International Journal of Medical Sciences And Clinical Research

VOLUME Vol.06 Issue06 2026
PAGE NO. 25-34
DOI 10.37547/ijmscr/Volume06Issue06-06

Prevalence of Strabismus and Cerebral Visual Impairment among 6- to 12-month-old Premature Babies in a Nigerian Tertiary Hospital

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Received: 13 April 2026; **Accepted:** 22 May 2026; **Published:** 18 June 2026

Abstract: Background: Visual disorders in premature infants remain a major concern due to their potential impact on early neurodevelopment and long-term functional outcomes. This study set out to determine the prevalence of strabismus and cerebral visual impairment among premature babies aged 6 to 12 months at a Nigerian tertiary hospital.

Methods: Researchers conducted a hospital-based cross-sectional study of consecutive eligible premature infants attending follow-up clinics. They collected biodata through interviewer-administered questionnaires and performed detailed ocular examinations, including the Hirschberg test for ocular alignment. Data analysis used IBM SPSS version 20, with results presented as frequencies and percentages.

Results: One hundred and twenty-six premature infants took part, with 57 males (45.2%) and 69 females (54.8%). Gestational age at birth ranged from 28 to 36 weeks. All participants showed orthophoria on the Hirschberg test, with no evidence of strabismus. Similarly, examiners found no cases of cerebral visual impairment.

Conclusion: In this cohort, the prevalence of both strabismus and cerebral visual impairment stood at 0%. These findings highlight the value of early screening in this age group, even when clinical signs appear absent. They also point to the need for continued follow-up as visual development progresses.

Keywords: Strabismus, cerebral visual impairment, premature infants, Nigeria.

INTRODUCTION

Premature birth places considerable strain on the developing visual system. Advances in neonatal care have substantially improved survival rates for infants born before 37 weeks of gestation, yet these children often face heightened risks of visual difficulties that extend well beyond the neonatal period. Among the most pressing concerns are strabismus and cerebral visual impairment, two conditions capable of profoundly influencing a child's visual function, motor development, and overall quality of life (Hatt et al., 2020; Fieß et al., 2024; Robitaille, 2024).

Strabismus, characterised by misalignment of the eyes, frequently emerges in children born prematurely. Recent investigations indicate that the condition may affect between 5% and 42% of preterm infants, with rates rising notably in those who experienced retinopathy of prematurity or lower gestational ages. For example, one study of adults born preterm reported strabismus prevalence reaching 17% in moderate preterm groups and up to 60% in those with treated retinopathy of prematurity (Fieß et al., 2024). Another analysis observed that strabismus frequency increased from early infancy into the preschool years, particularly among children with a history of retinal changes or refractive issues. The presence of esotropia appears more common than exotropia in this population, and risk factors commonly include lower birth weight, anisometropia, and neurological complications (Anastasiia & Sergii, 2024).

If undetected or untreated, strabismus can lead to amblyopia, reduced binocular vision, and lasting effects on self-esteem and social interaction. In resource-limited settings, where routine early screening may not be universal, these consequences carry additional weight. The dynamic nature of visual development in the first year of life means that alignment problems can appear or evolve over time, underscoring the need for timely assessment during critical windows such as 6 to 12 months of age (Hendry et al., 2019; Morelli, 2023; Oseji et al., 2025).

Cerebral visual impairment (CVI), sometimes referred to as cortical visual impairment, arises from damage to the retrochiasmal visual pathways and associated brain regions rather than from ocular structures themselves. Hypoxic-ischaemic events, periventricular leukomalacia, and intraventricular haemorrhage, all more frequent in preterm infants, represent major contributors. Studies suggest that CVI accounts for a substantial proportion of visual impairment in children born early, with estimates ranging from 21% to 47% in some preterm cohorts. In higher-income countries, CVI stands as one of the leading causes of childhood visual disability, and its prevalence appears to be increasing alongside improved survival of very preterm infants (Macintyre-Béon et al., 2023; Robitaille, 2024; Saluja et al., n.d.).

Children with CVI often exhibit variable visual performance, difficulties with visual attention, motion processing, or crowded environments, even when ocular examinations appear largely normal. These functional challenges can delay developmental milestones and complicate educational progress. The interplay between CVI and other preterm-associated conditions, such as cerebral palsy, further compounds the impact on daily functioning (Manley et al., 2022; Pilling et al., 2023; Lehman et al., 2024).

In sub-Saharan Africa, data on these visual outcomes among premature infants remain relatively scarce. Most existing research originates from high-income settings with advanced neonatal intensive care, where survival patterns and complication profiles may differ from those observed in low- and middle-income countries. Local factors, including variable access to antenatal care, differences in gestational age distribution at birth, and limited long-term follow-up, may influence the expression of these conditions (Lloyd et al., 2020; Mabrouk et al., 2022; Rodriguez et al., 2023). This gap highlights the importance of context-specific studies that reflect regional realities while contributing to the broader understanding of preterm visual morbidity.

This paper reports findings from a hospital-based cross-sectional study conducted at the University of Ilorin Teaching Hospital in north-central Nigeria. About 126 premature infants aged 6 to 12 months were examined to determine the prevalence of strabismus and cerebral visual impairment in this specific age group. The study employed standardised clinical assessments, including the Hirschberg test for ocular alignment and detailed evaluation of visual behaviour. Focusing on this early period of visual maturation, the work aimed to provide practical insights for clinicians involved in the follow-up care of premature babies in similar settings.

Understanding the occurrence of these conditions at this stage carries clear implications. Early identification supports timely intervention, which can mitigate secondary complications and promote better developmental trajectories. Even in the absence of overt signs, systematic screening remains valuable because subtle deficits may become more apparent as children grow and visual demands increase. The results from this Nigerian cohort therefore add a meaningful perspective to existing knowledge and reinforce the case for integrating ocular assessments into routine postnatal care for premature infants (Robitaille, 2024).

METHODS

This study was designed as a hospital-based cross-sectional investigation and carried out between January and April 2021 at the University of Ilorin Teaching Hospital in North-Central Nigeria. The hospital functions as a major tertiary referral centre for paediatric and ophthalmic services across the region. Its neonatal intensive care unit admits approximately 1200 newborns each year, of whom a substantial proportion are preterm. Following discharge, families typically attend scheduled follow-up appointments in the growth and development clinic until the child reaches one year of age.

The study population included premature infants born before 37 completed weeks of gestation who presented at either the growth and development clinic or the paediatric eye clinic during the study period. Eligible participants were required to be between 6 and 12 months of chronological age at the time of examination. Infants who were acutely ill or presented with major ocular pathologies, such as retinal detachment, were excluded. Written informed consent was obtained from parents or guardians of consecutive eligible infants before enrolment. Recruitment proceeded until the target sample of 126 participants was achieved.

Socio-demographic and clinical information was collected using a structured interviewer-administered questionnaire. This captured details such as sex, age at examination, gestational age at birth, and birth weight. All ocular examinations were performed by the principal investigator in the eye clinic. Assessment of ocular alignment was conducted with the Hirschberg test. A target light was held approximately 40 cm from the child, and the position of the corneal light reflexes was observed in both eyes during fixation. Symmetrical central reflexes indicated orthophoria, while any deviation suggested possible strabismus. Where cooperation permitted, cover testing and observation of head posture were also performed.

Evaluation for cerebral visual impairment involved detailed observation of visual behaviour and functional responses. Fixation, following movements, and responses to visual stimuli were assessed in varying environments. Particular attention was paid to any inconsistencies in visual attention, difficulties with complex scenes, or abnormal responses indicative of higher visual pathway dysfunction, even when the anterior and posterior segments appeared normal.

Data were entered and analysed using IBM SPSS version 20. Categorical variables were summarised as frequencies and percentages. Continuous variables were presented as means with standard deviations

where relevant. Given the descriptive nature of the study, focused on prevalence estimation, no extensive inferential statistics were required for the primary outcomes.

Ethical approval was obtained from the University of Ilorin Teaching Hospital Ethics and Research Committee (reference number: ERC PAN/2020/10/0079) before the study commenced. All procedures adhered to the principles of the Declaration of Helsinki. Participation was voluntary, and parents were informed of their right to withdraw at any time without affecting routine clinical care.

This design allowed for standardised clinical assessment within a routine service setting while concentrating on a specific and developmentally important age range of 6 to 12 months.

RESULTS

A total of 126 preterm infants were included in the analysis, comprising 57 (45.2%) males and 69 (54.8%) females. Participants ranged from 6 to 12 months of age, with the largest proportion observed among infants aged 6 months. Most infants were classified as low birth weight (74.6%), while moderate-to-late preterm birth constituted the dominant gestational age category. No participant had retinopathy of prematurity, and general ocular examination findings were clinically unremarkable.

Table 1 presents the demographic and clinical characteristics of the study population.

Table 1: Demographic and clinical characteristics of the study population

Variable	Number of participants (N)	%
Female	69	54.8
Male	57	45.2
Low birth weight	94	74.6
Very preterm	32	25.4
Moderate preterm	50	39.7
Late preterm	44	34.9

Note: N = 126 preterm infants. Percentages may not total 100% due to rounding.

Visual acuity assessment demonstrated predominantly normal functional visual responses for age. Most participants achieved 8 cycles per degree on Lea Gratings assessment, while the remaining infants largely demonstrated lower but clinically acceptable responses. No participant demonstrated absent light perception, and all infants showed preserved fixation or object-tracking behaviour.

Figure 1 illustrates the distribution of refractive status across both eyes. Hypermetropia represented the dominant refractive profile, accounting for the majority of observations in both right and left eyes.

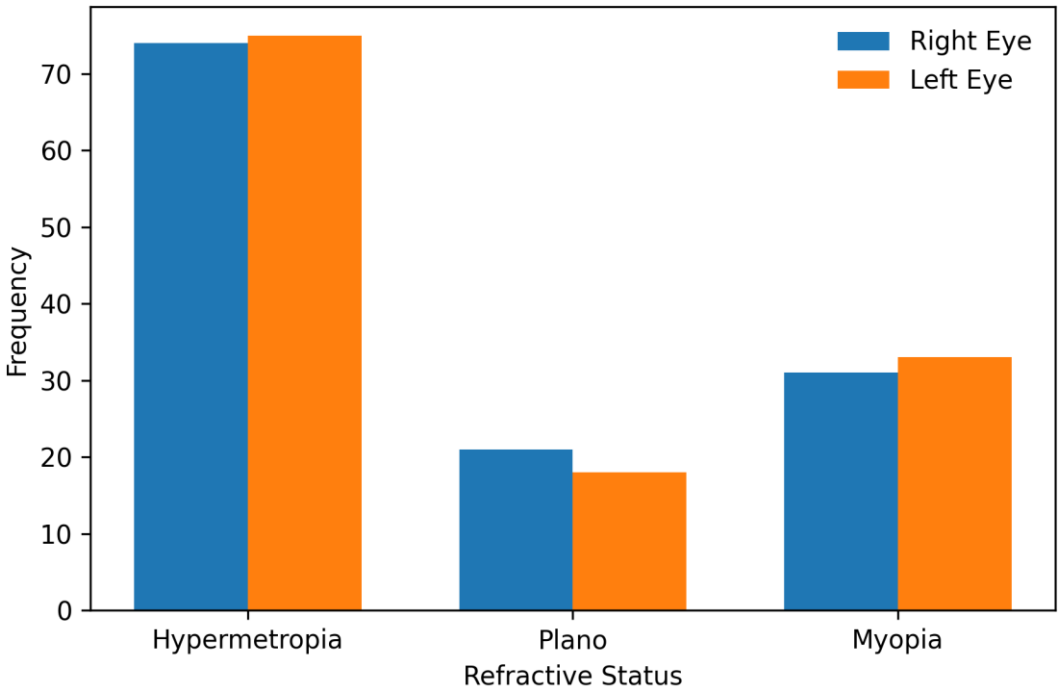

Figure 1. Distribution of refractive status among preterm infants aged 6–12 months (N = 252 eyes).

Low-grade hypermetropia was the most frequently observed refractive category, whereas severe myopia remained uncommon. Plano refractive status was identified in a smaller proportion of eyes. Only one infant met the American Association for Paediatric Ophthalmology and Strabismus threshold for clinically significant refractive error, corresponding to a prevalence of 0.8%.

Table 2 summarises the overall distribution of refractive error classifications across all examined eyes.

Table 2: Distribution of refractive error classifications across examined eyes

Refractive error category	Frequency	Percentage
Hypermetropia (< +2 DS)	117	46.4
Hypermetropia (+2 to < +4 DS)	32	12.7
Plano	39	15.5
Myopia (0 to < -2 DS)	58	23.0
Myopia (-2 to < -4 DS)	4	1.6
Myopia (-4 to < -6 DS)	2	0.8

Note: N = 252 eyes. Classification based on spherical equivalent values obtained following cycloplegic refraction.

A gradient pattern was observed across birth weight categories. Infants classified within the very low and low birth weight groups demonstrated higher frequencies of refractive abnormalities than infants with normal birth weight (Figure 2).

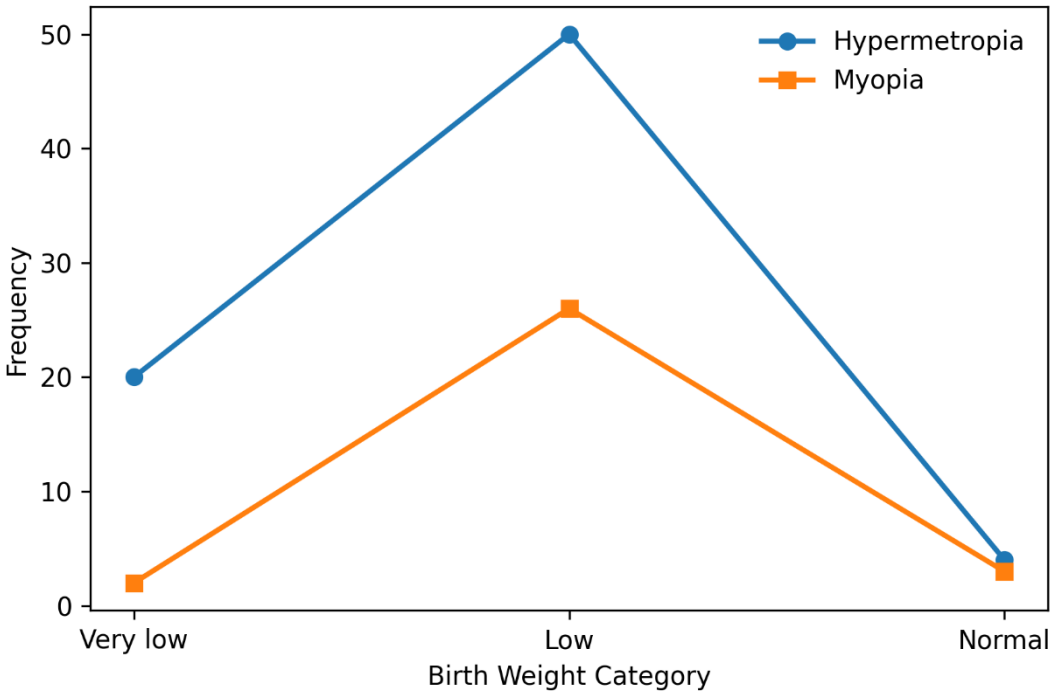

Figure 2: Distribution of hypermetropia and myopia according to birth weight category (N = 126).

Hypermetropia predominated among infants with very low birth weight, whereas myopic changes appeared more frequently among infants in the low-birth-weight category. Astigmatic errors were uncommon among infants with normal birth weight.

Gestational age also demonstrated a measurable relationship with refractive status. Moderate preterm infants accounted for the largest proportion of refractive abnormalities overall, while late preterm infants displayed comparatively lower refractive magnitudes (Figure 3).

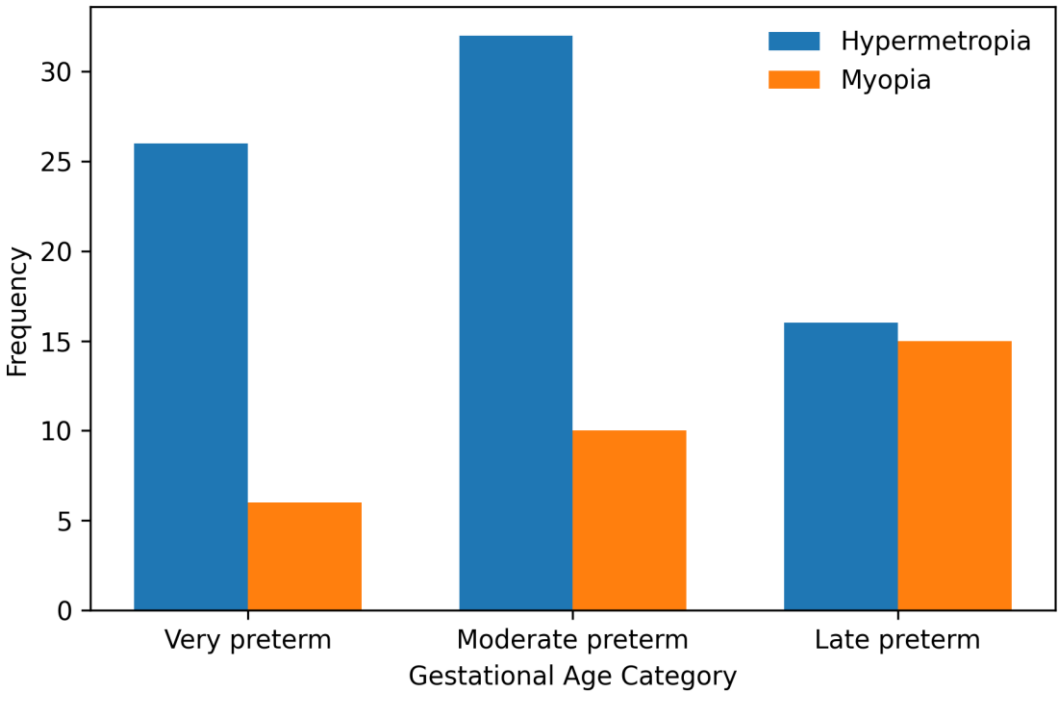

Figure 3: Refractive status according to gestational age category among preterm infants aged 6–12 months.

Pearson correlation analysis demonstrated statistically significant inverse relationships between refractive error and both birth weight and gestational age. For the right eye, refractive status correlated significantly with birth weight ($r = -0.244$, $p = 0.006$) and gestational age ($r = -0.320$, $p < 0.001$). Corresponding associations were also observed in the left eye for birth weight ($r = -0.174$, $p = 0.005$) and gestational age ($r = -0.234$, $p = 0.009$). Lower gestational age and lower birth weight were therefore associated with greater refractive abnormality.

No participant demonstrated clinical evidence of strabismus. Hirschberg assessment revealed symmetrical corneal light reflexes in all infants, and no manifest ocular deviation was identified during extraocular motility examination. Similarly, no infant fulfilled the clinical criteria for cerebral visual impairment. Fundoscopic findings remained normal across the cohort, and visual responsiveness appropriate for age was preserved, including among infants unable to complete formal Lea Gratings assessment.

DISCUSSION

The present study recorded no instances of strabismus or cerebral visual impairment among 126 premature infants assessed between 6 and 12 months of age at a tertiary hospital in north-central Nigeria. This finding stands in contrast to data from multiple international cohorts. One recent investigation documented an increase in strabismus frequency among preterm children from 13.3% to 20.0% in those without retinopathy of prematurity and from 22.7% to 45.5% in laser-treated cases when evaluated between 3 and 8 years of age (Anastasiia & Sergii, 2024). Another analysis of adults born preterm revealed strabismus rates ranging from 6.6% in late preterm individuals to 60% among those with a history of treated retinopathy of prematurity (Fieß et al., 2024).

The absence of detectable strabismus in the current sample may reflect several study-specific characteristics, including a gestational-age range largely between 28 and 36 weeks, with most infants classified as moderate or late preterm and very few presenting with extremely low birth weight or advanced retinopathy of prematurity (ROP). This comparatively higher maturity at birth likely reduced the risk profile relative to international cohorts that include more extreme prematurity and higher ROP burden, where strabismus prevalence has been shown to rise markedly as gestational age decreases and in the presence of treated ROP (Gilbert et al., 2029; Wang et al., 2029; Fieß et al., 2025). Differences in ROP prevalence, survival patterns, and developmental trajectories may also contribute to the discrepancy. In addition, assessment at 6 to 12 months captures a developmental window in which ocular misalignment may not yet be clinically apparent, as longitudinal studies report that strabismus in preterm infants is often first detected later in infancy and again around preschool age (Schalij-Delfos et al., 2000; Fieß et al., 2025). These factors collectively suggest that the absence of strabismus in this cohort does not preclude later emergence and underscores the importance of longitudinal follow-up, particularly because preterm children with lower gestational age and refractive or retinal changes remain at elevated risk over time (Schalij-Delfos et al., 2000; Pathai et al., 2010; Fieß et al., 2025).

Similarly, the lack of cerebral visual impairment diverges from patterns observed elsewhere. Estimates in other preterm populations suggest that cerebral visual impairment affects a substantial proportion of very preterm and very low birth weight survivors, frequently in association with perinatal brain injuries such as periventricular leukomalacia or hypoxic-ischaemic encephalopathy (Geldof et al., 2015; Ganesh & Rath, 2018). In a functional assessment study of very preterm and very low birth weight children, 24% met criteria for cerebral visual impairment when evaluated with a comprehensive battery of oculomotor, visual sensory, and visual perceptive measures (Geldof et al., 2015). Structured-history approaches in extremely preterm cohorts have likewise identified notable rates of cerebral visual impairment–related difficulties in mid-childhood (Hellgren et al., 2020). The current results may therefore reflect milder degrees of prematurity in the Nigerian cohort, effective local neonatal management that limits severe brain injury, or limitations in detecting subtle functional deficits through standard clinical observation at this young age, given that more nuanced cerebral visual impairment profiles often emerge only when children are older and assessed with targeted

visual-function tools (Geldof et al., 2015; Hellgren et al., 2020).

These outcomes hold practical significance for follow-up services in comparable resource-constrained settings. Systematic assessment of ocular alignment using simple tools such as the Hirschberg test, alongside observation of visual behaviour, can be readily integrated into existing growth and development clinics (Jac-Okereke et al., 2020; Hartness et al., 2025). Such measures support timely detection should problems develop as visual demands increase with age and activity. The findings also emphasise the value of longitudinal monitoring, given the dynamic nature of visual maturation in the early years.

This work contributes to the sparse literature on preterm visual outcomes from sub-Saharan Africa. Existing studies in the region highlight elevated risks of refractive errors and other ocular issues among preterm children, yet dedicated data on strabismus and cerebral visual impairment remain scarce. Context-specific evidence helps inform locally appropriate protocols while identifying priorities for future research, including multicentre designs with extended follow-up.

Future research should adopt longitudinal designs to track the same cohort beyond the first year of life. Multicentre studies across different regions of Nigeria would improve generalisability and provide clearer insight into how local variations in neonatal care influence visual outcomes. The inclusion of more extremely preterm infants and the use of supplementary tools, such as visual evoked potentials or detailed perceptual testing, could enhance detection of subtle cerebral visual impairment.

In clinical practice, paediatricians and ophthalmologists should maintain a high index of suspicion when managing children born prematurely. Scheduled visual assessments from 6 months of age, with continued follow-up at least until school entry, represent a prudent strategy. Families should receive clear guidance on the importance of attending these reviews, even when the child appears to see well.

Limitations of the study include its cross-sectional nature, single-centre recruitment, and moderate sample size. Reliance on clinical examination without advanced neuroimaging or detailed perceptual testing may have missed milder forms of cerebral visual impairment. Larger prospective studies across diverse Nigerian settings would provide a fuller picture of these conditions.

The complete absence of strabismus and cerebral visual impairment at this early stage offers reassurance for families and clinicians. Continued vigilance in routine care pathways remains important to safeguard long-term visual and developmental progress in children born prematurely.

CONCLUSION

The current study observed no cases of strabismus or cerebral visual impairment among 126 premature infants examined between 6 and 12 months of age at the University of Ilorin Teaching Hospital. This zero-prevalence occurred despite the known vulnerability of preterm infants to visual pathway disruptions. The findings suggest that, in this particular cohort with predominantly moderate to late preterm births and relatively higher birth weights, serious alignment or cerebral visual problems had not yet emerged by the end of the first year of life.

These results align with the understanding that visual development follows a dynamic trajectory. Conditions such as strabismus and cerebral visual impairment may become evident only with advancing age or increasing visual demands. The absence of detectable abnormalities at this stage provides reassurance but does not eliminate the need for ongoing surveillance.

Routine integration of simple ocular alignment assessments, such as the Hirschberg test, and basic evaluation of visual behaviour into existing growth and development clinics offers a practical and low-cost approach to monitoring preterm infants. Such measures can be implemented effectively even in busy tertiary centres with limited resources. Early identification of any emerging issues would allow timely intervention and help reduce the risk of secondary complications, including amblyopia or developmental delays.

This work contributes context-specific evidence from a low-resource setting and reinforces the value of structured follow-up care. Sustained attention to visual

health in premature infants can substantially improve long-term developmental outcomes and quality of life.

AUTHOR CONTRIBUTION

All authors played a substantive role in shaping this study and developing the manuscript. O.D.I. conceptualised the work and designed the overall study framework. Data analysis, interpretation of data and validation of findings were carried out collaboratively, with each author contributing to the discussions that informed the final results. O.A.Y. and K.O.O. prepared the initial manuscript draft, covering the introduction, methods, results and discussion. Co-authors strengthened the analysis, offered detailed revisions and enhanced the clarity and coherence of the final document. Every author reviewed the complete manuscript, approved the final version and accepted responsibility for the integrity of the work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ACKNOWLEDGEMENT

The authors acknowledge the management and technical staff of PENKUP Research Institute, Birmingham, UK, for their excellent assistance and for providing medical writing and editorial support in accordance with the Good Publication Practice (GPP3) guidelines.

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