



Seeing the Future: Community-Based Vision Screening and Eye Health Education for Preschool Children in Papua, Indonesia

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ARTICLE INFO

Keywords: Preschool Vision Screening, Refractive Errors, Strabismus, Early Childhood Development, Community-Based Health Intervention.

Received : 20, November

Revised : 15, December

Accepted: 18, January

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ABSTRAK

This study aimed to evaluate the feasibility and outcomes of a low-cost, community-based preschool vision screening and eye health education program in Jayapura, Papua, Indonesia, addressing limited early detection in low-resource settings. The program assessed visual acuity, ocular alignment, and anterior segment conditions using smartphone-based Snellen testing, Hirschberg, cover tests, and penlight examination among 29 children aged 3–6 years from two early childhood centers during a single screening period. Results showed subnormal visual acuity in 20.7% of children, suspected strabismus in 3.4–6.9%, and one case of epiblepharon. Educational outreach successfully engaged parents and teachers. The findings demonstrate that simple screening integrated with education is feasible and supports early identification and public health integration of preschool eye care programs.

INTRODUCTION

Visual health has a critical role in the development of children. Visual development affects the cognitive, social, and motor skills in children, and these skills are important in children's academic success. Some sources claim that approximately 70% of the activities conducted in the class in early childhood entail the use of visual inputs, and hence vision becomes essential in reading, socializing, as well as using educational materials in class (Alvarez-Peregrina et al., 2020; Birkeland Wilhelmsen & Felder, 2021). Small problems in vision may hamper the development in early literacy, attention, and socialization, especially when they remain unidentified during the preschool stage (Orlansky et al., 2015; Zimmerman et al., 2019). There has been a great deal of attention on the importance of maximizing vision use during the early childhood years and the role it has in developing the skills of exploration, language, and autonomous mobility, among others (Fabbro et al., 2020; Lueck & Heinze, 2005).

The global prevalence of myopia in children continues to rise, with the highest rates reported in Asia (60%, up to 73% in East Asia) compared to Europe (40%) and North America (42%), and very low rates in Africa and South America (<10%). By 2050, the global number of people with myopia is projected to reach 4.8 billion, with nearly half of the world's population affected and about 10% having high myopia, particularly in urban areas of East and Southeast Asia (Grzybowski et al., 2020; Lawrenson et al., 2025). Myopia has long been the most researched refractive condition, although other refractive problems, like hyperopia and astigmatism, are also frequent and have been related to problems in literacy, Visual Motor Integration, and basic academic skills in childhood (Anand et al., 2020; Atowa et al., 2019; Orlansky et al., 2015). Strabismus also affects between 2-5% of the world's children and, untreated, can cause amblyopia and permanent binocular vision loss (Chen et al., 2021; Hashemi et al., 2019; Tegegne et al., 2021).

Despite these findings, early vision screening for preschool-aged children remains inconsistent worldwide, particularly in low-resource settings. In Indonesia, the greatest number of child health services in the early childhood age group concentrate on nutrition or vaccinations, and only rarely include vision screening. This is a problem, since there has been evidence that undetected refractive problems can impair child performance and confidence in school (Alvarez-Peregrina et al., 2020; Zhang & Glauben, 2015). In fact, although there have been studies pointing out the link between vision problems and underachievement in school, there has still been a lack of vision screening among preschool children (Thurston, 2014; Varma et al., 2017). This gap in evidence highlights the urgent need for localized research and community-based intervention models.

Today, numerous screening tools are advocated in young children, such as visual acuity testing using the Snellen charts, photoscreeners, the Hirschberg test, and the cover-uncover test (Lam & Suh, 2022; Metsing et al., 2018). These tools can help in the detection of amblyopia, refractive errors, and strabismus before they advance and cause permanent vision problems. The application of the tools, however, may be constrained by factors such as cost, lack of skilled

personnel, and awareness, especially in some communities in Indonesia such as Papua.

In response to this public health challenge, a community-based eye health project titled “Mata Sehat, Generasi Cerdas” was initiated in Jayapura. The program focused on vision screening among two preschool-aged children using simple low-cost tools that are feasible for local implementation. In addition to screening, the program provided educational materials for teachers and parents to promote early recognition of visual problems and to encourage prompt referrals.

This study aimed to improve early childhood vision health through comprehensive screening and health education. Specifically, the project worked on three aspects, namely: (1) performing structured eye examinations on preschool-aged children, (2) training teachers and parents on indicative symptoms of visual impairment, and (3) promoting the use of WHO-compatible models designed for early detection. This study represents the first documented preschool vision screening initiative in Papua, Indonesia, and offers a locally adaptable, community-centered strategy for addressing the gap in early childhood eye care.

The novelty of this study lies in its integration of clinical eye screening and educational outreach within a previously unscreened and underrepresented population in Eastern Indonesia. The work provides basic data on refractive, strabismic, and anterior segment irregularities in preschool children, and also illustrates the efficacy of using the services of the community in early detection. The preschool children aged 3-6, from the two schools in Jayapura, an urban area, who underwent screening using the Snellen charts, Hirschberg and cover tests, and anterior segment inspection with a penlight, comprise the subjects. The study also involved the dissemination of child eye health information through brochures and videos designed for both teachers and parents.

This initiative contributes to the growing global effort to reduce the burden of childhood visual impairment and provides a replicable model for early detection and community engagement in low-resource settings.

IMPLEMENTATION AND METHODS

This study was part of a community service project that employed a descriptive observational design. The screening activities were conducted at two early childhood education centers in Jayapura, Papua: PAUD Ebenhaezer in Sentani and TK Diaspora in Kotaraja. Eye health screening was carried out on June 7, 2025, and June 14, 2025, with a total of 29 preschool children aged 3 to 6 years participating in the program (Figure 1).



Figure 1. Community-based vision screening activity conducted at a preschool setting in Jayapura, Papua.

All the children who were present during the activity and gave parental consent were considered using the total approach. The age, gender, ethnic origin, and location of the school of all the participants was recorded. The greatest number, 72.4%, were six years old, 69% were female, and 69% came from a non-Papuan ethnic origin.

The vision screening tools employed in the process were chosen because they are portable and appropriate in resource-limited settings. The visual acuity test was conducted using a smartphone application of the Snellen chart designed specifically for pediatric settings. Anterior segment examination was performed using a pen light, while strabismus was detected using the Hirschberg Test, Cover-Uncover Test, and Alternate Cover Test (ACT). All clinical findings were recorded using a simple paper-based medical form developed for community outreach activities (Figure 2).



Figure 2. Visual acuity screening of a preschool child using age-appropriate visual assessment tools under examiner supervision.

Aside from the screening, there was an educational intervention part designed primarily for the parents and teachers. These involved health brochures that carried important information regarding the signs and preventive measures against vision problems, and an educational video and presentation that was designed to inform the audience on the dangers posed by excessive use of screens among children. The materials were designed to be contextually appropriate and easy to understand (Figure 3).



Figure 3. Health education session on common eye conditions delivered to teachers and parents using visual learning media in a preschool classroom.

The screening process consisted of three stages: (1) measurement of visual acuity in each eye (RE and LE), (2) detection of ocular misalignment using strabismus tests, and (3) anterior segment inspection to identify structural abnormalities. All examinations were carried out by physicians assisted by medical students trained in pediatric vision screening under protocols that ensured child safety and comfort.

Data were manually collected and tabulated using Microsoft Excel. Descriptive statistics, including frequencies and percentages, were used to analyze the distributions of visual acuity results, presence of strabismus, and anterior segment abnormalities.

This study received verbal consent from both the school administration and parents of the children. All data were anonymized, and any children identified as needing further care were referred to appropriate ophthalmologic services. No therapeutic interventions were administered during screening.

RESULTS AND DISCUSSION

A total of 29 preschool children participated in the vision screening activity, as shown in Table 1. The average age of the participants was 5.52 years with a standard deviation of ± 0.871 . The majority of the children (72.4%) were 6 years old. Most participants were female (69.0%) and from non-Papuan ethnic backgrounds (69.0%), whereas the remaining 31.0% were Papuan. The children were almost evenly distributed between the two screening sites: 48.3% from the PAUD Ebenhaezer and 51.7% from the TK Diaspora.

Table 1. Characteristics of Preschool Children Screened for Refractive Errors

Variable	Number (n=29)	Percentage (%)
Age (years) (mean $\pm$ SD)		5.7 $\pm$ 1.131
3 years	1	3,4
4 years	4	13,8
5 years	3	10,3
6 years	21	72,4
Gender		
Male	9	31,0
Female	20	69,0
Ethnicity		
Papuan	9	31,0
Non-Papuan	20	69,0
School Location		
PAUD	14	48,3
Ebenhaezer	15	51,7
TK Diaspora		

The visual acuity results are presented in Table 2. Most children had a normal visual acuity of 20/20, specifically 86.2% in the right eye and 82.8% in the left eye. However, several of the children exhibited signs of reduced vision. One child had 20/25 in the right eye, and two had the same score in the left eye. Two children scored 20/32 in both eyes, one had 20/50 in the right eye, and another had 20/63 in the left eye. Overall, six children (20.7%) showed visual acuity below the optimal standard, suggesting mild refractive errors such as myopia, hyperopia, or astigmatism.

Table 2. Distribution of Visual Acuity Values Based on Refractive Error Screening in Preschool Children

Visual Acuity	Right Eye (OD) n (%)	Left Eye (OS) n (%)
20/20	25 (86.2%)	24 (82.8%)
20/25	1 (3.4%)	2 (6.9%)
20/32	2 (6.9%)	2 (6.9%)
20/50	1 (3.4%)	-
20/63	-	1 (3.4%)
Total	29 (100%)	29 (100%)

Table 3. Distribution of Strabismus and Anterior Segment Examination Findings in Preschool Children

Variable	Number (n=29)	Percentage (%)
Hirschberg Test		
Orthophoria	28	96,6
Exotropia	1	3,4
Cover/Uncover Test		
Orthophoria	27	93,1
Exotropia	2	6,9

Alternate Cover Test (ACT)		
No shifting	27	93,1
Shifting present	2	6,9
Anterior Segment		
Within normal limits	28	96,6
Right Eye Epiblepharon	1	3,4

As illustrated in Table 3, strabismus was assessed using three different tests. Using the Hirschberg test, exotropia was reported in one child (3.4%), and the remaining 28 children had orthophoria (96.6%). The cover and uncovered test and the alternate cover test revealed exotropia in the remaining two children (6.9%) in each test. Furthermore, anterior segment examination revealed that 28 children (96.6%) had normal results, while one child (3.4%) was found to have epiblepharon in the right eye, a condition that may cause corneal irritation if left unmanaged.

In the present investigation, it was revealed that approximately 20.7% preschoolers had reduced visual acuity ranging from 20/25 to 20/63 in one or both eyes, and up to 6.9% preschoolers exhibited symptoms of strabismus. The important role of the screening process, even in resource-scarce settings where the basic services related to vision care are not usually provided, has been supported here. The age distribution in our sample, with the predominance of six-year-old children (72.4%), corresponds with the stage where increased visual demands coincide with school readiness, although there are few studies available on preschool-aged children in Indonesia. Most previous Indonesian studies, such as Mahayana et al. (2017), have focused on older children aged 6–12 years, highlighting a higher prevalence of uncorrected refractive errors (URE) in urban (10.1%) and suburban (12.3%) areas and demonstrating a two- to three-fold increased risk compared with rural populations, suggesting that environmental factors in densely populated areas play a significant role in visual health outcomes (Mahayana et al., 2017).

Although our study focused on preschoolers rather than school-age children, the high proportion of visual deficits observed in urban Jayapura settings may be influenced by similar urbanization-related risks, such as increased screen time and reduced outdoor activity. In terms of gender, our subjects were 69% female, and there was no significant difference in the visual acuity between the genders, in keeping with the findings of Yusni et al., 2023, who revealed that there was no statistically significant relationship between gender and the prevalence of myopia among school-aged children, with the value of $p = 0.24$, despite the fact that the prevalence was slightly higher among girls (Yusni & Meutia, 2023).

The results are in support of Kukuh et al. (2024), who reported the prevalence of myopia and astigmatism in school-going children in Batu City to be 73.93%, and 22.42%, respectively, and strongly stressed the need for frequent screenings among school-going children in order to avoid complications in their studies and

quality of life.(Kukuh Mujiono et al., 2024)While their study involved older children, it strengthens the case that vision screening begins earlier, particularly given that the uncorrected conditions identified in our preschool cohort would otherwise remain undetected until school age.

Visual acuity values in our study ranged from 20/20 to 20/63, and 20.7% of children had vision below the optimal 20/20 level, mirroring the visual acuity patterns seen in international studies, such as those by Kulp et al. (2022), who found that even mild uncorrected hyperopia in preschoolers was associated with deficits in early literacy and attention.(Kulp et al., 2022) Our data confirm that preschoolers with a visual acuity of 20/32 or worse may already be at risk of academic challenges and warrant early referral and corrective support.

Strabismus was detected in 3.4% of children using the Hirschberg test and in 6.9% using the cover/uncover and ACT, primarily manifesting as intermittent exotropia. These results are in agreement with those findings by Chen et al. in 2021, who revealed the prevalence of strabismus in Chinese preschool children was 2.48%, and there was a higher prevalence of exotropia compared with esotropia, and parental history and prematurity were important risk factors.(Chen et al., 2021) In addition, Wang et al. in 2021 conducted a study in Eastern China and recorded a constant prevalence rate of strabismus at 5.56%, although there was an increase in intermittent exotropia from 2.78% to 4.69%, hence implying that despite the prevalence rate remaining constant, some forms might change over time and hence ought to be addressed.(Wang et al., 2021)

In our study, although we did not use advanced diagnosis tools, we were able to show the ability of basic screening methods in the community to identify major vision deficits like strabismus and other structural irregularities like epiblepharon. The value of this early detection aligns with the Vision in Preschoolers–Hyperopia in Preschoolers (VIP-HIP) study, which concluded that children who could not complete vision tests were more likely to have visual disorders and should be referred promptly.(Kulp et al., 2022) Despite limited preschool-specific data in Indonesia, our findings echo international evidence that community-based vision screening, when paired with educational interventions, is a feasible and effective model for early eye health detection.

CONCLUSIONS AND RECOMMENDATIONS

The vision screening program carried out in Jayapura, a community in Papua, Indonesia, has proven the efficacy of using simplified, inexpensive vision screening tools in detecting the afore-mentioned defects in preschool children. The vision screening process conducted in Jayapura, Papua, Indonesia, has evidenced the effectiveness of using simplified and inexpensive vision screening instruments in identifying the aforementioned defects in preschool-aged children. In light of the limitations imposed by the sample source, the findings have revealed the extent of the prevalence affecting the undetected refractive and alignment issues, validating the critical contribution made by the process. The process has also proven successful in merging the educational components relevant to the role of the parent and the teacher, in raising awareness and participation in child and eye health.

Moreover, the findings confirm the role of early vision health in influencing development, and the model would serve as an important application in resource-constrained settings. Efforts aimed at ensuring wider coverage in screening and appropriate referrals remain crucial in order to avoid problems in the childhood periods related to vision, education, and psychosocial development.

ACKNOWLEDGMENT

The authors would like to thank all lecturers at the Faculty of Medicine, Universitas Cenderawasih, academic support staff, and undergraduate medical students who contributed to the implementation of the community service program and data collection. The authors also gratefully acknowledge the Faculty of Medicine, Universitas Cenderawasih, for its institutional support through the Community Service Grant (No. 2048/UN20.3.2/AM/2025, dated April 8, 2025). In addition, sincere appreciation is extended to the principals and staff of PAUD Ebenhaezer Sentani and TK Diaspora Kotaraja as community partners who supported and facilitated the implementation of this community service activity.

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