

Amblyopia risk factors findings in preschool children in Jakarta, Indonesia using the Plusoptix pediatric autorefractor A09

Kianti R. Darusman

Department of Ophthalmology, Eka Hospital, Jalan Central Business District Lot 9 BSD City Serpong Tangerang Selatan, Banten 15321, Indonesia

Correspondence to: Kianti R. Darusman. Department of Ophthalmology, Eka Hospital, Jalan Central Business District Lot 9 BSD City Serpong Tangerang Selatan, Banten 15321, Indonesia. kiantiraisa@gmail.com

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应用 Plusoptix A09 小儿自动测光仪探求印尼雅加达地区学龄前儿童弱视影响因素

Kianti R. Darusman

(作者单位:15321 印度尼西亚万丹, Eka 医院眼科)

通讯作者: Kianti R. Darusman. kiantiraisa@gmail.com

摘要

目的:运用 Plusoptix A09 小儿自动测光仪探测雅加达地区学龄前儿童屈光不正及其他眼病的发生情况。

方法:对雅加达的三个地区(南唐格朗,勿加泗和西雅加达)三所幼儿园中,平均年龄 4.46 岁(2~6 周岁)的儿童进行屈光不正及其他眼病检测。

结果:受检的 166 名儿童中,男生占 51.2% ($n=85$),女生 48.8% ($n=81$)。视力筛选以 Arthur 修订标准为参考,并为 15.67% ($n=26$) 的儿童做更深一步的全面性眼部检查。其中 2 人高度远视,14 人严重散光,6 人散光加近视,1 人屈光参差,1 人无法检测,2 人患有其他眼病(由慢性咳嗽导致的先天性眼睑下垂、严重瘀斑和结膜下出血)。

结论:本研究表明,运用 Plusoptix A09 测出弱视危险因素结果为 15.67%。此项数据表明,印度尼西亚地区医疗保健人员对学龄前儿童视力筛选工作不够重视,尤其是对不可逆性弱视的危害性重视度不够。

关键词:视力筛选;学龄前;Plusoptix;印度尼西亚

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Abstract

• **AIM:** To report refractive error findings and other eye abnormalities in preschool children population in Greater Area Jakarta using the Plusoptix pediatric autorefractor A09.

• **METHODS:** Cross sectional study of preschool age children with mean age 4.46 (range 2-6 years old) of 3

preschools in 3 municipalities in Greater Area Jakarta (South Tangerang, Bekasi and West Jakarta) were screened for refractive errors and other eye abnormalities.

• **RESULTS:** Totally 166 children, consisting of 51.2% ($n=85$) male and 48.8% ($n=81$) female were screened. Using the Arthur modification criteria for vision screening referral, 15.67% ($n=26$) were given recommendations for further comprehensive ophthalmology examination. From those given recommendations, 2 had high hyperopia, 14 had significant astigmatism, 6 had combined hyperopia/astigmatism, 1 had anisometropia, 1 unable to measure, 2 had other ocular conditions (congenital ptosis and severe ecchymosis and subconjunctival bleeding due to chronic cough).

• **CONCLUSION:** The finding of amblyopia risk factors in using Plusoptix A09 was 15.67% in this study. This percentage should warrant healthcare providers in Indonesia, where the importance of preschool vision screening is not widely acknowledged, especially for the risk of irreversible amblyopia.

• **KEYWORDS:** vision screening; preschool; Plusoptix; Indonesia

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INTRODUCTION

Greater area Jakarta is an official definition of the urban area surrounding Jakarta, the capital city of Indonesia. Indonesia, an archipelago of 32 provinces, with a population of 200 million, has least 26.69% children below 15 years old. Greater area Jakarta comprises of 5 municipalities and 3 regencies. As of the 2010 census, the population of the area is 28 million, with density being most prominent in the capital Daerah Khusus Ibukota (Special District of Capital City) Jakarta. Indonesia's per capita income is estimated to be 4000 USD and is considered a developing nation, with a rank of 122 worldwide.

Vision screening in preschool age children in Indonesia has not been well performed in many developed countries. The known importance of this regular screening is early detection of any eye abnormalities requiring recognition and treatment.

Amblyopia, which occurs in children below age 8, affects 1.6%–3.6% of the population and may become irreversible if no early treatment was given^[1,2]. There is a prevalence of increase among those medically underserved and may affect a child's school performance^[3]. Refractive errors are among the major amblyogenic factors. The Sydney Pediatric Eye Disease Study, a large scale population-based of children age 30–72mo, reported an amblyopia prevalence of 1.9%^[4]. Anggraini *et al*^[5] reported a 2.7% of amblyopia prevalence in a school-based study in Jakarta, Indonesia. This study aimed to utilize Plusoptix A09 in preschool age population in Jakarta, Indonesia

Formal vision testing and cycloplegic refraction in children, though still the gold standard, requires more time for examination, full cooperation from the child and the number of trained personnel involved. Due to this disadvantage, many tools have been developed for easier and faster examination resulting in more children screened in less time. The use of autorefractor in children vision screening has been reported since 2007. Matta *et al*^[6] first described the superior performance of Plusoptix S04 in children age 6–192mo in detecting amblyopia risk factors. Many studies soon followed with various results. Moghaddam *et al*^[7] reported that Plusoptix is an objective screening tool in pediatric population aged 6–36mo. Mirzajani *et al*^[8] reported that Plusoptix result has a good consistency when compared with cycloplegic refraction. Plusoptix pediatric autorefractor A09 (Plusoptix GmbH), the second generation of its kind, is a hand-held binocular autorefractor connected to a computer screen that measures the refractive data, pupil size, pupil distance and gaze deviation in real-time. Children as early 6mo of age can be examined in 1-meter distance. The device produces a warble sound that attracts children to fix their attention to the smiley face located in front of the hand-held piece and result is obtained within 5s. Results are then stored and can be printed. Patients are given recommendations for further eye examination if the measurement suggests significant refractive error or anisometropia, anisocoria or if the pupillary centers are discrepant by 10° which suggest strabismus. If the entire pupil cannot be viewed, due to ptosis, referral will also be made^[9]. The purpose of this study is to report amblyopia risk factors in preschool children in Jakarta, Indonesia, using Plusoptix A-09.

MATERIALS AND METHODS

This is a cross-sectional study, part of eye health promotion program division of the ophthalmology department of the Eka Hospital conducted in 3 preschools in 3 municipalities in Greater area Jakarta, located in South Tangerang, Bekasi and West Jakarta. Parents and guardians were sent information sheet concerning children eye health and the importance of examination. Informed consent was also obtained prior to the screening. As it was part of a health promotion program, no institutional review board was obtained, but the data obtained and used in this study is in adherence to the Declaration of Helsinki.

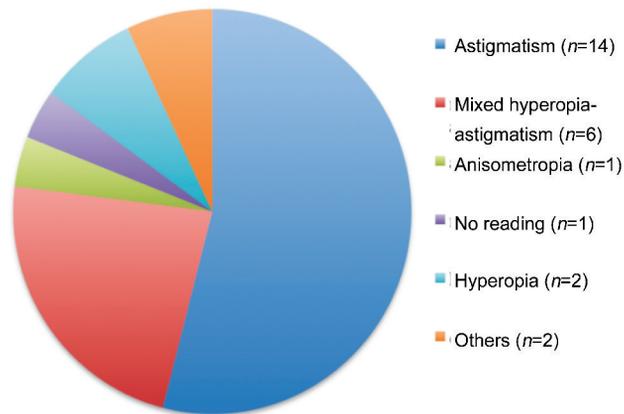


Figure 1 Diagnosis at recommendations for further eye examination (n=26).

Table 1 AAPOS vision screening committee guidelines for detecting amblyopia risk factors^[10]

Risk factors	
Anisometropia (spherical or cylindrical)	>1.5D
Any manifest strabismus	
Hyperopia	>3.5D
Myopia	>3.00D in magnitude
Media opacity	>1mm
Astigmatism	>1.5D at 90° or 180° >1.00D in any axis more than 10° eccentric to 90° or 180°
Ptosis	>1mm margin reflex distance

In a dim light room, children were consecutively examined for their refractive status and alignment at primary position with the autorefractor, then evaluation of the red reflex with direct ophthalmoscope. Refractive status was measured at least twice for each child. If misalignment was detected, alternate cover test and extra ocular muscles movement evaluation were performed. If other abnormalities beside refractive errors were found, anterior segment was examined with a portable binocular slit-lamp (Reichert PSL, Depew, NY, USA). Children were given recommendations for further comprehensive ophthalmology examination based on the American Association of Pediatric Ophthalmology and Strabismus (AAPOS) Vision Screening committee guidelines for detecting amblyopia risk factors (Table 1)^[10], using the Arthur modification 2 criteria, as was previously described by Arthur *et al*^[11] utilizing Plusoptix S04 which refers anisometropia >1.5D, astigmatism >2.50D, myopia >3.00D, hyperopia >3.50D, anisocoria >1.00mm. A descriptive statistics was used in describing the study findings.

RESULTS

One hundred and sixty six out of a total 183 children (90.7%) were screened. The remaining 9.3% were not examined due to absence at the day of screening and/or unreturned informed consent. Twenty-six children (15.67%) were found to not pass the criteria and were given recommendations for further eye evaluation such as cycloplegic refraction. Comparison of percentage of children whom did not pass the criteria can be seen in (Figure 1).

Table 2 Distribution of gender and age of children from 3 preschools

Gender	No. of screened (n)	Given recommendation (%)	Mean age (a)
Boys	85	13 (15.29)	3.90 (range 2–6)
Girls	81	13 (16.05)	4.16 (range 2–6)
Total	166	26 (15.67)	4.82 (range 2–6)

Significant astigmatism of $> 2.5D$ was found in more than half of the subjects given recommendations for further eye examination, followed by mixed hyperopia–astigmatism. No reading in one subject is probably due to limitation of spherical and/or cylindrical range of the autorefractor^[7]. Red reflex of this subject was normal. We found no significant difference in mean age and gender in the screening (Table 2).

DISCUSSION

The use of Plusoptix photoscreener in vision screening was first described by Matta *et al*^[6] which showed the effectiveness, user–friendly and portable way in detection of amblyopia risk factors. However, modification of the referral criteria provided by the manufacturer has a high negative predictive value, sensitivity 100% and only 37% specificity. Field–testing of a large population was then conducted and a better criterion for referral was obtained, giving a sensitivity of 88% and 85% specificity, known as the Arthur modification 2 criteria^[11,12].

Performance of the tool is constantly reported, in different population, age and screening referral criteria. Bloomberg and Suh^[13] reported the performance of Plusoptix A08 in Iowa, United States in 290 preschool children age 0–5y and found a high predictive value in detecting refractive amblyogenic risk factors, but low sensitivity in detecting strabismus <20 Prism Diopter. Its validity, performed as the only examination if Plusoptix result is normal reported by Silbert and Matta^[14] in a retrospective study of 190 children. This study concluded that a normal Plusoptix, combined with normal alignment and motility evaluation and visual acuity was found to have a 98% negative predictive value for ophthalmic pathology, including significant refractive errors. Dilating eye drops are traumatic for many children, thus the Plusoptix and an abbreviated eye examination may obviate the need for dilation in select children.

To our knowledge, this is the first study in preschool children using Plusoptix in Southeast Asia and the second performed in developing nations with similar percentage of amblyogenic risk factors^[15]. Our study found astigmatism to be the highest in this series. Limitation of this study is the descriptive nature, non–masked single examiner and no further comparison to gold standard eye examination. However, Mirzajani *et al*^[8] reported the similar result with Plusoptix compared to cycloplegic refraction in a study in Iran. Given the knowledge of previous studies by Chia *et al*^[2] in Singaporean Chinese population and Lai *et al*^[16] in Taiwan which showed that myopia prevalence is higher in Asia compared to Western

countries, this study can be considered as a preliminary study for amblyopia risk factors screening utilizing Plusoptix in Southeast Asian population. Further studies ideally are to be conducted in a larger population scale, which include comparison analysis of the autorefractor finding and gold standard orthoptic examination with cycloplegic refraction and/or a different criteria for recommendations. In Indonesia alone, this study should be able to alert healthcare providers of the importance of amblyopia risk factors screening.

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