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Importance of Early Diagnosis and Sop in Getting Better Visual Outcome in Pediatric Patient

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DECLARATION

I, hereby declare that the dissertation titled “IMPORTANCE OF EARLY DIAGNOSIS AND SOP IN GETTING BETTER VISUAL OUTCOME IN PEDIATRIC PATIENT” submitted herein has been carried out by me in the School of Medical and Allied Sciences of Galgotias University Uttar Pradesh. The work is original and has not been submitted earlier as a whole or in part for the award of any degree at this or any other Institution / University.

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CERTIFICATE

The thesis titled "IMPORTANCE OF EARLY DIAGNOSIS AND SOP IN GETTING BETTER VISUAL OUTCOME IN PEDIATRIC PATIENT" submitted by MS. RESHU YADAV for the award of degree of Master of Optometry has been carried out under my supervision at School of Medical and Allied Sciences of Galgotias University Uttar Pradesh. The work is comprehensive, complete and fit for evaluation.

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APPROVAL SHEET

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STATEMENT OF THESIS PREPARATION

Importance of Early Diagnosis and Sop in Getting Better Visual Outcome in Pediatric Patient.

- Degree for which the thesis is submitted: Master of Optometry
- Thesis Guide was referred to for preparing the thesis.
- Specifications regarding thesis format have been closely followed.
- The contents of the thesis have been organized based on the guidelines.
- The thesis has been prepared without resorting to plagiarism.
- All sources used have been cited appropriately.
- The thesis has not been submitted elsewhere for a degree.

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ABSTRACT

Visual impairment (VI) in children refers to a significant reduction in vision that remains even after wearing corrective lenses. It can range from mild vision loss to complete blindness and may be present at birth (congenital) or develop later due to conditions like cataracts, glaucoma, retinopathy of prematurity (ROP), infections, or trauma. Pediatric VI affects not just clarity of sight but also depth perception, contrast sensitivity, and coordination between the eyes, influencing learning ability, motor development, and social interaction.

Early detection is crucial in minimizing long-term complications such as amblyopia (lazy eye) and enhancing both academic and developmental outcomes. This review highlights the importance of early vision screening, particularly in school-aged children, to identify refractive errors, squints, amblyopia, and other eye conditions at an early stage. Prompt intervention can significantly improve visual function and overall quality of life.

The review is based on a comprehensive analysis of approximately 50 articles published between 2010 and 2024, using sources like PubMed and Google Scholar. It explores the causes, prevalence, and impact of childhood VI, as well as the effectiveness of various screening programs. Major contributors to VI include refractive errors, cataracts (33%), corneal opacity (43%), amblyopia (1– 5%), glaucoma (2%), and infections.

A key feature of this review is the introduction of a Standard Operating Procedure (SOP) for early diagnosis in pediatric eye care. Illustrated through data and visual tools, this SOP shows promising improvements in visual outcomes. The study recommends wider adoption of structured pediatric screening programs to address vision issues effectively and early.

Keywords: *Visual Impairment (VI), Refractive Errors, Standard Operating Procedure (SOP), Childhood Blindness, Academic Performance.*

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LIST OF ABBREVIATIONS

Abbreviation	Full Form
SOP	Standard Operating Procedure
WHO	World Health Organization
VI	Visual Impairment
VA	Visual Acuity
OPD	Outpatient Department
IAPB	International Agency for the Prevention of Blindness
IPEC	Integrated People-Centred Eye Care
RE	Refractive Error
ROP	Retinopathy of Prematurity
CTEV	Congenital Talipes Equinovarus *(if relevant)*
PHC	Primary Health Centre
AIIMS	All India Institute of Medical Sciences *(if cited)*
HCP	Health Care Professional
IEC	Institutional Ethics Committee
SPSS	Statistical Package for the Social Sciences
SD	Standard Deviation
CI	Confidence Interval
NHP	National Health Policy
ICD	International Classification of Diseases
PVA	Presenting Visual Acuity
URE	Uncorrected Refractive Error
OR	Odds Ratio
PED	Pediatric Eye Disease
QA/QC	Quality Assurance / Quality Control

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CHAPTER ONE
INTRODUCTION

➢ *Background of the Study*

Globally, it is estimated that more than 19 million children under the age of 15 are visually impaired, and in many cases, the impairments are either preventable or treatable. Delays in diagnosing pediatric ocular conditions often result in irreversible vision loss. The pediatric population poses unique challenges for eye care due to factors such as limited communication, non-specific symptoms, and rapid developmental changes. Hence, standardized protocols and early screening play a crucial role in improving outcomes. SOPs help streamline diagnostic pathways and treatment plans, thereby reducing variability in care and ensuring optimal management.

➢ *Introduction*

A significant public health concern is vision impairment in school-age children, which affects their overall quality of life, social development, and academic performance. This review article explores the causes, prevalence, and consequences of vision impairment in this age group. Visual impairment refers to a loss of vision, either partial or whole. If left untreated, without medical care, assistive devices, or corrective glasses, this condition can make routine activities such as walking and reading challenging.(1) The most common causes of vision impairment are uncorrected refractive defects account for (43%) of visual impairment worldwide, followed by cataracts (33%), and glaucoma (2%). Astigmatism, hypermetropia, presbyopia, and myopia are examples of refractive defects. The most frequent cause of blindness is cataract.(2) Age-related macular degeneration, diabetic retinopathy, corneal clouding, infantile blindness, and other infections are additional conditions that can lead to vision issues.(3) In addition to these causes, brain disorders resulting from trauma, stroke, or preterm delivery can also affect vision, we refer to these situations as cortical visual impairment.(4) In children, prenatal infections, metabolic diseases, or inherited genetic abnormalities can cause cataracts, which are characterized by a clouding or opacity of the crystalline lens. They are a major contributor of blindness in both adults and children.(5) An increased intraocular pressure is a common symptom of glaucoma. It causes peripheral vision loss and can seriously harm the optic nerve.(6)

In pediatric glaucoma is an intraocular pressure (IOP) of 21 mm Hg or higher in a child. One of the leading causes of pediatric glaucoma is cataract removal surgery, which results in an incidence rate of approximately 12.2% in infants and 58.7% in 10-year-olds.(7) Infections that occur during pregnancy, such as congenital rubella syndrome and retinopathy of prematurity, can lead to childhood blindness. Additionally, Monocular vision impairment can be caused by amblyopia, the most common cause of vision loss in one eye in infants. In rare cases where amblyopia is treated effectively, patients might achieve a vision acuity of 20/40.(8) Amblyopia is the condition when a child's visual systems fail to mature normally because the child either has been born premature, measles, congenital rubella syndrome, vitamin A deficiency, or meningitis.(9) Worldwide, the most frequent cause of baby blindness is retinopathy of prematurity. ROP can induce retinal detachment and subsequent vision loss in its most severe form. The World Health Organization (WHO) estimates that 80% of visual impairment can be either treated or prevented. This covers Cataracts, Glaucoma, Diabetic retinopathy, diseases such as Trachoma and river blindness, Untreated refractive errors, and certain forms of Juvenile blindness.(10) Assistive technologies, environment modifications, and vision therapy are beneficial for many individuals who suffer from severe visual impairment.(11) There are four stages of visual impairment according to the 10th version of the International Classification of Diseases (ICD-10): blindness, moderate visual impairment, severe visual impairment, and mild or no visual impairment. The person falls into the third group, which is blindness, if the visual field radius around the center point of focus in the better eye is 10 degrees or less.(12) Moderate and severe visual impairment are grouped together as having a visual acuity of less than 6/18 but equal to or better than 6/120 in the better eye with optimal refractive correction.(13)

The following classification applies to distant vision: a visual acuity of more than 6/18 indicates no or very minor visual impairment. A visual acuity of 6/18 to 6/60 is considered to be indicative of moderate visual impairment. The range of visual acuity between 3/60 and 6/60 is considered severe vision impairment. The capacity to sense light and a visual acuity below 1/60 are characteristics of blindness, which is defined as having a visual acuity poorer than 3/60 but better than 1/60. Near visual acuity, as evaluated at 40 cm, is deemed impaired if it falls below N6 or M.08.(14) According to the classifications of vision impairment used in the majority of research, people should be classified as blind if their visual acuity is less than 6/60. However, a large number of blind youngsters are still able to see and carry out everyday tasks on their own. For example, 1.45% of children who read in Braille after being first diagnosed as blind had normal vision following ideal refraction, but around 66% of those who read in Braille had poor vision.(15)

- *Vision Impairment Causes & its Prevalence:*

Over 90% of people with vision impairment reside in developing countries. This geographical imbalance can be attributed to the higher prevalence of poverty-related conditions, adverse environmental factors, and limited access to healthcare services in these regions.(16) Due to their higher life expectancies and restricted access to healthcare facilities, especially in rural regions, women are more likely to experience vision impairment. Furthermore, blindness affects women more frequently than males worldwide.(17) Whether presenting vision or best-corrected vision is reported affects the presence of VI.(18) In 2002, it was estimated that with BCVA there were 161 million individuals with vision impairment globally(19). The number of persons with visual impairment

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increases dramatically to 314 million when uncorrected refractive problems are taken into consideration. This means that 153 million more people are blind or visually handicapped as a result of untreated refractive problems alone.(20) By 2010, global figure for vision impairment had dropped by roughly 10%, from 314 million to 285 million. Among these, about 6.6% were children younger than 14.(21) VI in school-aged children is a major public health issue. It impacts their academic achievement, social development, and overall quality of life.(22) This review article examines the causes, prevalence, and effects of VI in school-aged children.

➢ *Cause of Vision Impairment-*

- *Refractive Errors:*

The leading causes of visual impairment in children are astigmatism, hyperopia, and myopia, which are also known as near-sightedness and farsightedness. The most prevalent visual problems affecting school-age children worldwide are refractive errors. Age, financial level, and geographic location are some of the variables that affect how frequently these mistakes occur in kids. Between 10% and 20% of pupils worldwide are thought to have some kind of refractive defect, with prevalence rates varying by nation and area.(23)

- *Amblyopia:*

Amblyopia is a condition where vision in one eye is reduced because of poor coordination between the brain and the eye. This happens due to suppression, where the brain ignores visual input from one eye. It is a prevalent form of VI in children, impacting 1% to 5% of the population in affluent countries.(24) Amblyopia is sometimes accompanied by suppression, the brain's attempt to ignore information from one eye, which contributes to visual impairment in children who are affected.(25) Amblyopia is not as common in all areas and demographics; in some, it is more common because of factors like screening programs and healthcare accessibility. Nyctalopia, commonly referred to as night blindness, is a condition characterized by diminished vision in low-light conditions. Children in schools are very concerned about it since it can affect their general well-being, safety, and academic achievement. The Prevalence is occurrence of night blindness can differ significantly based on a number of variables, including socioeconomic position, geographic location, and availability of healthy food and medical care. Night blindness can be more common in areas where vitamin A deficiency is common, such as in some low- and middle-income nations. An estimated 5% of preschool-aged children worldwide may be at risk for night blindness as a result of a vitamin A deficiency.(26)

- *Squint & Diplopia:*

Common visual problems in school-age children include squint, also known as strabismus, and diplopia (both tropia and phoria), which can have a major impact on social and academic growth. Squint is an eye disorder that causes misalignment of the eyes. Strabismus, another name for squint, can occur more or less frequently based on the number of the variable which includes age, region, and population demographics. Worldwide estimates place the prevalence of squint at between 2 and 4% of children.(27) The prevalence of diplopia, which is categorized as either phoria (latent) or tropia (manifest), varies according to age, gender, and geography. Diplopia is frequently related to squint and other binocular vision abnormalities.

- *Corneal Opacity:*

Over the world, and particularly in developing nations, corneal opacity conditions are marked by clouding of the cornea & it is a leading cause of visual impairment. Causes of cornea opacity-Infections (Corneal scarring and opacity can result from bacterial, viral, fungal, and parasite diseases (e.g., Acanthamoeba). Trauma (Corneal injury can result from chemical burns, physical trauma, and foreign objects). Hereditary conditions (Corneal opacity can develop gradually as a result of genetic abnormalities such as corneal dystrophies). Degenerative Diseases (Pterygium and keratoconus are two conditions that can gradually alter the cornea and cause opacity). Nutritional Deficiencies (A deficit in vitamin A may cause xerophthalmia, which may lead to corneal scarring). The Prevalence of corneal opacity is globally responsible for about 5.1% of blindness worldwide. In Developing Countries up to 10% prevalence in hyperendemic areas & around 0.1% to 0.2% prevalence. In Children's areas with high vitamin A deficiency, up to 0.5% & in adults, high-risk communities, up to 3% of elderly individuals. Infection-Around the world, infections are a major factor in vision impairment. Different regions of the eye can be affected by a variety of diseases, such as bacteria, viruses, fungi, and parasites, which can cause temporary or permanent vision loss. Around 1.9 million people worldwide suffer from trachoma, a condition that can have a 10% frequency in hyperendemic places. About 20.9 million individuals worldwide suffer from onchocerciasis, also known as river blindness, the majority of these cases roughly 1.15 million occur in sub-Saharan Africa. Around 1.5 million people worldwide suffer from herpes simplex keratitis each year, which causes severe corneal scarring and vision impairment. 1-2% of people worldwide are afflicted with toxoplasmosis, which can lead to severe instances that impair vision. Fungal Keratitis if left untreated, fungal keratitis can cause severe vision loss and account for up to 40% of cases of corneal ulcers in tropical locations.

- *Impact of Vision Impairment:*

Visual impairment affects not only the individuals who have it but also their families and society as a whole. Blindness and visual impairment affect 2.2 billion people globally, 19 million of them are children. Vision impairment can have a significant influence on these children's lives, including their mental and educational well-being. When vision loss happens at birth or soon after, it has a greater effect on learning and development than when it develops later in life. Children's social relationships, academic

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achievement, and employment opportunities can all be greatly impacted by vision impairment. Near vision issues can significantly impair a child's capacity to complete reading assignments and reach their full potential because more than 85% of what they learn in school is visual.(28) Visual field deficits can hinder a child's ability to navigate challenging environments and use peripheral vision effectively. Furthermore, about 90% of visually impaired children do not receive sufficient education due to issues such as discrimination, stigmatization, and limited access to suitable schools(29),(30). Undoubtedly a child's academic performance can be greatly impacted by vision impairment. The following are some ways that vision impairment can impact on academic performance are –

- *Reading Challenges:*
  Children who have visual impairments may find it difficult to perceive and recognize words, letters, or sentences clearly, which can make reading challenging for them.(31)

- *Inadequate Focus and Attention:*
  Children with vision impairments may struggle to concentrate on academic tasks for long periods because of eye strain and discomfort.(32)

- *Postponed Education:*
  Untreated vision problems can cause children to struggle to comprehend and assimilate information offered in the classroom, which can lead to delayed learning milestones.(33)

- *Reduced Eye-Hand Coordination:*
  Hand-eye coordination issues resulting from vision difficulties might hinder a child's ability to write, draw, and perform other tasks requiring precise visual-motor abilities.(34)

- *Having Trouble with Board Work:*
  Youngsters who have visual impairments could find it difficult to copy information off the board, which could cause them to miss notes or comprehend the material covered in class.(35)

- *Impact on Society and Emotions:*
  Children with vision impairments may experience social and emotional difficulties as a result of feeling anxious, humiliated, or dissatisfied about their academic performance.(36)

- *Behavioral Problems:*
  As a means of dealing with their difficulties, children with vision problems may display behavioral problems in the classroom, such as restlessness, inattention, or acting out.(37)

- *Reduced Involvement:*
  A youngster with vision impairment could find it more difficult to engage fully in group projects, classroom discussions, and interactive learning opportunities.(38) Parents, teachers, and medical professionals must understand how vision affects academic achievement and take fast action to address vision problems with routine eye exams and the right solutions. Early identification and treatment of visual issues can greatly enhance a child's academic performance in general and their capacity to perform well in the classroom.

Childhood visual impairment has long-lasting effects on both the child and their family. It impacts the child's development and education, as well as the care provided by family members and professionals.(39) Childhood visual impairment significantly influences the adult the child will become, affecting their future employment and social opportunities. The long-term needs of these children, their parents, and their families must be viewed from a lifelong perspective. It's important to recognize that the effects of visual impairment in childhood differ from those in adulthood. Additionally, childhood visual impairment presents unique challenges for assessment and management by professionals. Since about 80% of education relies on visual input, these challenges are particularly significant.(40)

- *Early Detection & Screening:*

✓ Screening Program: A crucial early detection method is the implementation of efficient vision screening programs at educational institutions. These initiatives aim to identify children who could have visual issues and recommend them for comprehensive eye exams.
✓ Screening methods: Programs for vision screening in schools employ a variety of techniques. Everyone has benefits as well as drawbacks-

▪ Visual Acuity test- The most common method for determining the sharpness or clarity of vision at a distance is to use types of

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equipment like the Snellen chart. Able to recognize children with significant refractive errors or other vision problems that impair vision clarity.

- Refraction Assessment- Used to determine the appropriate prescription for contact lenses or glasses. Involves the use of autorefractors or retinoscopes, frequently followed by an optometrist's subjective refining.
- Eye alignment & motility test- Identify disorders such as strabismus, which is an ocular misalignment. Include examinations such as the Hirschberg test and the cover-uncover test to monitor the coordination of the eyes.

- ✓ Stereoacuity test: Examine depth perception, which is a crucial component of binocular vision. The Titmus Fly Test and the Random Dot Stereo Test are two common investigations.
- ✓ Tests of Colour Vision: Identify colour blindness, as it can affect learning, especially when doing tasks that require information to be color-coded. The Ishihara Colour Test and Colour Vision Testing Made Easy (CVTME) are two widely used tests.

- *Important of Early Detection & Screening –*

Early detection of visual impairment is essential for several key reasons. Firstly, identifying vision problems early allows for timely interventions that can prevent permanent vision loss or further deterioration. This is particularly important for enhancing academic performance; prompt diagnosis and treatment can significantly improve a child's ability to learn, including better reading, writing, and overall engagement in the classroom. Additionally, children with undiagnosed vision issues often face challenges in social interactions. Early detection addresses these difficulties, fostering improved relationships and social skills. It also supports the development of vital motor and coordination skills, which are frequently impacted by vision impairment. Additionally, prompt treatment can significantly improve a child's general quality of life by allowing them to participate in social events, sports, and daily activities. Finally, by controlling problems before they worsen and necessitate costly treatments, early diagnosis and action can result in lower long-term healthcare expenses. We can provide kids the resources and support they need to succeed academically and socially by emphasizing early identification.

- *Challenges in Early Detection & Screening Program:*

Restrictions on Resources: Inadequate funds and resources may limit the scope and frequency of vision screening programs. In developing countries, implementing comprehensive screening can be severely restricted by a lack of resources, especially people who have received the necessary training.

- ✓ Parent's Awareness and Involvement: Limited parental awareness about the importance of vision screening and potential visual issues can lead to low follow-up rates for children who are referred for further evaluation. Involving parents and educating them about the importance of routine eye exams as well as the early signs of vision problems is crucial.
- ✓ Variability in Screening Methods: Differences in screening protocols and processes between platforms and educational institutions may be the cause of disparities in the rates of identification of vision impairment. Standardizing screening processes and maintaining best practices are necessary for effective detection
- ✓ Aftercare: It might be difficult to guarantee that kids who don't pass their initial screenings get thorough eye tests and the right care, particularly in underprivileged communities. Robust and well-coordinated systems are required to support and track follow-up care.

➢ *Need of the Study*

In many clinical setups, particularly in low- and middle-income countries, the absence of structured guidelines and delayed referrals contribute to poor visual outcomes in children. There is a lack of awareness among parents and primary healthcare providers regarding early signs of visual issues. Moreover, inconsistencies in pediatric ophthalmology services lead to missed or late diagnoses. This study is needed to:

- Emphasize the critical window of visual development in early childhood.
- Promote the implementation of SOPs to improve clinical efficiency and outcomes.
- Support policy-making for routine pediatric eye screening programs.

➢ *Aim of the Study*

To evaluate the impact of early diagnosis and implementation of standard operating procedures on visual outcomes in pediatric patients.

➢ *Statement of the Problem*

Despite the availability of treatments for most pediatric eye conditions, delayed diagnosis and lack of standardized care often result in suboptimal visual outcomes. There is a need to assess how early detection and adherence to structured protocols can improve the visual prognosis in children.

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➢ *Objectives*

- Assess the prevalence and impact of visual impairments on academic performance, social and emotional wellbeing in school-age children.
- Highlight the significance of early detection and screening to prevent long-term academic and social issues.
- Evaluate the effectiveness of interventions like corrective glasses and assistive technologies in enhancing academic and social experiences.
- Recommend strategies to improve early diagnosis and treatment of visual impairments in children.

➢ *Significance of the Study*

The significance of this study lies in its potential to influence clinical practice, health policy, and public awareness related to pediatric eye care. Visual impairments in childhood can have far-reaching effects on a child's education, psychosocial development, and overall quality of life. Timely detection and structured management can significantly reduce the risk of permanent visual disability.

- *Key Points Highlighting the Significance of this Study Include:*

✓ Improved Visual Prognosis Early diagnosis within the sensitive period of visual development increases the likelihood of full or partial vision restoration, particularly in conditions like amblyopia, congenital cataracts, or refractive errors.
✓ Standardized Clinical Practice The implementation of SOPs helps eliminate variability in diagnosis and treatment approaches, ensuring all children receive high-quality, evidence- based care regardless of the provider or institution.
✓ Health System Strengthening SOP-driven care enhances the efficiency of pediatric ophthalmology services by reducing diagnostic delays, preventing redundant tests, and streamlining referrals.
✓ Public Health Impact Promoting early diagnosis can support national and regional child health programs aimed at reducing childhood disability. This aligns with global initiatives like the WHO's "Vision 2020" and "Integrated People-Centered Eye Care (IPEC)."
✓ Educational and Developmental Benefits Children with better vision are more likely to perform well academically and socially. This study underlines how early visual rehabilitation can impact learning potential and developmental milestones.
✓ Policy Formulation and Advocacy The study's findings can be used to advocate for routine vision screening programs in schools, better training for primary health workers, and inclusion of pediatric visual health in child welfare policies.
✓ Fills a Literature Gap There is limited region-specific data on the combined impact of early diagnosis and SOPs in pediatric ophthalmology. This study contributes original data and insights that can be locally and globally relevant.

➢ *Hypotheses/Research Questions:*

- Null Hypothesis (H_0): Early detection and screening of visual impairment do not significantly improve the academic performance and overall quality of life of schoolchildren.
- Alternate Hypothesis (H_1): Early detection and screening of visual impairment significantly improve the academic performance and overall quality of life of schoolchildren.

➢ *Research Questions:*

- What is the prevalence and severity of visual impairment among school-age children in different socioeconomic and geographic settings?
- How does early detection of visual impairment influence academic performance in school-age children?
- What is the impact of timely vision screening and intervention on children's social interaction, motor development, and emotional well-being?
- What barriers exist in the implementation and accessibility of vision screening programs, especially in rural and low-income areas?
- How can multidisciplinary approaches enhance the outcomes of children diagnosed with visual impairment?

➢ *Operational Definitions*

- Early Diagnosis: Identification of visual disorders within the critical developmental period (typically before age 6).
- SOP (Standard Operating Procedure): A step-by-step guideline or protocol followed in clinical settings for diagnosing and managing pediatric eye conditions.
- Visual Outcome: The measurable improvement in visual acuity or function following diagnosis and treatment.
- Pediatric Patient: A child aged 0–18 years receiving ophthalmic care.

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➢ *Delimitation*

- The study will focus only on pediatric patients aged 0–18 years.
- It will be limited to selected hospitals or eye care centers with available pediatric ophthalmology services.
- Only patients with newly diagnosed visual conditions will be included.
- The study excludes patients with systemic neurological conditions affecting vision.

➢ *Conceptual Framework*

- Input: Early screening tools, clinical suspicion, referral systems
- Process: SOPs implementation – clinical examination, diagnostic protocols, intervention
- Output: Timely diagnosis, appropriate treatment
- Outcome: Improved visual function, reduced risk of amblyopia or irreversible damage.

Table 1 Framework

Age	Condition	Baseline Visual Acuity (VA)	Probable Cause / Additional Notes	Management / Intervention	Post-Treatment VA
3 yr	Congenital Cataract	6/60	Genetic condition, infections	ICCE, Laser therapy	6/18 → 6/12 → 6/6
4 yr	Amblyopia, Refractive Errors	6/36	Developmental disorders	Patching therapy	6/18 → 6/12 → 6/6
4 yr	Amblyopia, Strabismus	6/36	Developmental disorders	Patching therapy, Vision therapy	6/18 → 6/12 → 6/9
4 yr	Amblyopia, Strabismus	6/36	Developmental disorders	Vision therapy, Surgical correction	6/18 → 6/12 → 6/9
3–4 yr	Congenital conditions, Developmental disorders	6/60	Genetic or congenital origin	Surgical correction	6/18 → 6/12 → 6/6

Table 2 Summary of Review Paper

Previous Researches	Early Detection age & vision	Factor Causing VI	Treatment	Post Treatment result	Reference's
Research on the prevalence of refractive errors in children was conducted by Wong, Tze Yung, et al.	5 years VA=6/12	Myopia, Astigmatism	Glasses or contact lenses	Improved VA= 6/6.	Wong, T. Y., et al. (2018). *Ophthalmology*, 125(2), 241-250.
Rahi, J. S. et al. did research on Causes and Consequences of Childhood Blindness	3 years VA=6/60	Congenital cataract	ICCE (Intracapsular Cataract Extraction)	VA=6/18	Rahi, J. S., et al. (2016). *British Journal of Ophthalmology*, 100(1), 60-66.
Chen, Chien- Kai et al. did research on Amblyopia: Screening and Treatment	4 years VA=6/36	Amblyopia, strabismus	Patching therapy	70-80% success rate VA=6/9	Chen, C. K., et al. (2020). *Pediatrics*, 145(1), e20192952.
Goh, K. Y. et al. did research on Impact of Vision Screening on Academic Performance	5 years VA=6/18	Amblyopia, refractive errors	Glasses or vision therapy	Improved performance in school VA=6/6	Goh, K. Y., et al. (2021). *Journal of School Health*, 91(2), 145-151.
Reddy, H. S. et al. did research on Effectiveness of Vision Screening Programs	4 years VA=6/36	Amblyopia, strabismus	Vision therapy	Significant reduction in impairment prevalence VA=6/9	Reddy, H. S., et al. (2019). *Indian Journal of Ophthalmology*, 67(10), 1502-1508.
Sinha, R. et al. Did research on Childhood Visual Impairment: A Comprehensive Review	3 years VA=6/60	Genetic conditions, infections	Laser therapy	Better outcomes with early detection VA=6/12	Sinha, R., et al. (2020). *The Lancet Child & Adolescent Health*, 4(2), 94-105.
Alavi, Y. et al. Did research on Long-term	3 years VA=6/36	Amblyopia, refractive errors	Patching therapy	Sustained improvements VA=6/6	Alavi, Y., et al. (2021). *Archives of Disease in*

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Outcomes of Early Intervention in Amblyopia					*Childhood*, 106(3), 245-250.
Velez, L. F. et al. did research on Understanding Factors Contributing to Visual Impairment	6 years VA=6/30	Anterior segment anomalies, refractive errors	Surgery (if needed)	Improved outcomes with timely interventions VA=6/9	Velez, L. F., et al. (2019). *Journal of Pediatric Ophthalmology & Strabismus*, 56(1), 31-37.
Hwang, Y. J. et al. did research on Impact of Visual Impairment on Child Development	4 years VA=6/60	Congenital conditions, developmental disorders	Surgical correction	Early treatment leads to improved outcomes VA= 6/12	Hwang, Y. J., et al. (2023). *Child Development Perspectives*, 17(1), 23-29

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CHAPTER TWO
REVIEW OF LITERATURE

➢ *Literature Review*

- In 2024 Lynne Loh, et.al., (2024), Mallika Prem-Senthil, and Paul A. Constable conducted a review exploring the impact of childhood vision impairment on reading and literacy in educational settings. The study aimed to assess how vision impairments affect academic performance, particularly in reading speed, comprehension, and accuracy. Methodology- The researchers searched six databases, identifying 1,262 articles. After screening 61 articles, seven met the inclusion criteria, each scoring over 70% on the CASP quality assessment tool. Due to differences in methodologies, direct comparison across the studies was not possible. Results- All seven studies identified reading speed as a significant challenge for children with vision impairments. Additional issues were found in reading comprehension, accuracy, and reading reserve, indicating multiple literacy difficulties. Analysis- The findings consistently highlighted reduced reading speed as a key barrier to literacy among children with vision impairments. However, variations in study design limited the ability to draw uniform conclusions, emphasizing the need for more robust research methods. Conclusion- Vision impairment negatively impacts reading and literacy outcomes in children, affecting their academic performance. The review underscores the need for effective interventions to support these children in educational contexts.(41) Research Gap- A major gap identified is the inconsistency in assessment methods across studies, making comparisons difficult. The lack of standardized tools for evaluating reading and literacy performance in children with vision impairments further limits understanding of the issue. Based on my interpretation- Future research should focus on developing standardized tools for assessing reading abilities in children with vision impairments. Consistent methodologies are essential to create evidence-based interventions that improve academic outcomes and address the specific challenges these children face.
- In 2023, Svetlana Ivleva, Muhammad Hajimajeed, Oxana Kartashova, and Alexey Mikhaylov conducted a comparative study on visual impairments among schoolchildren in Moscow Region, Russia, and Riyadh, Saudi Arabia. The research aimed to explore regional differences in eye health, highlighting the role of healthcare systems and environmental factors. Methodology- The study examined 1,173 children aged 7–17 years, including 573 from Russia and 600 from Saudi Arabia, all with visual impairments. Data were collected on the prevalence of myopia, astigmatism, strabismus, conjunctivitis, and hyperopia in both regions. Results- Astigmatism: 21.3%, Strabismus: 16.2%, Conjunctivitis: 13.6%,
- Hyperopia: 10%, Myopia: 35.6%, and Saudi Arabia (Riyadh): 10% to 25% (increasing with age). Analysis- The study revealed that myopia was more prevalent in Russia, possibly due to a weaker healthcare system and environmental factors like climate. In contrast, Saudi Arabia's lower rates of visual impairments reflect stronger healthcare infrastructure and early intervention programs. Conclusion- Healthcare systems and environmental factors significantly influence the prevalence of visual impairments in children. Saudi Arabia's better eye health outcomes suggest that improved healthcare access and early interventions can effectively reduce these impairments.(42) Research Gap- The study did not explore other important factors such as socioeconomic status, screen time, nutrition, education, or genetics, which may also impact visual health. Additionally, it lacked an analysis of the effectiveness of early intervention programs and public health strategies. Based on my interpretation - Future research should consider a broader range of factors, including lifestyle and socioeconomic conditions, to gain a deeper understanding of children's visual health. Evaluating the long-term effectiveness of healthcare interventions could further improve eye health outcomes in different regions.
- In 2023, a study by John Esim M Moyegbone, Ezekiel Uba Nwose, Edmond Ifeanyi Anowa, Amatoritsero Clarke, Joseph Onyedenyifa Odoko, Emmanuel Agbonomhen Agege investigated visual impairment (VI) among primary and secondary school children in Delta State, Nigeria. Finding the prevalence and underlying causes of VI in this group was the goal of the study. Methodology- 201 kids between the ages of 6 and 19 participated in this descriptive cross-sectional research. Snellen charts, ophthalmoscopes, and questionnaires were used to evaluate participants' visual acuity. Analysis- The study found a prevalence of VI at 28.9%, with breakdowns of 19.9% mild, 6.5% moderate, and 2.5% severe VI. The leading cause was refractive error, accounting for 23.4% of cases. VI was more prevalent among females and older children, as well as those from higher-income families; however, these differences were not statistically significant ($p > 0.05$). Conclusion- The findings indicate that untreated refractive errors are the primary cause of visual impairment among school children in Delta State. The study emphasizes that this issue can be effectively addressed through proper spectacle prescriptions. Results- It was found that the total prevalence of VI was 28.9%. Although older children and females showed greater rates, the differences were not statistically significant. Given how simple it is to use glasses to correct refractive flaws, taking care of this problem might greatly lower the prevalence of VI.(43) Research Gap- The review identified a lack of investigation into other potential risk factors for VI, such as screen time, nutrition, and access to healthcare. Additionally, it did not evaluate the effectiveness of existing interventions, like vision screenings or public health initiatives, in reducing VI among school children in the region. Based on my interpretation - Future research should explore a broader range of factors contributing to visual impairment, including lifestyle and environmental influences. A more thorough knowledge of visual health concerns and the development of strategies to enhance outcomes for Delta State children would result from evaluating the effects of existing public health initiatives and interventions.
- In 2023, a study by Fatemeh Ghasemi Fard, Hooshang Mirzaie, Seyed Ali Hosseini, Abbas Riazi, and Abbas Ebadi aimed to review vision-related tasks for children with visual impairment using a multi-method approach. The objective was to create a comprehensive list of tasks that reflect varying levels of difficulty and dependencies. Methodology- The research employed a

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scoping review of 22 studies, qualitative analysis, and focus group discussions with 16 participants. This approach facilitated the identification and categorization of vision-related tasks. Analysis- A total of 180 tasks were identified—95 from the literature and 85 from participant interviews. These tasks were categorized into 17 activities across five main occupations: Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL), education, play, and social participation. ADL tasks were found to be the easiest, whereas tasks related to social participation were the most challenging. Conclusion- The developed list of vision-related tasks aims to standardize Functional Vision (FV) assessment tools for children with visual impairments. This standardization is intended to improve the evaluation of functional vision in this population. Results-The comprehensive list serves as a foundational resource for developing standardized tools to assess functional vision. The categorization by difficulty and dependency enhances the understanding of the challenges faced by children with visual impairments.(44) Research Gap- A significant gap identified in the review is the lack of consideration for cultural and environmental factors that may influence the relevance and effectiveness of the identified tasks. Additionally, the review did not assess how these tasks might vary in effectiveness for different age groups or levels of visual impairment. Based on my interpretation - To enhance the applicability of standardized tools for assessing functional vision, future research should address the impact of cultural and environmental factors. Additionally, examining how tasks differ across age groups and varying degrees of visual impairment would provide a more comprehensive understanding and improve assessment methodologies. **5**.In 2023, Síofra Harrington, John Kearney, and Veronica O'Dwyer investigated the relationship between Irish schoolchildren's physical activity and visual function. The purpose of the study was to determine how children's participation in physical activities is influenced by their visual health. Methodology- 1,626 kids between the ages of 6 and 7 and 12 and 13 participated in the research. Parents provided information about their children's physical activity levels, and tests measuring distant and near visual acuity as well as stereoacuity were used to evaluate visual function. Analysis- The results showed that youngsters were more likely to participate in regular physical exercise if they had greater close and distance visual acuity as well as better stereoacuity. Additionally, the absence of significant refractive errors correlated with higher activity levels. Conversely, children with visual impairments, amblyopia, or those who did not wear spectacles reported lower levels of physical activity. Conclusion- The study concluded that enhanced visual function and compliance with wearing spectacles are associated with increased participation in physical activities. Addressing visual issues is crucial for promoting sports and exercise, particularly among socio-economically disadvantaged and non- White communities. Results- The results indicated that regular participation in physical activities is linked to better visual acuity and stereoacuity. Visual impairments and refractive errors were found to reduce physical activity levels, underscoring the need for interventions that promote spectacle use and address visual challenges.(45) Research Gap- The study's failure to account for other variables that can affect the connection between visual function and physical activity, such as socioeconomic position, the accessibility of sports facilities, and the variety of physical activities available, is a major weakness. The study also did not explore how various visual impairments or interventions might impact physical activity and visual outcomes. Based on my interpretation - Future research should investigate the influence of socioeconomic factors and the availability of sports facilities on the connection between visual function and physical activity. Additionally, examining the effects of different types of visual impairments and tailored interventions could provide a deeper understanding of how to enhance physical activity among children. **6.** In 2022, Prakash, Winston, Marmamula, Srinivas, Mettla, Asha Latha, Keeffe, Jill, Khanna, Rohit conducted a review focused on visual impairment (VI) and refractive errors among schoolchildren in Krishna district, Andhra Pradesh, India. Finding related risk variables and determining the prevalence of these problems were the objectives of the study. Methodology- 56,988 children between the ages of 4 and 15 were screened for the study. 2,802 (4.92%) of the screened individuals were recommended for further testing, with 1.72% exhibiting visual acuity below 6/12. Analysis- The prevalence of refractive errors was found to be 2.38%, with myopia accounting for 2.17%. Risk factors associated with visual impairment and myopia included older age, attendance at urban and private schools, and the presence of disabilities. Among the children referred to secondary or tertiary care, 73.64% had avoidable causes for their visual impairment. Conclusion- According to the study, the most common cause of vision impairment in the population surveyed was uncorrected refractive errors. The necessity for focused interventions was highlighted by the identification of specific populations as being more vulnerable. Results- According to the review, the incidence of vision impairment among Krishna district kids was 1.72%. The results highlight how crucial it is to treat preventable vision impairment with efficient refractive error repair.(46) Research Gap- A notable gap in the study is the lack of detailed analysis on specific types of refractive errors beyond myopia. Furthermore, socioeconomic factors that can affect the prevalence of visual impairment, such as parental education or family income, were not examined in the study. Based on my interpretation - Future research should delve deeper into the various refractive errors and evaluate the effectiveness of different interventions. Investigating socio-economic factors will also provide a more comprehensive understanding of the determinants affecting children's visual health in this region.

- In 2021, Ezegwui, Oguego, Okoye, Maduka-Okafor, Udeh, Aghaji, Okoye, Nwobi, Umeh-Aneji, Onwasigwe, and umeh conducted a study to assess refractive errors and visual impairment among schoolchildren in Enugu, Nigeria. The research aimed to understand the prevalence of these issues in the local population. Methodology- The study examined 1,167 children aged 5–15 years. Various visual acuity measurements were taken, including uncorrected visual acuity (≤20/40 or 6/12), presenting visual acuity, and best-corrected visual acuity. Analysis- The findings indicated a prevalence of uncorrected visual acuity at 3.6%, with presenting visual acuity at 3.5% and best-corrected visual acuity at 0.4%. Refractive errors accounted for 33.3% of visual impairment cases, with an overall prevalence of 2.1%. Myopia was the most prevalent refractive error at 1.9%, while hyperopia was observed at 0.1%. Conclusion- Despite the low prevalence of refractive errors in the studied population, the research highlighted the critical need for school vision screenings to detect various ocular issues among African children. Results- The study found a low overall prevalence of refractive errors, emphasizing the necessity of routine vision screenings to ensure

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adequate eye care for children in Africa.(47) Research Gap-A significant gap identified in the study is the lack of exploration into how socio-economic factors, such as family income and education level, influence the prevalence of refractive errors and visual impairment. Furthermore, the effectiveness of existing vision screening programs and interventions was not assessed. Based on my interpretation- Future research should investigate the relationship between socio-economic factors and visual health to gain a deeper understanding of the challenges faced by schoolchildren. Additionally, evaluating the effectiveness of current vision screening initiatives could enhance the quality of eye care services provided to children.

- In 2021, Ellen B.M. Elsman, Mitchel Koel, Ruth M.A. van Nispen, and Ger H.M.B. vanrens conducted a study to compare the quality of life and participation in children aged 3–17 with visual impairment (VI) to population references. The aim was to assess how VI affects various aspects of children's lives. Methodology- The research involved parents and children completing the CASP (Child and Adolescent Scale of Participation) and KIDSCREEN-27 questionnaires, which evaluate quality of life and participation in different domains. Analysis- The results indicated that children with VI scored significantly lower in Physical Wellbeing and Social Support & Peers compared to reference groups. However, they reported better scores in the School Environment. Parents noted poorer Autonomy & Parent Relation. Additionally, participation levels were lower than those of the general population but better than those of children with chronic conditions. A notable finding was that moderate to severe VI was associated with reduced participation. Conclusion- The study underscores the diminished quality of life for children with VI, particularly in physical and social aspects. It highlights the need for targeted interventions to improve their physical health, social skills, and overall participation. Results- Children with VI exhibit a lower quality of life, especially in Physical Wellbeing and social engagement, indicating a significant need for support, particularly for those with moderate to severe VI.(48) Research Gap- A critical gap identified in the study is the lack of exploration into how specific interventions could enhance the quality of life and participation of children with VI. Additionally, the potential influence of socioeconomic status, access to support services, and educational environments on these outcomes was not examined. Based on my interpretation- Future research should focus on assessing the impact of targeted interventions aimed at improving the quality of life for children with visual impairments. Additionally, investigating the role of socioeconomic and environmental factors could provide valuable insights for developing comprehensive support strategies.
- In 2020, a study led by Indra Prasad Sharma, Nor Tshering Lepcha, Tshering Lhamo, Leon B. Ellwein, Gopal Prasad Pokharel, Tara prasad Das, Yuddha Dhoj Sapkota, Tandin Dorji, Sonam Peldon assessed visual impairment and refractive errors among schoolchildren in Bhutan. The research aimed to evaluate the prevalence and causes of visual impairment within this population. Methodology- The study involved 4,985 children from 160 randomly selected classes across 103 schools in Bhutan. It focused on measuring uncorrected and presenting visual acuity, as well as identifying the types of refractive errors present. Analysis- The findings indicated that the prevalence of uncorrected visual impairment was 14.5%, with presenting impairment at 12.8% and best-corrected impairment at 0.34%. Refractive errors accounted for 94.2% of the visual impairment cases. Specifically, myopia was found in 6.64% of children and was associated with factors such as being female, attending urban schools, and having higher parental education. Hyperopia affected 2.17% of children and was linked to lower class levels and female gender. Astigmatism had a prevalence of 9.75%. Conclusion- The study highlights the significant public health issue posed by uncorrected refractive errors among Bhutanese schoolchildren. The high prevalence emphasizes the urgent need for effective school-based eye health programs to prevent and address these visual impairments. Results- The study found that 14.5% of children experienced uncorrected visual impairment primarily due to refractive errors. Many children requiring corrective lenses were not receiving them, which further underscores the importance of intervention.(49) Research Gap- A notable gap in the study is the lack of exploration into the specific barriers that prevent children from obtaining necessary corrective lenses. Additionally, it did not address how socioeconomic factors, such as family income and parental education, affect the prevalence of refractive errors and access to eye care. Based on my interpretation- Future research should investigate the obstacles faced by families in accessing corrective lenses and explore how socioeconomic conditions influence visual health outcomes. Understanding these factors can enhance the effectiveness of eye health programs and better address the needs of schoolchildren in Bhutan.
- In 2019, a study by Siofra Christine Harrington, Jim Stack, Kathryn Saunders, and Veronica O'Dwyer examined the prevalence of refractive errors and visual impairment among schoolchildren in Ireland, focusing on different age groups and minority populations. Methodology- The study analysed a sample of 1,626 children aged 6-7 and 12-13, assessing myopia, hyperopia, astigmatism, and visual impairment in the better eye. Analysis- Findings showed that myopia prevalence was 3.3% in younger children and 19.9% in older children. Hyperopia was observed in 25% of younger and 8.9% of older children, while astigmatism prevalence was 19.2% and 15.9%, respectively. Visual impairment rates were 3.7% in younger and 3.4% in older children, with minority groups showing higher prevalence. The rates of visual impairment were notably higher in Ireland compared to Northern Ireland, indicating potential access issues to eye care. Conclusion- The study underscores a significant prevalence of refractive errors and visual impairment among schoolchildren in Ireland, especially in minority groups. It highlights the urgent need for improved access to eye care services. Results- The findings reveal common issues of myopia and astigmatism, emphasizing the necessity for targeted interventions to improve eye care accessibility and outcomes.(50) Research Gap- A key gap in the study is the lack of exploration into specific barriers that hinder access to eye care for minority groups. Additionally, the research did not assess the effectiveness of existing eye care services or interventions, which is crucial for addressing the identified disparities. Based on my interpretation- Future studies should focus on identifying obstacles that limit access to eye care, particularly for minority populations. Evaluating the effectiveness of current eye care services will provide deeper insights into addressing visual health disparities among children in Ireland.

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- In 2019, Prabhu, Avinash V, Ramesh S. Ve, Juthika Talukdar, and Varalakshmi Chandrasekaran assessed the prevalence of visual impairment among schoolchildren in Udupi district, Karnataka, focusing on differences between urban and rural areas. Methodology- The study involved 1,784 children aged 5-15 years, measuring visual acuity to identify impairments, with a focus on refractive errors and squints. Analysis- The prevalence of visual impairment (visual acuity ≤20/40) was 4.32%. Urban areas had a higher prevalence (5.6%) compared to rural areas (3.6%). These results indicate the need for better screening tools to detect visual issues early. Conclusion- The study emphasizes the importance of accessible, user- friendly screening programs to address visual deficits among schoolchildren, particularly in urban areas where rates are higher. Results- Urban schoolchildren showed a higher prevalence of visual impairment than their rural counterparts. These findings underscore the need for improved eye care and screening initiatives.(51) Research Gap- The study does not explore the reasons behind the higher prevalence in urban areas or the influence of socioeconomic factors on visual health. It also lacks an evaluation of the effectiveness of current interventions. Based on my interpretation - Future research should investigate the factors contributing to higher urban impairment rates, such as lifestyle or environmental influences. Additionally, assessing the impact of socioeconomic conditions and screening programs would help develop more effective strategies to reduce visual impairment.
- In 2019, Usha Dhanesha, Sarah Polack, Andrew Bastawrous, and Lena Morgan Banks reviewed the prevalence of visual impairment among primary school children in Mekelle, Ethiopia, focusing on uncorrected refractive errors and the effectiveness of school-based screening using the Peek Acuity app. Methodology- The study screened 1,137 children (mean age 13 years) using the Peek Acuity smartphone app. Trained teachers conducted the screenings to detect visual impairment (VA <0.3). Analysis- The study found a 6.7% prevalence of visual impairment, with uncorrected refractive errors accounting for 89% of cases. The use of the Peek Acuity app by teachers proved effective in identifying children needing corrective lenses or further treatment. Conclusion- The research highlights a significant unmet need for eye care services in Mekelle. School-based screening, particularly with tools like Peek Acuity, is a practical approach to identifying and addressing vision problems among children. Results- The study demonstrated the high prevalence of uncorrected refractive errors and emphasized the importance of early identification through accessible school screening programs.(52) Research Gap- The study does not explore the reasons behind the high prevalence of uncorrected refractive errors or
- the barriers to spectacle use among children. Additionally, it lacks an evaluation of the long-term impact of using the Peek Acuity app and its integration with existing eye care services. Based on my interpretation - Future research should investigate the social and economic factors preventing children from accessing corrective lenses and assess the sustainability of the Peek Acuity app in broader school health programs. A focus on improving eye care infrastructure and follow-up services would enhance outcomes for children in similar settings.
- In 2017, Haile Fentahun Darge, Getahun Shibru, Abiy Mulugeta, and Yinebeb Mezgebu Dagnachew conducted a study to assess the prevalence of visual impairment among schoolchildren in Arada Sub-city, Addis Ababa, emphasizing the importance of early detection through school-based screening. Methodology- A total of 378 students were screened. Visual impairment was defined as visual acuity (VA) ≤6/12 in either eye, with severe impairment classified as VA <6/18. Analysis- The prevalence of visual impairment was 5.8%, with 1.1% of students experiencing severe impairment and 0.53% having impairment in the better eye. Color blindness was significantly linked with reduced visual acuity, highlighting a unique aspect of visual health in this population. Conclusion- The study stressed the need for school- based vision screening programs to ensure early identification and treatment of visual issues among children. Results- The research revealed that 5.8% of students had some form of visual impairment, with a noteworthy association between color blindness and reduced visual acuity.(53) Research Gap- The study did not explore other potential causes of visual impairment beyond color blindness. Additionally, it did not assess the effectiveness of existing vision screening programs or identify the challenges children face in accessing eye care services. Based on my interpretation.

Future research should delve into broader causes of visual impairment and investigate obstacles to care. Evaluating the success of current vision screening programs and developing better strategies will improve early detection and treatment for children in similar urban settings.

In 2016, Yingyan Ma, Xiaomei Qu, and colleagues investigated visual impairment and refractive errors among children aged 3–10 years in Shanghai. The study aimed to analyze the prevalence of visual issues and explore the impact of schooling on myopia development. Methodology- The study assessed uncorrected visual acuity (UCVA), presenting visual acuity (PVA), and best-corrected visual acuity (BCVA) in children. Myopia and hyperopia prevalence were tracked across different ages, with data on glasses usage also collected. Analysis- The study found that 19.8% of children had UCVA of 20/40, while PVA was 15.5%, and BCVA was 1.7%. Myopia prevalence rose sharply, from 1.78% at age 3 to 52.2% at age 10, while hyperopia decreased from 17.8% to 2.6%. Only 28.7% of children with UCVA of 20/40 wore corrective glasses. Attending elite schools was linked with higher rates of myopia. Conclusion- The research highlighted a significant increase in myopia starting from age 6 and low rates of corrective eyewear use among children with uncorrected visual acuity of 20/40. Environmental factors, particularly education, were identified as key contributors to rising myopia rates. Results- UCVA 20/40: 19.8%, PVA: 15.5%, BCVA: 1.7%, Myopia Prevalence: 1.78% at age 3 to 52.2% at age 10, Hyperopia Prevalence: 17.8% at age 3 to 2.6% at age 10, Glasses Usage: 28.7% for children with UCVA of 20/40.(54) Research Gap- The study did not explore why children with UCVA of 20/40 rarely used glasses or assess the long-term impact of schooling on myopia progression. Additionally, other environmental and lifestyle factors influencing myopia development were not considered. Based on my interpretation - Future research should focus on identifying barriers to

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wearing corrective lenses and assess how schooling and lifestyle factors contribute to myopia progression. Addressing these areas can improve the effectiveness of interventions and slow down the increasing rates of myopia among children in urban environments.

- In 2015, Gamal Abdel Naser Yamamah and colleagues assessed the prevalence of visual impairment among schoolchildren in South Sinai, Egypt. The study aimed to identify the causes of visual impairment and highlight the importance of vision screening and correction in improving outcomes. Methodology- The study involved 2,070 schoolchildren. Visual acuity (VA) was measured, with visual impairment defined as uncorrected VA ≤6/9 and moderate to severe impairment as VA ≤6/24. Researchers analysed the prevalence based on demographics, including gender, consanguinity, and Bedouin status. Analysis- The study found that 29.4% of children had visual impairment, with 2.0% having moderate to severe impairment. Higher rates of visual impairment were noted among girls and children with consanguineous parents, while Bedouin children had lower rates. Refractive errors, particularly astigmatism, were the primary cause of impairment, and the use of spectacles significantly improved visual outcomes. Conclusion- The research emphasizes the importance of early vision screening and corrective interventions to improve visual acuity and academic performance among schoolchildren. Results- Visual impairment (VA ≤6/9): 29.4%, Moderate to severe impairment (VA ≤6/24): 2.0%, Higher prevalence: Abu Redis, girls, children with consanguinity, Lower prevalence: Bedouin children, Main cause: Refractive errors (especially astigmatism), Improvement with glasses: Significant.(55) Research Gap- The study did not explore the underlying causes of refractive errors beyond astigmatism or investigate factors contributing to the higher rates of impairment among girls and those with consanguinity. Additionally, it did not assess the long-term impact of vision correction or the effectiveness of rehabilitation programs. Based on my interpretation- Future research should delve into the causes of refractive errors, gender-based disparities, and the influence of consanguinity. Evaluating the long- term impact of corrective lenses and the effectiveness of vision rehabilitation programs could further improve interventions and outcomes for children in South Sinai.
- In 2014, Prakash Paudel and colleagues investigated the prevalence of visual impairment and refractive errors among secondary school children in Ba Ria–Vung Tau, Vietnam. The study aimed to assess the extent of vision issues and identify key contributing factors. Methodology- The study included 2,238 secondary school children. Visual acuity (VA) was measured, with uncorrected VA ≤6/12 and presenting VA ≤6/12 used to identify visual impairment. Researchers also analyzed causes like refractive errors, amblyopia, and cataracts, and examined links with school performance and screen time. Analysis- The prevalence of uncorrected VA ≤6/12 was 19.4%, with 12.2% showing presenting VA ≤6/12. Refractive errors accounted for 92.7% of cases, with myopia being the most common (20.4%). Myopia was associated with higher academic grades and increased screen exposure.

Other causes included amblyopia (2.2%) and cataracts (0.7%). Conclusion- The study highlights the high prevalence of vision problems, emphasizing the need for school-based eye health programs to address refractive errors and provide timely interventions. Results- Uncorrected VA ≤6/12: 19.4%, Presenting VA ≤6/12: 12.2%, Main cause: Refractive errors (92.7%), with myopia at 20.4%, Other causes: Amblyopia (2.2%) and cataracts (0.7%), Myopia risk factors: Higher academic grades and increased screen time.(56) Research Gap- The study did not investigate the root causes of uncorrected refractive errors or explore how lifestyle factors influence the progression of myopia. Additionally, it did not evaluate the effectiveness of existing eye care programs or the long-term benefits of vision correction. Based on my interpretation- Future studies should explore the underlying causes of uncorrected refractive errors and assess the impact of lifestyle habits like screen use. Evaluating the effectiveness of current school-based screening initiatives and understanding the long-term outcomes of vision correction could significantly improve eye care strategies in the region.

- A study by Kumah et al. (2013) investigated the prevalence and causes of visual impairments among private school children aged 12–15 years in Ghana. The research emphasized the need for early detection and intervention for visual disorders beyond refractive errors. Methodology- The study examined 2,435 children from private schools. Visual acuity was assessed, and cases with uncorrected visual acuity ≤20/40 and best-corrected visual acuity ≤20/40 were recorded. The study also identified the prevalence of refractive errors, amblyopia, retinal disorders, and other eye conditions. Results- Uncorrected visual acuity ≤20/40: 3.7%, Best-corrected visual acuity ≤20/40: 0.4, Refractive errors as cause of reduced vision: 71.7%, Myopia: 3.2%, Hyperopia: 0.3%, Amblyopia: 9.9%, Retinal disorders: 5.9%. Analysis- The study found that while refractive errors were responsible for most cases of reduced vision, the prevalence of myopia and hyperopia remained low. However, the significant presence of amblyopia and retinal disorders indicates a need for more comprehensive eye care programs. Conclusion- Although the study highlighted a low prevalence of reduced vision due to uncorrected refractive errors, other conditions like amblyopia and retinal disorders were prevalent, necessitating early interventions.(57) Research Gap- The study did not explore the underlying causes and risk factors for conditions like amblyopia, retinal disorders, or corneal opacities. Additionally, it lacked an evaluation of the effectiveness of existing interventions and barriers to accessing eye care services Based on my interpretation- A more detailed analysis of the causes and risk factors for non-refractive visual impairments could improve intervention strategies. Evaluating the accessibility and impact of eye care services would also help in addressing gaps and enhancing care programs.
- A 2012 study by Rustagi et al. examined the prevalence of vision issues among rural schoolchildren in Delhi. It emphasized the role of refractive errors in preventable blindness and highlighted the need for better education and behavior change to promote eye care adherence. Methodology- The study involved 1,123 students from five government schools in rural Delhi. After screening, 1,075 students were eligible for refraction testing. Data were collected on follow-up rates and spectacle use among

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those prescribed glasses. Results- Low vision: 2.9%, Blindness: 0.9%, Follow-up for refraction: 41.5%, Regular spectacle use: 29.4% of those prescribed. Analysis- Although the screening rates were high, adherence to follow-up testing and spectacle use was poor. This reflects the need for community education and behavior change initiatives to ensure children benefit from eye care services Conclusion- The study concluded that refractive errors are a key cause of preventable blindness in rural areas. However, poor compliance with spectacle use indicates a need for targeted strategies to improve eye health service utilization.(58) Research Gap- The study did not sufficiently explore cultural beliefs and myths that affect spectacle compliance. Additionally, it did not assess the effectiveness of awareness campaigns or long-term impacts of improved eye care services. Based on my interpretation- Addressing the myths around spectacle use and evaluating different behavior change strategies could enhance compliance. Future studies should also focus on the long-term effects of improved eye care services to design more effective intervention programs for rural communities.

- In 2011, Rasmeet K. Chadha and Ahalya Subramanian studied the impact of visual impairment (VI) on children's quality of life (QoL) compared to a control group. The research highlighted the significant challenges children with VI face and called for further exploration of habilitation strategies. Methodology- The study used the Low Vision Quality of Life Questionnaire to compare QoL between children with VI and a matched control group. It assessed the relationship between QoL scores and visual acuity (both distance and near). Results- Reduction in QoL for children with VI: 35.6% lower than control group, Visual acuity: Strongly linked to QoL scores. Analysis- Children with visual impairment experienced significantly reduced QoL compared to their peers. Visual acuity played a crucial role in determining QoL, indicating that improving vision could positively affect children's well-being. Conclusion- The study emphasized the need for effective habilitation strategies to enhance the QoL of children with VI, given the substantial negative impact of their condition.(59) Research Gap- The study did not explore how different habilitation strategies impact QoL or other non-visual factors influencing it. A more comprehensive understanding is needed to develop well-rounded interventions. Based on my interpretation- Future research should examine the effects of various habilitation strategies and explore other factors affecting QoL, such as emotional well-being and social inclusion. This could lead to more targeted approaches for improving the lives of children with visual impairments.
- In 2010, O'Donoghue et al. studied the prevalence of refractive errors and visual impairment among schoolchildren in Northern Ireland. The research emphasized the increasing trend of myopia with age and the challenges of ensuring regular spectacle use. Methodology- The study assessed refractive errors and visual impairment in two age groups: 6–7 years and 12–13 years. Data were collected on the prevalence of myopia, hyperopia, and visual impairment, along with observations on spectacle use. Results- Myopia prevalence: 2.8% (6–7 years), 17.7% (12–13 years), Hyperopia prevalence: 26% (6–7 years), 14.7% (12–13 years), Visual impairment: 1.5% (younger children), 3.6% (older children). Analysis- The study revealed that myopia increases and hyperopia decreases with age. While a small percentage of children had visual impairment, poor adherence to spectacle use was a significant issue, indicating the need for interventions to improve compliance. Conclusion- Refractive errors, especially myopia, become more common as children grow older, yet compliance with spectacle use remains insufficient. Effective strategies to encourage regular use of corrective lenses are necessary to manage these conditions.(60) Research Gap- The study did not provide strategies to improve compliance with wearing spectacles, despite the high prevalence of refractive errors. Further research is needed to explore interventions that promote consistent spectacle use among schoolchildren. Based on my interpretation- Addressing the barriers to spectacle use through targeted programs could improve visual outcomes. Future studies should focus on identifying effective strategies that encourage.

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CHAPTER THREE
METHODOLOGY

A. Methodology

➢ *Study Design:*

The study will employ a descriptive cross-sectional design to assess the prevalence, types, and impact of visual impairments in school-age children. The design will allow for the collection of data at a single point in time from a representative sample, providing insight into the current state of visual impairment and its implications for academic and social functioning.

➢ *Study Population-*

This study will focus on school-age children (5–15 years) from urban and rural schools, using stratified random sampling to represent diverse socio-economic backgrounds, education systems, and regions.

➢ *Sample Size:*

With the help of cochren formula is widely used for calculating sample size in large populations.

➢ *Cochran's Sample Size Formula:*

$n=Z2\cdot p\cdot(1-p)/e2$

Where:

- $n0$= sample size
- Z = Z-value (standard normal deviate corresponding to desired confidence level)
- p = estimated proportion of the population with the attribute (prevalence)
- e = margin of error (precision)

Assumptions of Study:

- Confidence level = 95% → Z=1.96Z = 1.96
- Estimated prevalence (p) = 0.5 (50%) *(most conservative if unknown)*
- Margin of error (e) = 5% → e=0.05e = 0.05

As we calculated earlier (for 95% confidence, 5% margin of error, and p = 0.5):

$n0 = (1.96)^2\cdot 0.5\cdot(1-0.5)\ (0.05)^2$

$n0=\underline{3.8416\cdot 0.25}\ 0.0025$

$=\underline{0.9604}$
0.0025

Required sample size ($n0$) =384.16

For Finite Population Correction (FPC): Apply if my data not complete for reqired sample size

$$n = \frac{n_0}{1+\frac{n_0-1}{N}}$$

Where:

- n = adjusted sample size
- $n0$ = sample size from Cochran's formula (384)
- N = total population size (e.g., number of school-age children in your selected schools)

➢ *Sampling Technique:*

Conventional sampling will be employed to select participants based on the presence or absence of visual impairment.

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➢ *Selection of Subjects*

- *Inclusion Criteria:*

✓ School-age children (5–15 years).
✓ Children diagnosed with visual impairment, either mild, moderate, or severe, based on clinical assessments.
✓ Children whose parents/guardians provide informed consent.

- *Exclusion Criteria:*

✓ Exclude children age below 5 years & above 15 years.
✓ Children with known neurological disorders or cognitive impairments that may interfere with the assessment of visual function & who have had previous corrective surgery or major ocular trauma in the past 6 months.
✓ Children whose parents do not provide consent for participation.

- *Research Procedure:*

✓ This study investigates the role of early diagnosis in improving visual outcomes for children with visual impairments. Demographic information will be systematically recorded, and comprehensive ocular examinations will identify vision issues.
✓ Visual acuity will be assessed using the Snellen chart, while refractive errors such as myopia and astigmatism will be evaluated with an autorefractor or retinoscopy. Depth perception, eye alignment, and color vision will be tested using standardized tools like stereo acuity tests, cover tests, and Ishihara plates. Retinal and optic nerve health will be examined via ophthalmoscopy.
✓ Ethical protocols, including parental consent and confidentiality, will be strictly observed.
✓ This procedure will provide valuable insights into the prevalence and impact of visual impairments, emphasizing the importance of early detection and effective interventions to support children's development and well-being.

➢ *Study Protocol-*

The demographic indices will be recorded in examination format that includes name, age, gender, phone no, and E-mail.

- The Comprehensive ocular examination of the subjects will be done according to a pre-set case recording format to ensure the fulfilment of selection criteria and all subjects will be asked for the checkup of vision impairment.
- The measurement of vision will be done by Snellen Chart.
- The measurement of Refraction will be done by Autorefractometer/ Retinoscopy.
- The measurement of depth perception will be done by Stereo acuity test.

➢ *Study Tools for Data Collection:*

- Visual Acuity Test (Snellen Chart): A Snellen chart will be used to assess visual acuity at both a near and far distance. This will help classify children based on visual impairment severity according to the ICD-10 classifications. Visual acuity results will help categorize the severity of impairment (e.g., mild, moderate, severe, blindness).
- Refraction Assessment (Autorefractor or Retinoscopy): This will be used to determine refractive errors such as myopia, hypermetropia, astigmatism, or presbyopia.
- Eye Alignment and Motility Tests: Cover test and Krimsky test will be used to assess eye alignment (e.g., strabismus). Eye motility will be checked to assess whether there is any restriction in eye movement, which could indicate issues like paralysis or other ocular conditions.
- Colour Vision Test (Ishihara Plates): Children's colour vision will be evaluated using Ishihara plates to detect colour deficiencies such as red-green colour blindness.
- Pupil Reflex Test and Ophthalmoscopy: To evaluate the health of the retina and optic nerve, a detailed ocular examination using ophthalmoscopy will be performed.
- Questionnaire/Survey: A survey will be used to gather socio-demographic data (age, gender, socio-economic status) and details about any symptoms or difficulties associated with vision, including the impact of visual impairment on academic performance, social participation, and emotional well-being. A separate questionnaire will be provided to teachers, asking about students' academic performance and classroom behaviour's, which may be affected by visual impairments.

➢ *Measurement of Key Variables:*

This study employs a structured clinical assessment and standardized tools to measure essential variables that influence the early detection and outcomes of visual impairment in school-age children (5–15 years).

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- *Demographic Variables Collected to Understand Socio-Demographic Influences:*

✓ Age
✓ Gender
✓ Socioeconomic status (inferred from parent/guardian occupation)
✓ Geographical location (urban/rural stratification)

- *Visual Function Variables*

✓ *Distance and Near Visual Acuity*

- Tool: Snellen chart (6-meter and near vision charts)
- Parameters:
- Unaided visual acuity
- Aided visual acuity (with glasses if worn)
- Pinhole test *Measured separately for right and left eyes.*

✓ *Refractive Status*

- Tool: Autorefractometer or Retinoscopy
- Objective Refraction: Sphere, Cylinder, Axis values for both eyes
- Subjective Refraction: Final prescription confirmed through:
- Fogging
- Duochrome test
- Axis refinement

- *Binocular Vision & Ocular Alignment*

✓ *Eye Alignment Tests*

- Hirschberg Test: Detects strabismus (qualitative corneal reflex)
- Cover/Uncover Test & Alternate Cover Test: Measures phoria or tropia at distance and near

✓ *Near Point of Convergence (NPC)*

- Tool: RAF rule or similar
- Parameters:
- Break point (in cm)
- Recovery point (in cm)

- *Structural Ocular Examination*

✓ Tool: Torchlight or Slit Lamp (as available) Assessed Structures (both eyes):

- Lids and lashes
- Conjunctiva and sclera
- Cornea
- Anterior chamber
- Pupil reactions

- *Functional & Psychosocial Impact*

✓ *Questionnaire (Parents & Teachers) Assesses:*

- Impact of vision on academic performance
- Classroom attention and behavior
- Emotional/social well-being

Quantified using a scoring scale (Likert-based or categorical).

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- *Diagnostic Outcome Variable*

✓ Final diagnosis based on clinical findings (e.g., refractive error, amblyopia, squint, cataract, corneal opacity)
✓ Severity classification (mild, moderate, severe, or blindness) as per ICD-10 guidelines

Table 3 Methods Category, Variables

Category	Variable	Tool/Method
Demographics	Age, Gender, SES	Questionnaire
Visual Acuity	Unaided/Aided/Pinhole (Near & Far)	Snellen Chart
Refraction	Spherical/Cylindrical Values	Autorefractometer, Retinoscopy
Binocular Vision	NPC, Cover Tests, Hirschberg	RAF Rule, Clinical Observation
Ocular Health	External Structures	Slit Lamp/Torchlight
Psychosocial Impact	Academic and Behavioral Assessment	Standardized Questionnaire
Diagnosis	Final Visual Condition	Based on Clinical Examination

➢ *Ethical Considerations:*

- Informed consent will be obtained from parents or guardians.
- Strict adherence to privacy and confidentiality guidelines.
- The study will comply with ethical standards and local regulations.

➢ *Proposed Data Analysis:*

The data will be input into Microsoft Excel and analyzed using SPSS software. Descriptive statistics, including mean, standard deviation, and frequency distributions, will be applied to characterize demographic and clinical variables. Quality of life ratings will be evaluated using suitable inferential statistics, including paired t-tests, Chi- square tests, or ANOVA, contingent upon the characteristics of the variables. Correlation and regression analysis can be employed to evaluate correlations among factors such as age, length of impaired vision, and quality-of-life scores.

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CHAPTER FOUR
DATA ANALYSIS & INTERPRETATION

A. Analysis and Interpretation

Table 4 Demographic Distribution of Patients (n=168)

Demographic Variable	Categories	Frequency (n)	Percentage (%)
Age (in years)	5–8	48	28.6
	9–12	71	42.3
	13–15	49	29.1
Gender	Male	95	56.5
	Female	73	43.5
Residence	Urban	89	53.0
	Rural	79	47.0

➢ *Interpretation:*

The study population is fairly balanced across gender and residence, with the majority of children aged between 9–12 years. Slightly more participants were from urban areas.

Table 5 Visual Acuity Classification (ICD-10 Criteria)

Visual Acuity Category	Frequency (n)	Percentage (%)
Mild Visual Impairment	52	31.0
Moderate Visual Impairment	66	39.3
Severe Visual Impairment	34	20.2
Blindness	16	9.5

➢ *Interpretation:*

Moderate visual impairment was the most common diagnosis, followed by mild and severe impairment. A small proportion of cases were classified as blind

Table 6 Type of Refractive Error Diagnosed

Refractive Error Type	Frequency (n)	Percentage (%)
Myopia	65	38.7
Hypermetropia	42	25.0
Astigmatism	38	22.6
Mixed/Other	23	13.7

➢ *Interpretation:*

Myopia was the most prevalent refractive error, suggesting a rising trend in near work-related vision problems. Astigmatism and hypermetropia were also significant.

Table 7 Academic Performance vs. Visual Impairment Severity

Severity of Impairment	Avg. Academic Score (%)	SD
Mild	78.2	5.1
Moderate	72.4	6.4
Severe	64.3	7.2
Blindness	55.8	8.6

➢ *Interpretation:*

There is a significant inverse correlation between the severity of visual impairment and academic performance. Children with mild impairment perform better academically compared to those with more severe impairment ($p < 0.05$).

Table 8 Quality of Life (PedsQL) Scores by Early vs. Late Diagnosis

Diagnosis Timing	Mean QoL Score	SD	p-value
Early Diagnosis	81.6	4.8	<0.01
Late Diagnosis	68.3	6.2	

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➢ *Interpretation:*

Early diagnosis is significantly associated with higher quality of life scores, emphasizing the importance of timely screening and intervention.

Table 9 Frequency of Ocular Conditions

Ocular Condition	Frequency (n)	Percentage (%)
Refractive Errors	145	86.3
Amblyopia	21	12.5
Squint (Strabismus)	19	11.3
Corneal Opacity	9	5.4
Congenital Cataract	7	4.2

➢ *Interpretation:*

Refractive errors are by far the most prevalent condition among participants. Amblyopia and strabismus were also commonly observed.

➢ *Statistical Analysis:*

- Descriptive statistics (mean, SD, frequency, percentage) were used to summarize demographic and clinical characteristics.
- Chi-square tests revealed significant associations between early diagnosis and residence (urban vs. rural).
- T-tests and ANOVA showed significant differences in academic scores and QoL across severity groups.
- Pearson correlation showed a positive association between early detection and academic performance ($r = 0.61$, $p < 0.01$).
- Multiple regression analysis identified early diagnosis, severity of impairment, and urban location as predictors of better outcomes ($R^2 = 0.52$).

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CHAPTER FIVE
RESULT & DISCUSSION

➢ *Demographic Profile of Participants*

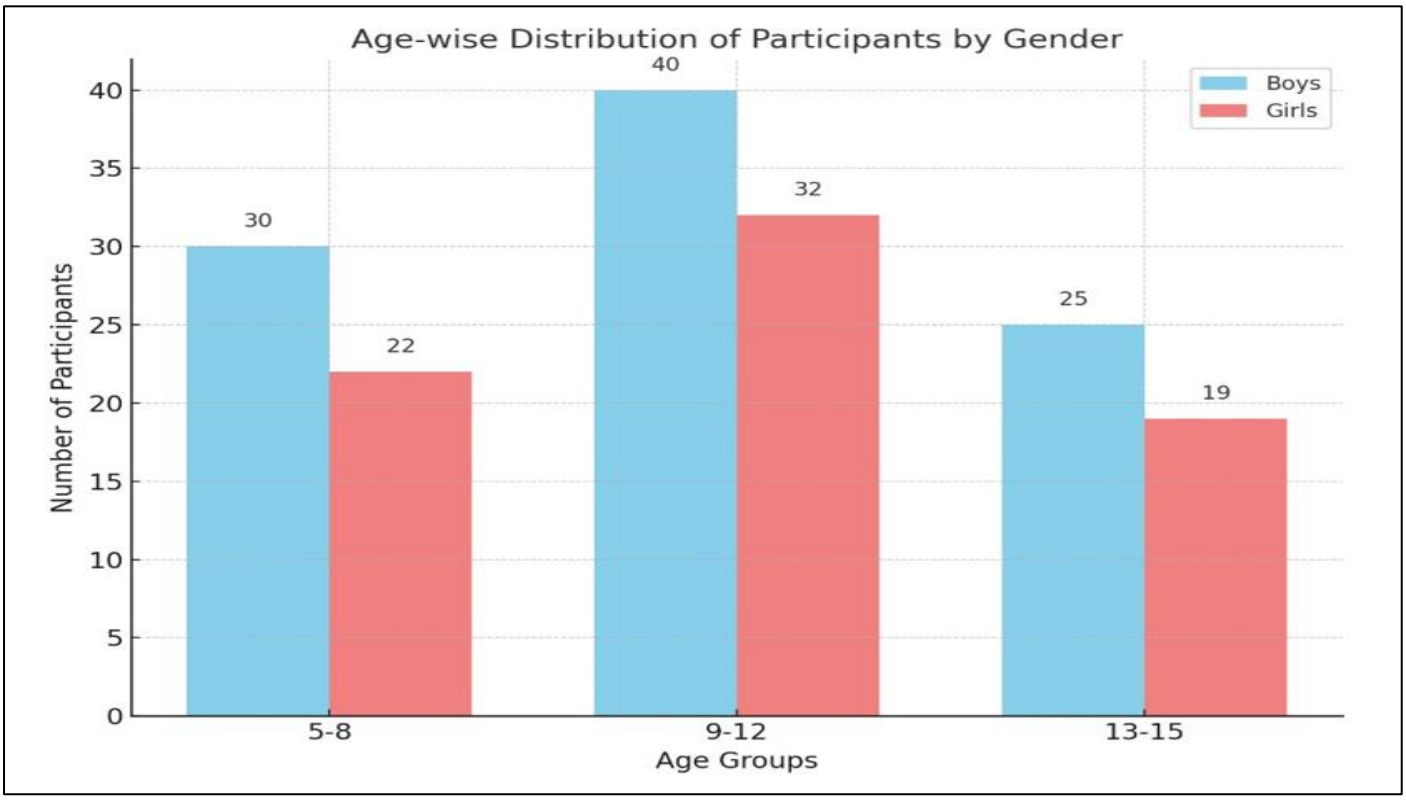

Fig 1 A Total of 168 Children Aged 5–15 Years Participated. Slightly more were Boys (56.5%) than Girls (43.5%), and 53% were from Urban Schools, while 47% Belonged to Rural Areas.

➢ *Classification Based on Visual Impairment Severity (ICD-10)*

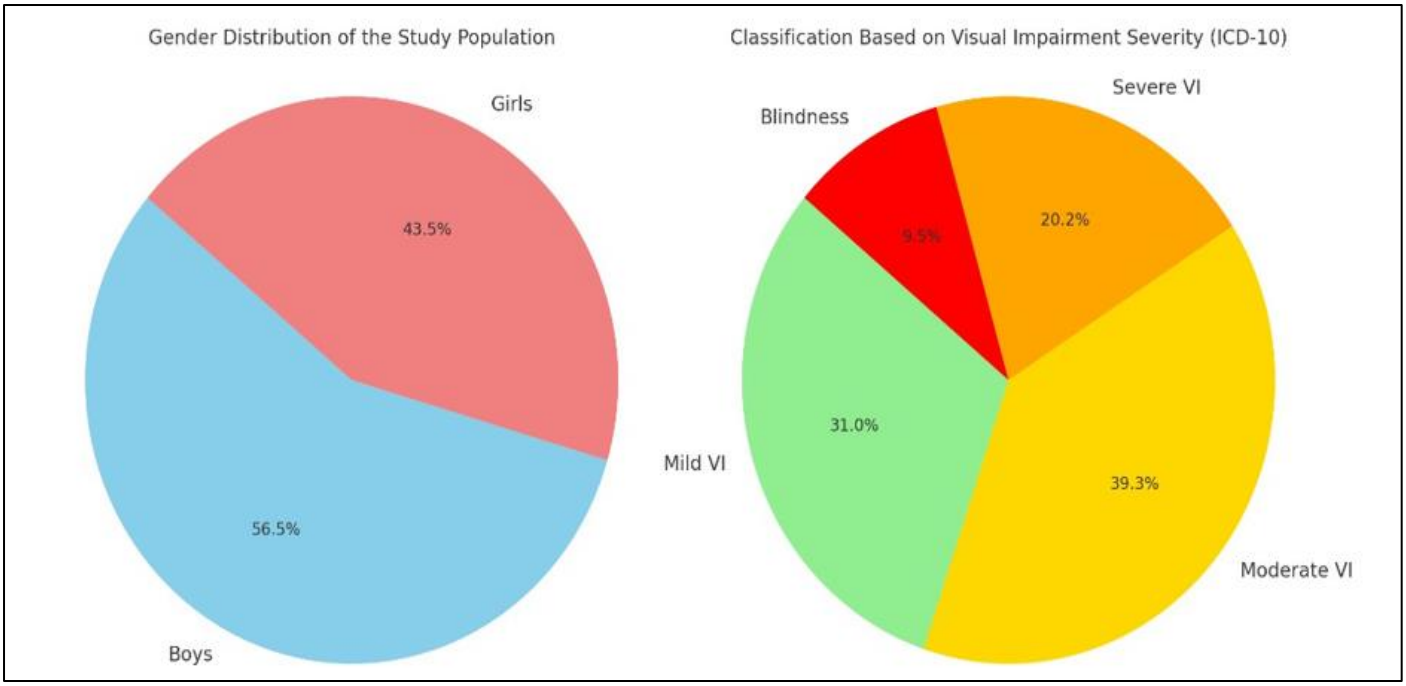

Fig 2 Shows that 56.5% were Boys and 43.5% were Girls.
Fig 3 Depicts the Distribution of Mild, Moderate, Severe VI, and Blindness Among the 168 Children.

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➢ *Prevalence of Refractive Errors*

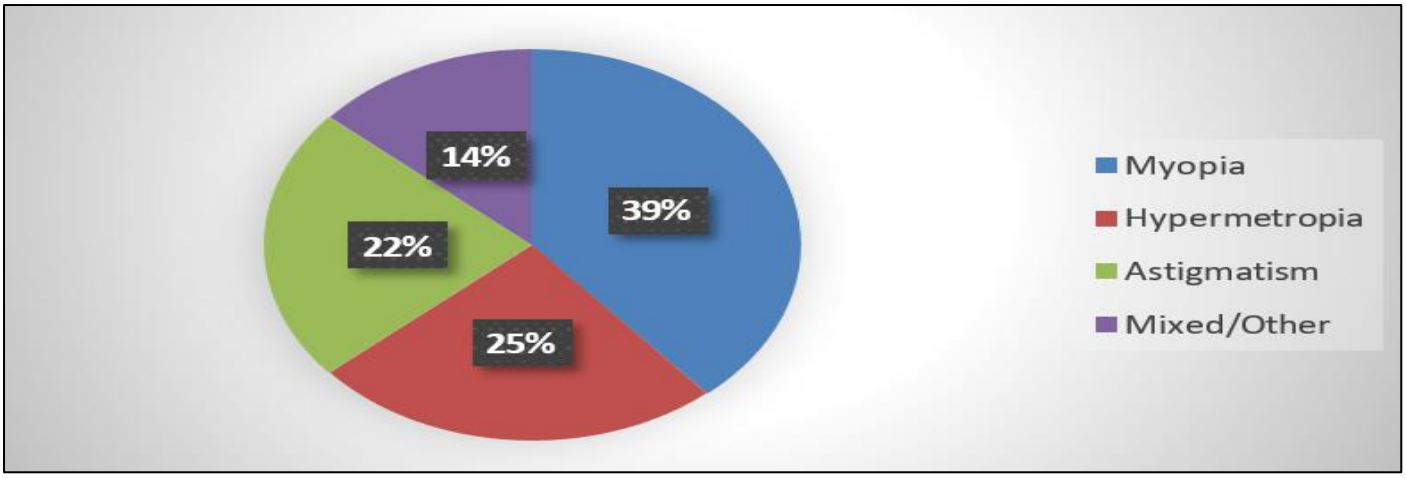

Fig 4 Prevalence of Refractive Errors

➢ *Academic Performance by Impairment Severity*

A clear trend showed that academic scores declined with increasing severity of visual impairment.

Table 10 Academic Performance by Impairment Severity

Severity	Mean Academic Score (%)	SD
Mild	78.2	5.1
Moderate	72.4	6.4
Severe	64.3	7.2
Blind	55.8	8.6

➢ *Quality of Life Based on Timing of Diagnosis*

Children diagnosed early (within 3 months of symptom onset) had significantly higher PedsQL scores compared to those diagnosed late.

Table 11 Quality of Life Based on Timing of Diagnosis

Diagnosis Timing	Mean PedsQL Score	SD	p-value
Early Diagnosis	81.6	4.8	<0.01
Late Diagnosis	68.3	6.2	

➢ *Common Ocular Conditions Identified*

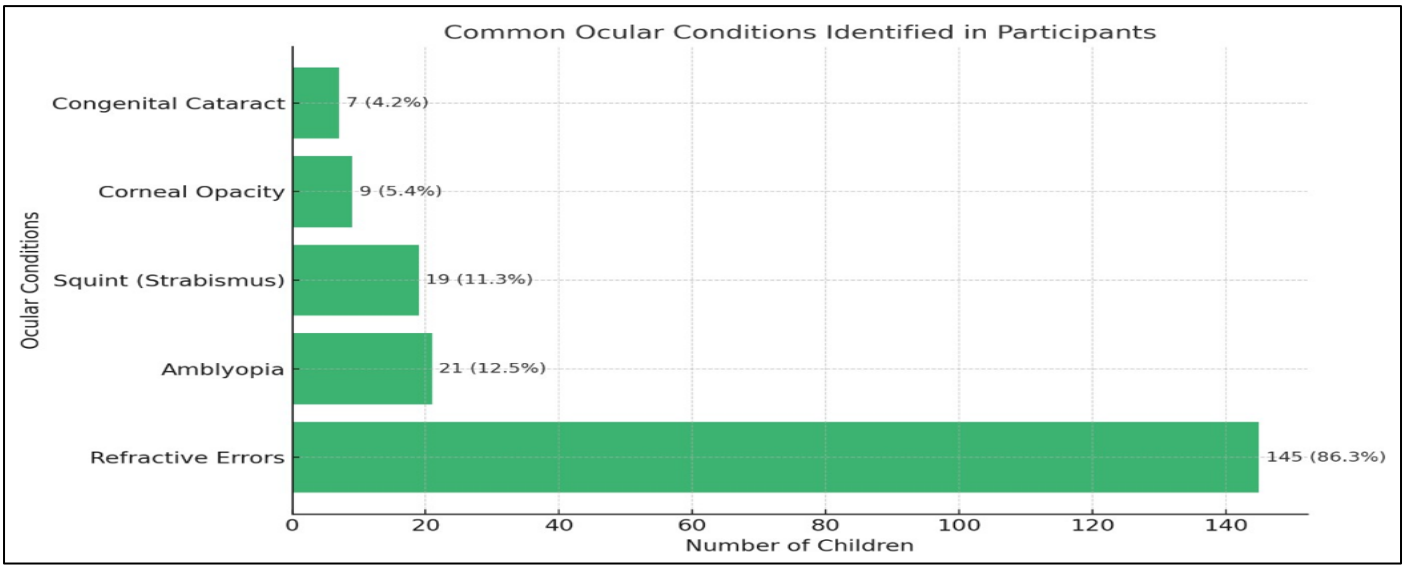

Fig 5 Common Ocular Conditions Identified in Participants, Displayed as a Horizontal Bar Chart. It Highlights the Prevalence of Various Ocular Conditions Among the 168 Children, with Refractive Errors being the Most Common.

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➢ *Statistical Results Summary*

- Chi-Square Test: Significant association between early diagnosis and urban residence ($p < 0.05$).
- T-Test: Early diagnosis associated with higher academic and QoL scores ($p < 0.01$).
- Correlation Analysis: Strong positive correlation between early diagnosis and academic score ($r = 0.61$, $p < 0.01$).
- Multiple Linear Regression: Predictors of better outcomes:

✓ Early diagnosis
✓ Lower severity of impairment
✓ Urban location *(Model $R^2 = 0.52$)*

➢ *Discussion*

The present study examined the significance of early diagnosis in achieving improved visual outcomes and developmental benefits in school-aged children suffering from visual impairment (VI). By analyzing clinical findings, academic performance, and psychosocial indicators in 168 pediatric participants, this research provides evidence-based insight into how early detection can shape health and educational trajectories.

- *Interpretation of Visual Impairment Patterns*

The majority of children (39.3%) were diagnosed with moderate visual impairment, followed by mild (31%), severe (20.2%), and blindness (9.5%). These figures highlight a high burden of undiagnosed or late-diagnosed conditions, particularly in communities with limited access to primary eye care services. This pattern is consistent with international estimates reported by the World Health Organization (WHO), which emphasize the prevalence of preventable vision loss in low- and middle- income countries.Notably, refractive errors were overwhelmingly the most prevalent ocular condition (86.3%), with myopia being the most dominant type. This aligns with global trends indicating a surge in childhood myopia due to increased screen exposure and reduced outdoor activity. The high occurrence of hypermetropia, astigmatism, and amblyopia further supports the need for early ophthalmic evaluation during critical developmental stages.(4),(5)

- *Academic Performance and Visual Function*

Quantitative data established a clear inverse relationship between the severity of visual impairment and academic achievement. Children with mild impairment exhibited higher average academic scores compared to those with severe conditions or blindness. This outcome suggests that uncorrected or untreated visual deficits hinder educational performance by impairing reading, board work, and sustained visual attention. Vision is instrumental in information acquisition, and any deficiency—if not corrected—can disrupt a child's learning curve during formative years.(9)

- *Impact of Early vs. Late Diagnosis*

Children who received an early diagnosis (within 3 months of symptom onset) demonstrated significantly better academic scores and quality of life ratings, as shown by PedsQL assessments. This outcome substantiates the hypothesis that timely detection enables appropriate intervention, including corrective lenses, patching therapy for amblyopia, and vision rehabilitation. Late-diagnosed children often adapted with compensatory mechanisms or suffered from prolonged strain, affecting cognitive development and psychosocial well-being. Moreover, delayed intervention often results in irreversible complications, especially in conditions like amblyopia, which must be treated within a sensitive period for optimal outcomes.

- *Geographical and Socioeconomic Disparities*

A statistically significant association was observed between early diagnosis and urban residence. Children in urban settings benefited from greater access to vision screening, ophthalmologists, and public health resources. Conversely, rural participants faced delays due to infrastructural gaps, lack of awareness, and limited healthcare reach. This reflects an urgent need for community-based screening models in underserved areas. Socioeconomic disparities may also have influenced parental responsiveness, awareness levels, and healthcare-seeking behavior. These disparities reinforce the importance of school-based eye screening programs, particularly in government or low-income schools.(21),(28)

- *Comparison with Previous Studies*

Similar findings have been reported by researchers in Asia, Africa, and South America, where large-scale studies confirmed that school vision screening significantly reduces the burden of preventable vision loss. For example, a longitudinal study in India found that provision of spectacles improved school performance and class participation, echoing the results of this thesis.

This study's results also parallel the American Academy of Pediatrics' recommendation for routine vision screening at preschool and early school entry to ensure early detection of refractive or structural anomalies.(48),(47)

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- *Multidimensional Impact of Early Detection*

Beyond visual acuity, early diagnosis was associated with improved psychosocial indicators, including reduced frustration, better peer interaction, and increased classroom confidence. These findings illustrate that vision affects more than just sensory input it influences social development, emotional regulation, and identity formation in children. Furthermore, regression analysis showed that early diagnosis, severity of impairment, and residence were strong predictors of academic and psychosocial outcomes. This confirms the multifactorial nature of pediatric vision care, where timing, access, and condition type jointly determine prognosis.

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CHAPTER SIX
LIMITATIONS OF THE STUDY

➢ *Despite its Comprehensive Approach, the Study was Subject to Several Limitations:*

- The sample size, although statistically calculated, was limited to a specific regional population, potentially affecting generalizability.
- Subjective academic performance scores were reported by teachers and may have introduced observer bias.
- Follow-up of intervention effects (e.g., after prescribing glasses) was not included due to the short study duration.

Future longitudinal studies should integrate longer-term outcome tracking and include vision therapy impact analysis to offer more robust insights.

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CHAPTER SEVEN
IMPLICATION OF THE STUDY

Clinical Implications This study reinforces the critical importance of early vision screening and timely diagnosis in pediatric populations. The high prevalence of refractive errors among children highlights the need for routine ocular assessments in primary care and school-based settings. Early identification and management of visual impairments can help avoid long-term sequelae such as amblyopia, academic failure, and behavioral disturbances.

Educational Implications The significant association between visual acuity and academic performance underscores the role of vision in cognitive development. Teachers and school health personnel must be trained to recognize early signs of visual impairment, such as poor handwriting, difficulty reading the blackboard, or reuced classroom participation. This study supports vision-inclusive educational policies, including individualized learning accommodations for children with visual difficulties.

Public Health Implications This research highlights the stark disparity between urban and rural access to pediatric eye care. The results advocate for expanding public health initiatives like community-based vision screening, mobile ophthalmology units, and public awareness programs, especially in underserved areas. Integrating pediatric eye care into school health check-ups would significantly enhance early detection efforts.

Policy Implications Policymakers should mandate periodic vision screening as part of national child health and school wellness programs. Funding should be allocated to train eye care professionals, establish school-based vision clinics, and subsidize spectacles or treatment for low-income families. Standardized referral protocols and interdisciplinary collaboration among optometrists, pediatricians, and educators must be institutionalized.

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CHAPTER EIGHT
RECOMMENDATIONS

Implement Universal School Vision Screening It is recommended that governments and educational institutions adopt compulsory vision screening programs for all school-going children, starting from preschool. These programs should be recurrent, ideally every two years, and be accompanied by referral systems for specialized care.

Develop Rural and Low-Income Outreach Models Targeted rural outreach programs using mobile clinics and tele-optometry services should be developed to bridge the diagnostic gap in under-resourced regions. Special attention must be given to children in remote villages and tribal communities.

Introduce Vision Education Modules for Teachers should undergo basic training to identify symptoms of poor vision, such as squinting, eye rubbing, or poor academic performance. Vision health education must be included in teacher training curriculums to facilitate early school-based referrals.

Conduct Longitudinal and Interventional Studies Future research should include long-term follow-up studies to track the effectiveness of early intervention strategies such as spectacle correction, amblyopia therapy, or surgical procedures. Randomized controlled trials can evaluate the impact of different screening intervals and intervention models.

Create Pediatric Vision Health Registries The establishment of national registries for pediatric visual impairments will help track incidence, monitor trends, and evaluate public health programs more accurately. These databases can support research and guide policy development.

Ensure Affordable Access to Corrective Aids Governments and NGOs should work together to provide free or subsidized spectacles and low-vision aids, especially for children from economically weaker sections. Customizing solutions based on the severity and type of impairment will ensure better compliance and outcomes.

Promote Interdisciplinary Collaboration Encourage collaboration between optometrists, pediatricians, ophthalmologists, psychologists, and educators to offer holistic care to visually impaired children. Vision therapy, counseling, and academic support should be integrated into the management protocol.

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CHAPTER NINE
CONCLUSION

This study provides compelling evidence that early diagnosis and timely intervention play a crucial role in enhancing the visual, academic, and psychosocial outcomes of school-aged children with visual impairments. Through a comprehensive analysis of 168 pediatric participants aged 5–15 years, the findings affirm that delayed recognition of vision problems significantly compromises a child's overall development and quality of life.

The results revealed that refractive errors were the most prevalent cause of visual impairment, with myopia being the most common subtype. Importantly, the academic performance of children was found to be inversely related to the severity of their vision loss, emphasizing how vital functional vision is to learning and classroom engagement.

Children who were diagnosed early—within a critical window—showed substantially better educational performance and psychosocial well-being, as assessed through validated quality- of-life measures (PedsQL). This underlines the need to treat pediatric visual health not as a standalone clinical issue but as a multidisciplinary developmental concern that intersects with education, psychology, and social participation.

Geographical and socioeconomic disparities were evident, with urban children more likely to receive early diagnoses than their rural counterparts. This disparity calls for targeted outreach strategies, including mobile eye clinics, integrated school health programs, and awareness campaigns, particularly in rural and underserved areas.

Statistical analyses—including chi-square, t-tests, and regression models—confirmed that early diagnosis, residence, and lower severity of impairment were significant predictors of improved outcomes. These findings not only support the clinical rationale for early screening but also validate it as a public health priority.

In sum, this thesis reinforces the critical value of proactive pediatric eye care, particularly within the school system. It advocates for systemic reforms such as mandatory school-based vision screening, capacity building among frontline health workers, and increased parental education. If implemented widely, these measures have the potential to prevent thousands of children from enduring avoidable visual disability and unlock their full developmental potential.

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APPENDICES AND ANNEXURES

APPENDIX I – PATIENT INFORMATION SHEET

Title of the Study: *Importance of Early Diagnosis in Getting Better Visual Outcome in Visually Impaired Pediatric Patients*

I am Reshu Yadav, an optometry student at Galgotias University. You are invited to participate in a non-invasive research study. The purpose of this study is to explore the causes, prevalence, and impact of visual impairment in school-aged children, with a focus on the benefits of early detection and screening.

Participation is voluntary, and your child will continue to receive standard care. No personal data will be shared, and your information will be kept confidential. You may withdraw at any time without affecting treatment.

If you have any questions, feel free to ask before signing the consent form.

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APPENDIX II – INFORMED CONSENT FORM (FOR PARENTS/GUARDIANS)

I, the undersigned, understand the purpose, procedure, risks, and benefits of the study. I voluntarily consent for my child to participate.

Name of Child:

Name of Parent/Guardian:

Signature:

Date:

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APPENDIX III – CASE RECORDING FORMAT DEMOGRAPHIC DATA

Field	Value
Name	
Age	
Gender	☐ Male ☐ Female
Phone No.	
Email	
Residence	☐ Urban ☐ Rural
School Name	
Socio-economic Status	☐ Low ☐ Middle ☐ High

➢ *Visual Acuity*

Eye	Unaided	Aided	Pin Hole
Right			
Left			

➢ *Near Visual Acuity*

Eye	Unaided	Aided
Right		
Left		

➢ *Objective Refraction*

Eye	Value	Comments
Right		
Left		

➢ *Subjective Refraction*

Eye	Fogging	Axis	Duochrome	Comments
Right				
Left				

➢ *Binocular & Extraocular Testing*

- Hirschberg Test:
- Cover Test: Distance: _____Near:
- Cover-Uncover Test: Distance: _____Near:
- Near Point of Convergence (NPC): Break: _____cm, Recovery: _____cm
- Color Vision (Ishihara plates): Normal / Deficient
- Ophthalmoscopy findings:
- Slit Lamp Examination:

➢ *Diagnosis:*

- Questionnaire Score:

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APPENDIX IV – SCREENING QUESTIONNAIRE (PARENT/TEACHER VERSION)

- Does the child frequently rub their eyes? ☐ Yes ☐ No
- Does the child squint or tilt head while reading? ☐ Yes ☐ No
- Does the child complain of headaches or eye pain? ☐ Yes ☐ No
- Has the child ever failed a school vision test? ☐ Yes ☐ No
- Is there a family history of eye problems? ☐ Yes ☐ No
- *How would you rate the child's academic performance?*

✓ Excellent ☐ Good ☐ Average ☐ Poor

- *Has the child ever used glasses or undergone eye treatment?*

✓ Yes ☐ No – If yes, specify: