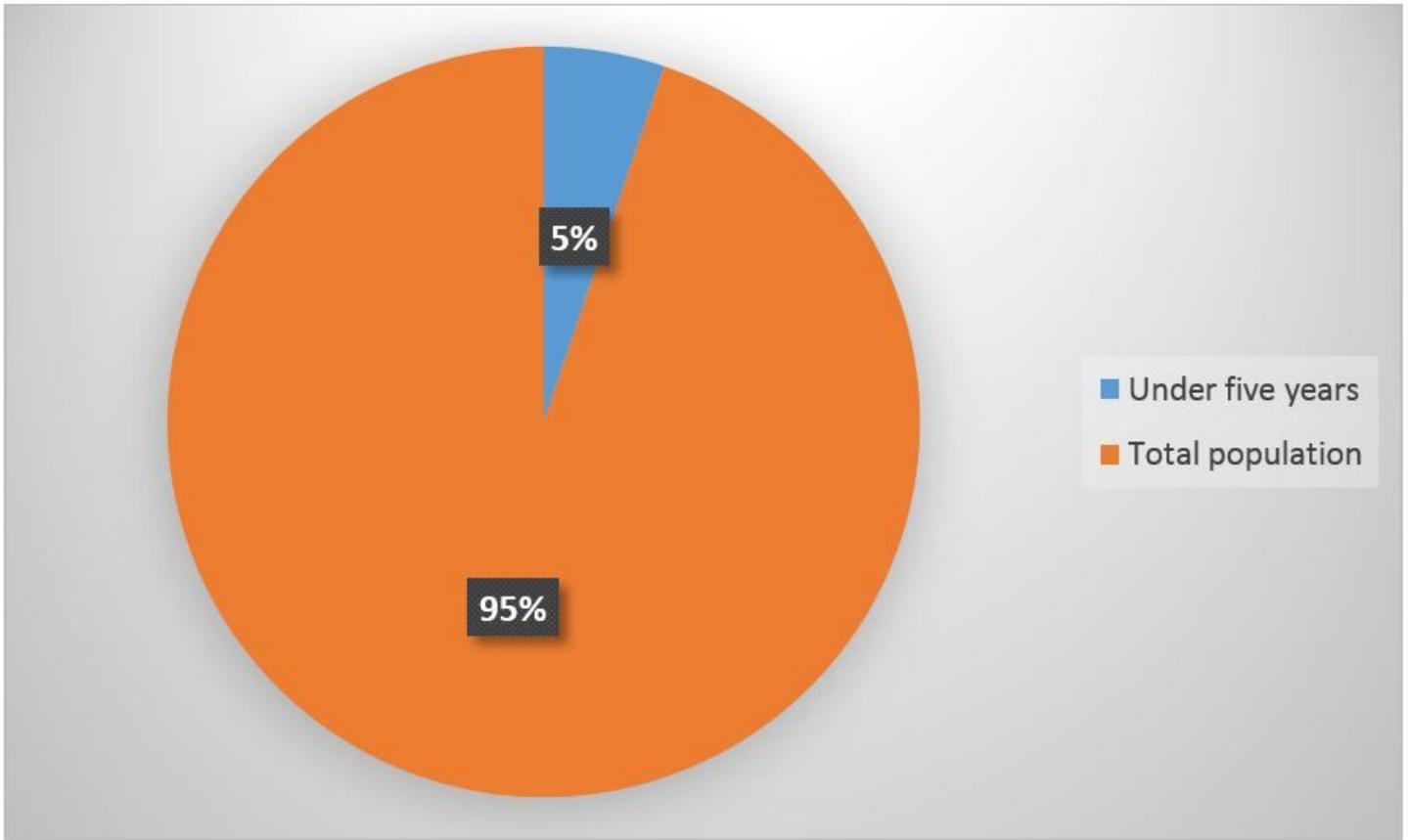


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Proportion of under-five children in comparison to total population

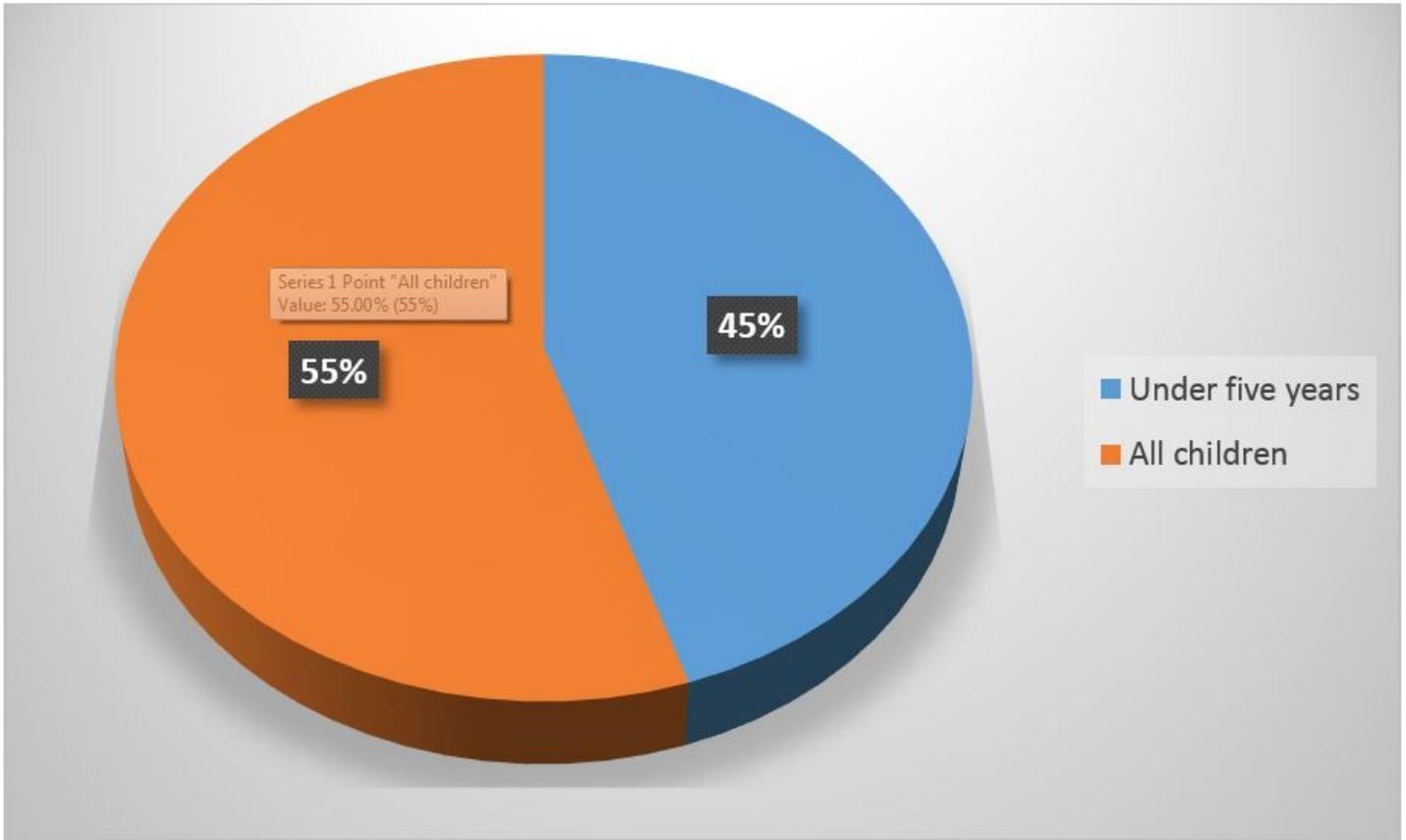


Figure 2

Proportion of under-five children in comparison to all children

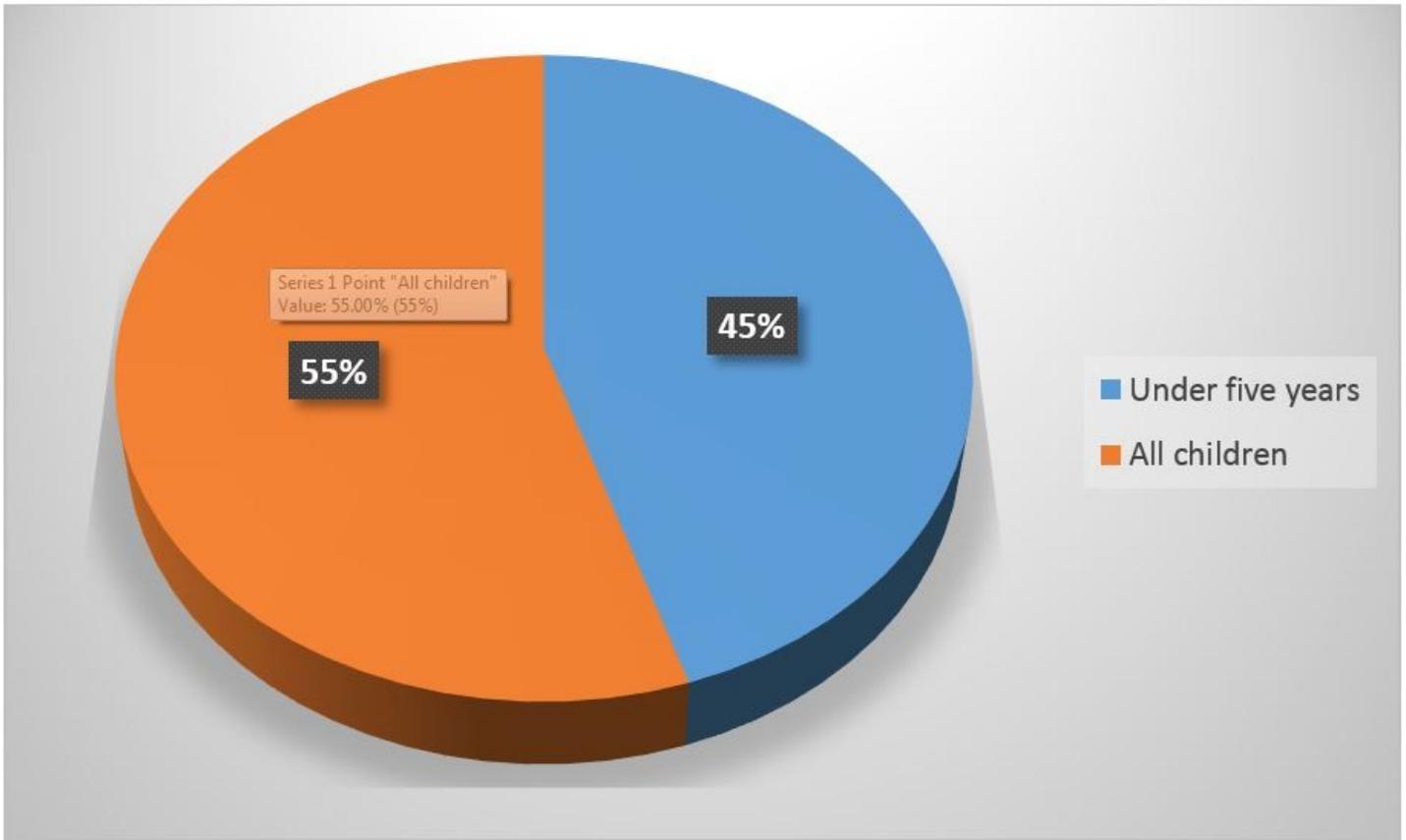


Figure 2

Proportion of under-five children in comparison to all children

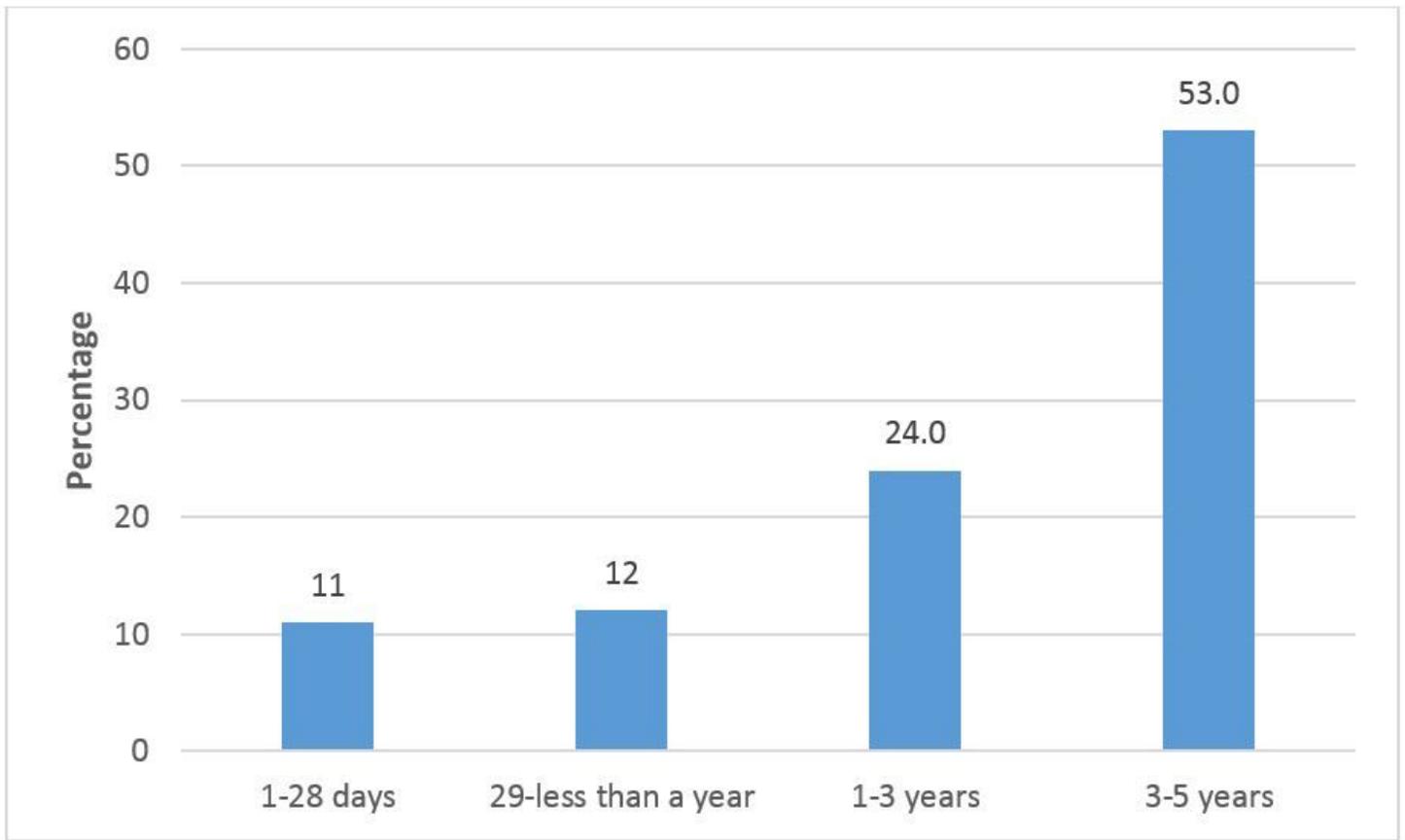


Figure 3

Age groups of under-five children

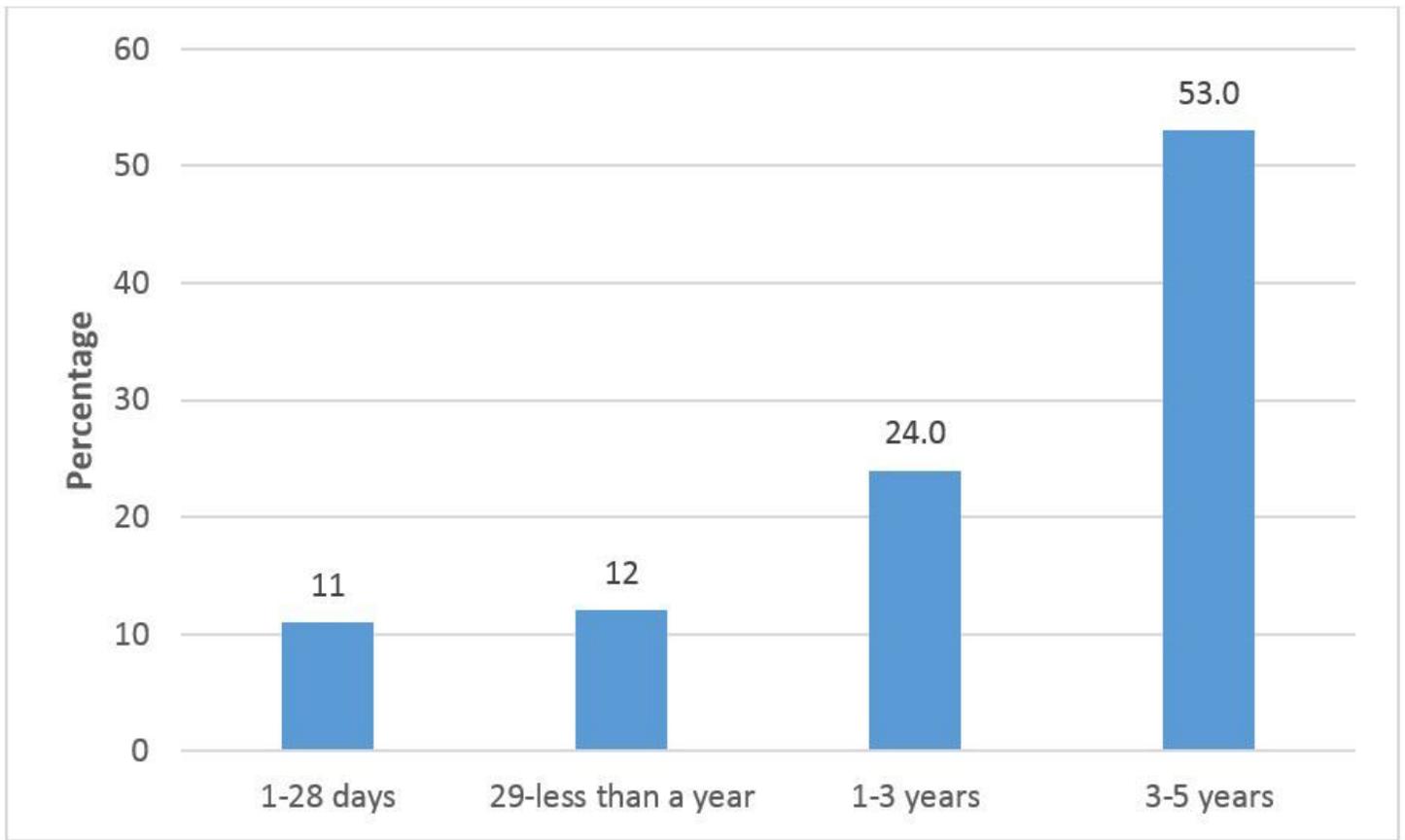


Figure 3

Age groups of under-five children

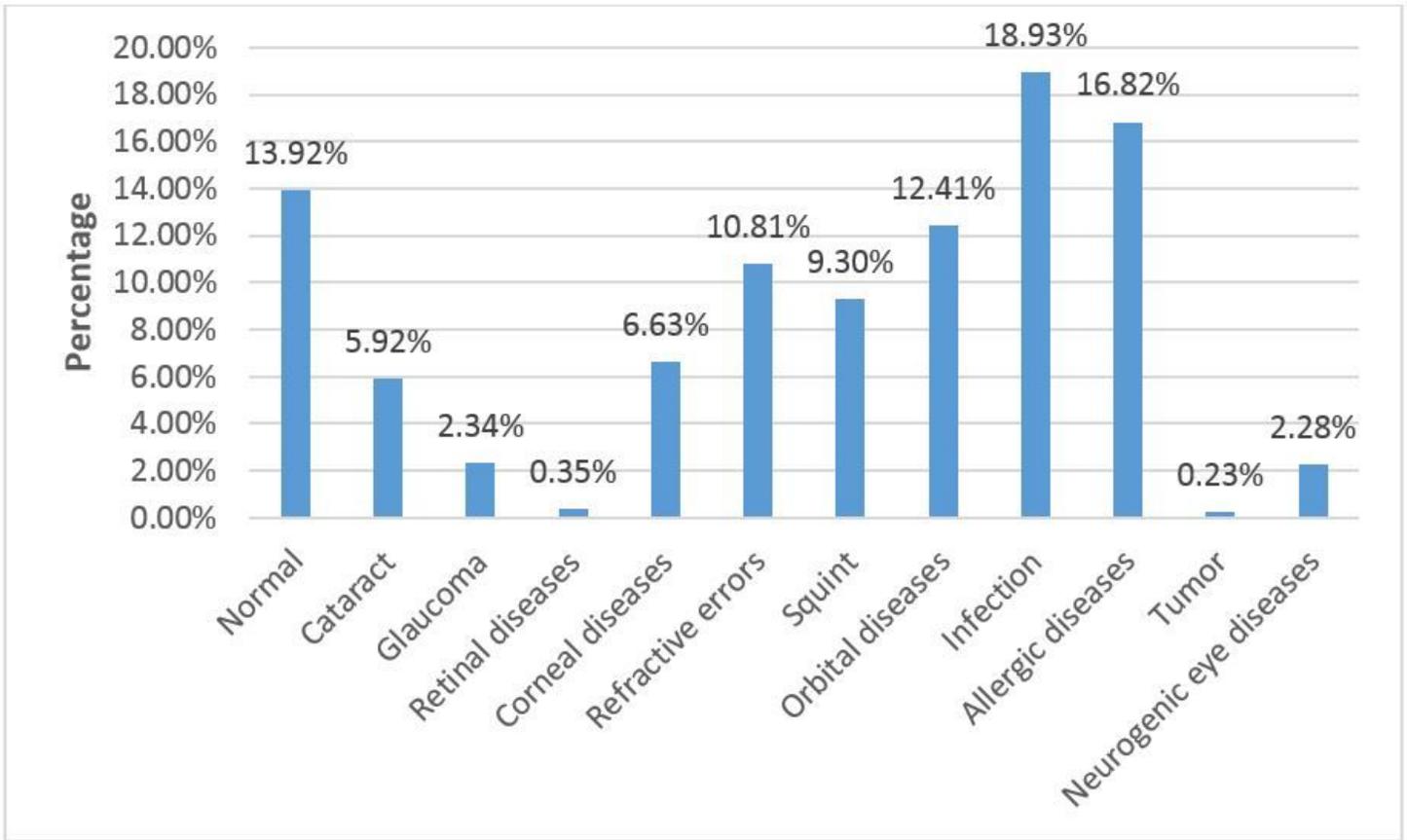


Figure 4

Type of ocular morbidity among under-five children

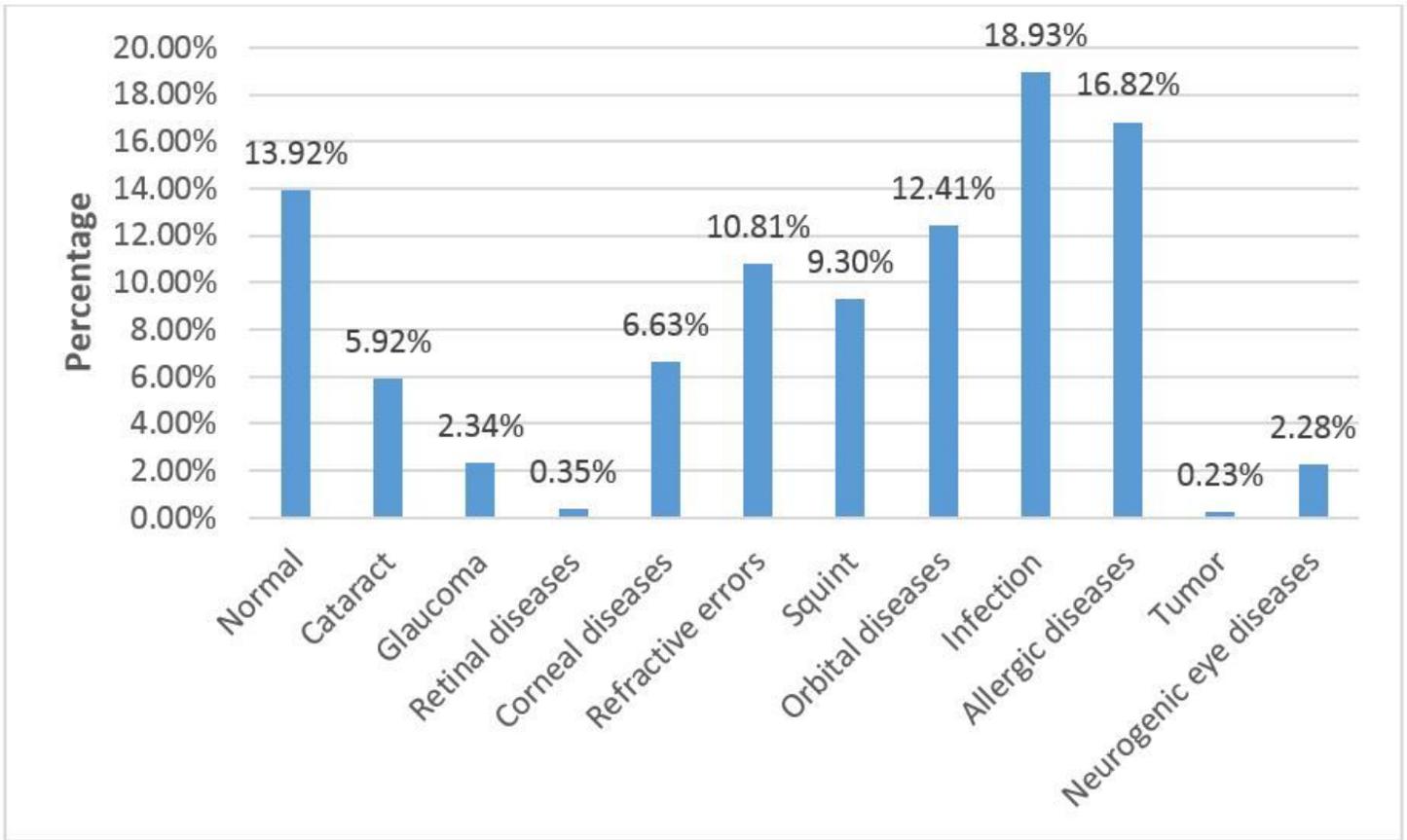


Figure 4

Type of ocular morbidity among under-five children

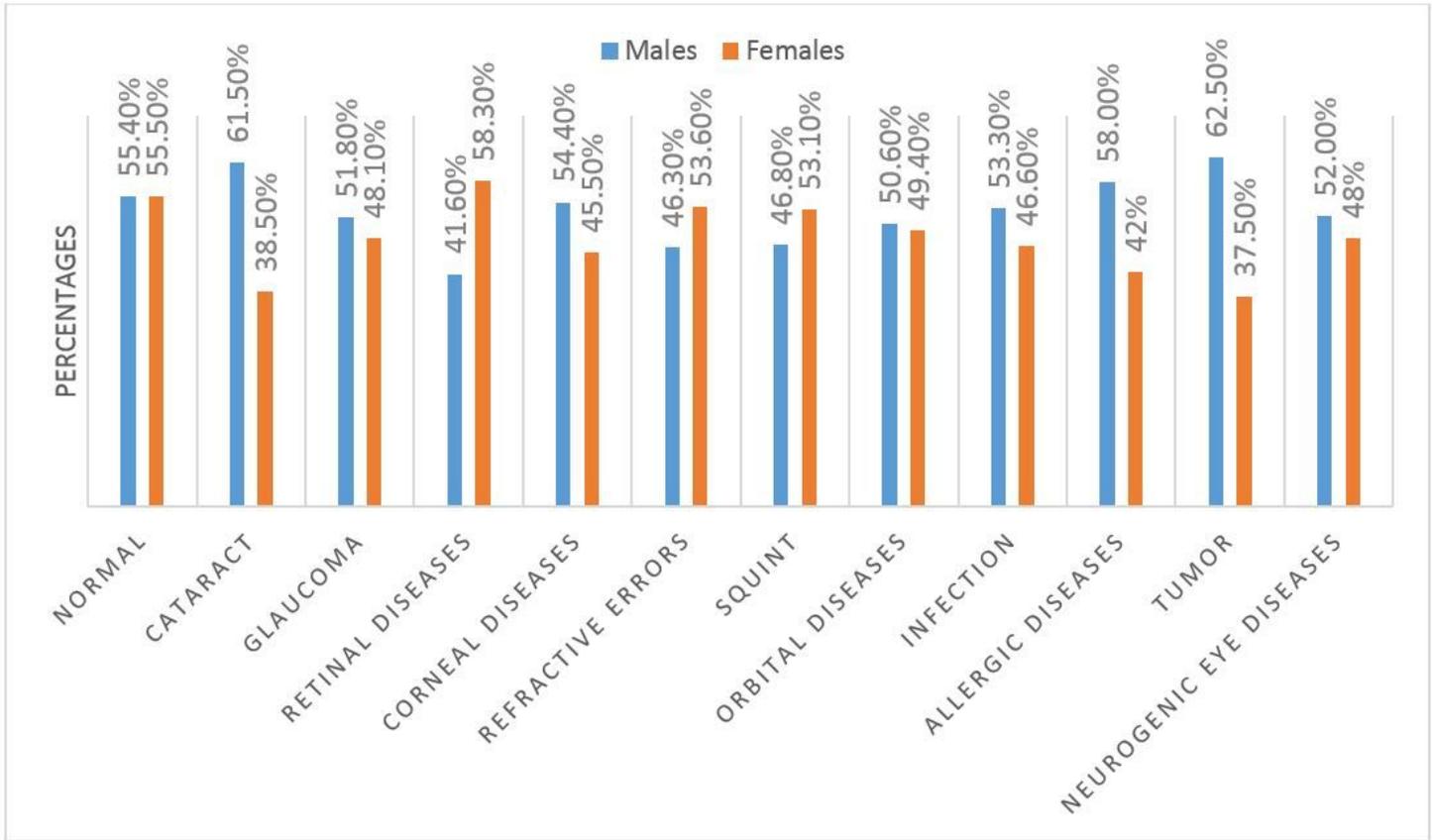


Figure 5

Variations in patterns of ocular morbidity according to gender among under-five children

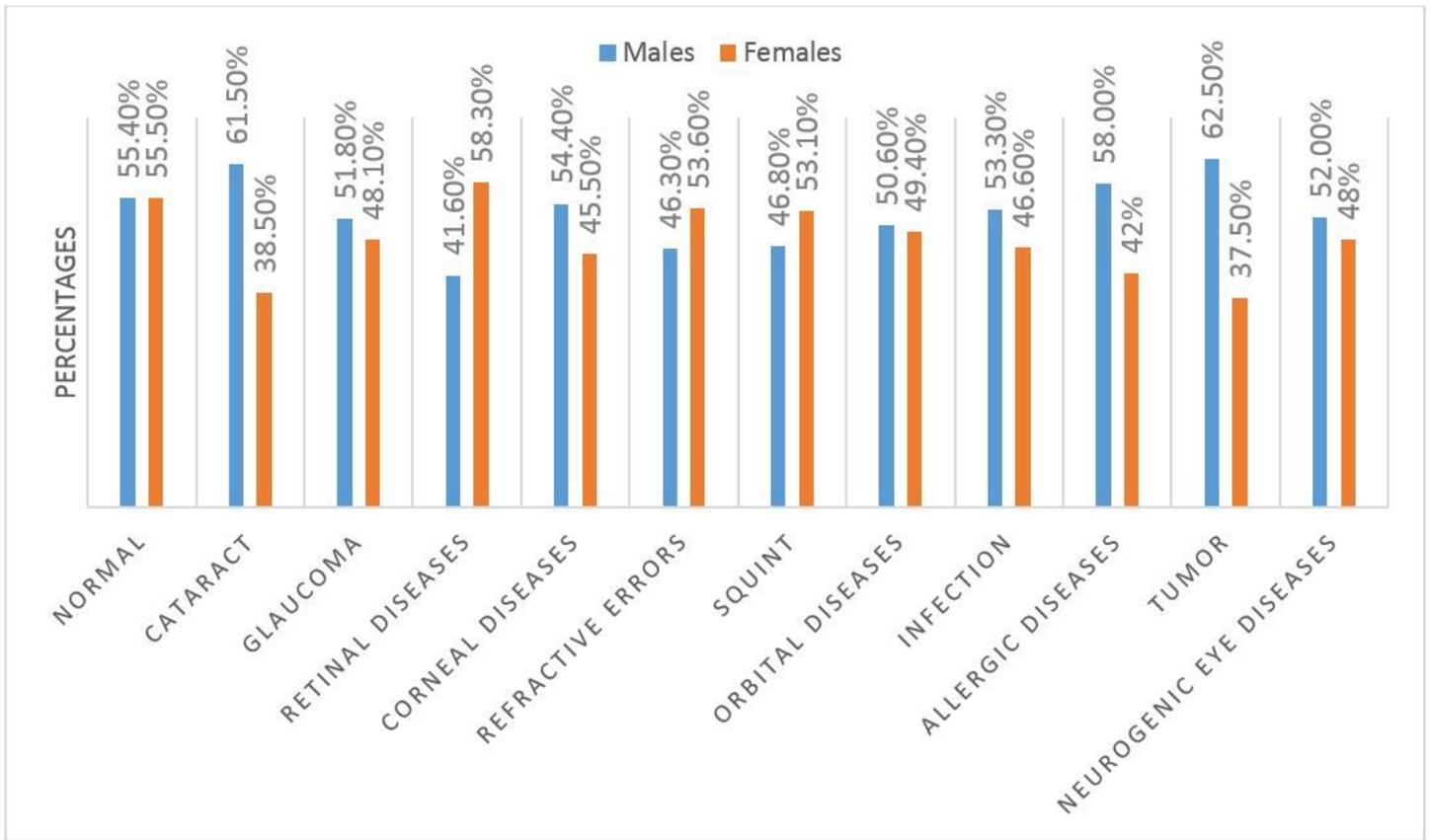


Figure 5

Variations in patterns of ocular morbidity according to gender among under-five children