



Can India Go in for Pre- School / Pre- Verbal Eye Screening Now with Red Reflex? - A Feasibility Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To study the feasibility and challenges for early vision screening of the 0-6 yr preverbal/preschool children in both urban and rural settings of India using the simple Red Reflex test.

Study Design: Operational research.

Place and Duration of Study: Four settings (two urban and two rural) were designed to target the 0-6year old children. Model I .Pre School (Urban slum Population), Model II. Health Centre (Urban Hospital), Model III. Immunization OPD of Municipal Hospital (Rural hospital) Model IV. Anganwadi Centre (Rural Population) was designed and conducted July 2017 –Dec 2017 (6 months).

Methodology: All models were conducted as single day vision screening camps except Model III which was an opportunistic screening for a period of 3 months (July – Sept 2017). Vision screening was done using Red Reflex test and follow up was done for three months. Data was analyzed on MS Excel and expressed in proportions / percentages.

Results: Maximum children (155) were screened in Model I. Out of the 301 total children screened

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33 (10.96%) had abnormal Red Reflex test. The yield was maximum 6 (17.14%) in Model III. Urban health centre Model I was the most time efficient model(average 0.74 minutes/child).
Conclusions: Single day screening of population based cohort is time efficient but opportunistic screening using universal immunization programme model had maximum yield.

Keywords: Red reflex; early vision screening; India.

1. INTRODUCTION

In India, it is estimated that there are 0.8 blind per 1000 children[1,2]. In developing countries, 30–72% of pediatric blindness is treatable with majority in fact , being preventable [3].The prevalence of undetected vision problems among preschool age children is estimated to be 5% to 10% [4].

The three major interventions to prevent childhood blindness in India are a) Vitamin A supplementation incorporated in the National Immunization Schedule, b) MMR/MR vaccination and c) School Health Programme.Currently, there is no recommendation for eye screening for 0-6 yr olds in India as they are considered difficult to locate and uncooperative for eye screening.

The red reflex test is an important diagnostic tool and its utility is well documented in literature [5]. It can detect leukocoria and strabismus ,an early sign of the dreaded eye cancer Retinoblastoma. Leukocoria or white pupil can be seen in many other eye diseases as well [5]. Ophthalmic abnormality is a common presenting symptom in pediatric brain tumors [6]. The simple red reflex test also facilitates early detection of vision threatening eye diseases like cataract, corneal opacities, amblyopia, which is associated with lesser disease burden and better outcomes if tackled early[7] .

Amblyopia as such cannot be directly picked up by the red reflex test, but ocular abnormalities like high refractive errors, ptosis(droopy eyelid), cataract , that can contribute to amblyopia can be detected [8].

The red reflex test uses transmission of light from an ophthalmoscope through all the normally transparent parts of a subject's eye, including the tear film, cornea, aqueous humor, crystalline lens, and vitreous humor. This light reflects off the ocular fundus, is transmitted back through the optical media and through the aperture of the ophthalmoscope, and is imaged in the eye of the examiner. Any factor such as cataract, corneal

opacities, pupillary abnormality etc that impedes or blocks this optical pathway will result in an abnormality of the red reflex [8].

The American academy of Pediatric ophthalmology and Strabismus, American Academy of Paediatrics and American Academy of Ophthalmologist recommend Red reflex test once between 0-1 year, then once between 1-5 yrs, then at 5 yrs followed by annual eye examinations[9]. However presently in India there is no recommendation for eye screening in pre-verbal children.

2. METHODOLOGY

Type of Study – Operational Research.

Study Duration – July 2017 –Dec 2017 (6 months).

Study Design – Four different approaches were designed to reach out to the Pre verbal 0-6 years age population in rural and urban areas (Two Urban based and Two Rural based).Table 1 depicts the four different models of approach.

Model I: A Pre-school in the suburbs of Mumbai was randomly selected and vision screening was conducted on an appointed day. Sensitization of parents and teachers was done 2 weeks prior. Lists of all the enrolled children were prepared with informed written consent/ Assent a day before the check up. Teachers were present to help for a systematic screening and to sensitize the parents regarding the follow up. All the children were screened for vision abnormality with the simple Red Reflex test. Those found with suspicious or abnormal Red Reflex were referred to the Health Centre for follow up. During the waiting period, health education on hand hygiene was given to all the children.

Model II: A vision screening day was fixed in Urban Health Centre of suburbs of Mumbai. The community and local Anganwadi workers were sensitized regarding the importance of eye screening 2 weeks prior to the vision screening day. The list of the 0-6 yr old for the screening was prepared on arrival and the screening was

done using the Red reflex test. Those found to have an inconclusive or abnormal Red reflex test immediately underwent full ophthalmic check up and were advised appropriately. The waiting time was utilized in health education on proper hand washing techniques.

Model III: The Govt. Hospital in rural area runs an immunization clinic once a week on the same day. The staff in the immunization clinic was sensitized about early vision screening at every session and the children were sent for eye screening before immunization. It was done for 3 months (July – Sept. 2017). Those found to have an inconclusive or abnormal Red reflex test were encouraged to undergo a detailed eye examination on the same visit or subsequent visit.

Model IV: All the Anganwadi workers were sensitized of early vision screening and one Anganwadi was picked randomly. On a fixed day eye screening was done with the simple Red Reflex in the presence of their primary care giver. Those found with suspicious and abnormal Red Reflex were referred to the Hospital for further evaluation.

Vision screening was done by the same Ophthalmologist in all the models using Red reflex test. The test was done in a dark room with the child placed comfortably at 1 metre distance using the direct ophthalmoscope. Symmetrical red reflex in both eyes was considered normal. Any asymmetry in the red reflex, absence of red reflex and presence of crescent was interpreted as abnormal test. If the pupils were too small to examine, the child was asleep or red reflex appeared suspicious or variable, then it was categorized into 'suspicious/inconclusive'. All the children who had an abnormal or inconclusive test were advised to follow with full ophthalmic examination and appropriate treatment.

3. RESULTS AND DISCUSSION

The total children screened were 301. In Model I the total children screened were 155, in Model II 68, in Model III 35 children and in Model IV, 43 children.

Table 2 shows the age distribution of children screened in four different models.

It was observed that a definite population below 6 year old children can be reached out for early

vision screening. Meenakshi Wadhvani et al[10] in their review article on childhood blindness in India state – “Despite various intervention programs, Childhood Blindness (CHB) remains a challenge, as much as for the epidemiologist as for the care provider”. The major challenges faced are due to inequitable distribution of healthcare services, with most of the advanced eye care centers being located in the urban areas, and remote rural villages getting ignored. In an endeavor to overcome the challenges of early vision screening such as difficulty to examine preverbal children, difficulty to reach out to them and above all their follow up, several ways have been tried and tested like reliability of school teachers[11] or health workers to detect vision abnormalities or devices like Auto refraction, Letter and symbols charts, Plusoptix[12], MTI photo screener [13]etc. We found the Red Reflex test to be simple enough to be taught to the optometrist who can be utilized for early vision screening in the community as well.

Through Model III (Immunization Clinic) we could approach the infants. In Model II (Health Centre) only around 6 years old children were brought for the screening. We missed the under 5 year old children in this approach. Parkshit Gogate et al[14] opined that there is a narrow window of opportunity in treating a visually impaired infant because binocular single vision develops by 6 months of life and a visual deficit, if not detected and treated in time, may leave the child bereft of stereopsis which is dense and difficult to treat.

The outcome of the Red Reflex screening test in all the four models is shown in Table 3.

The Immunization Clinic Model showed a better yield of Abnormal red reflex test. The time taken for the eye screening session and the follow up of screening all the 4 models is depicted in Table 4.

In the urban scenario the maximum number of children could be screened at a pre- school (Model I) however the follow up was better in the community based health centre model (Model II). Lowry EA[15] reported that community based follow up was better and cost effective.

Out of 301 screened children, 70 were asked to follow up for detailed eye examination (23%, Table 5). The most common abnormality was refractive error (76%) followed by squint (17.6%).

Table 1. Study model approach

	Model I	Model II	Model III	Model IV
Setting	Urban	Urban	Rural	Rural
Base	Preschool (Community Based)	Health Centre(Hospital Based)	Immunization Centre (Hospital Based)	Anganwadi (Community Based)
Trained Manpower	2(Ophthalmologist, Optometrist)	2(Ophthalmologist, Optometrist)	2(Ophthalmologist, Optometrist)	2(Ophthalmologist, Optometrist)
Sensitization Sessions	1	1	4	1
Screening Sessions	1	1	4	1
Follow up Sessions (3 months)	12	12	12	12

Table 2. Screening of children in different models

	Model I (Pre-School) N =155 (InYrs)	Model II (HealthCentre) N =68 (InYrs)	Model III (Immunization Clinic) N= 35 (InYrs)	Model IV (Anganwadi) N = 43 (InYrs)
Mean	2.82	6.73	0.71	3.55
Min	2.81	6.19	0.21	3.04
Max	2.83	7.27	1.22	4.06
STD Dev	0.01	0.76	0.71	0.72
Median	2.82	6.73	0.71	3.55

Table 3. Outcome of the Red Reflex screening test

Red Reflex Test	Model I (Pre-school) N=155	Model II (Health centre) N=68	Model III (Immunization Clinic) N=35	Model IV (Anganwadi) N=43	Total N=301
Normal	126(81.29%)	48(70.58%)	20(57.14%)	34(79.06%)	228(75.74%)
Abnormal	22(14.19%)	4 (5.88%)	6 (17.14%)	1(2.32%)	33(10.96%)
Inconclusive	5(3.22%)	15(22.05%)	9 (25.71%)	8 (18.60%)	37 (12.29%)

Table 4. Taken for eye screening session and the follow up of screening

	Time Taken per session	Average Time taken per Child	Follow up done
Model I (Pre-school) N=155	170 min	1.09 min	7.40%
Model II (Health centre) N=68	50 min	0.73 min	84.21%
Model III (Immunization Facility) N=35	30 min	0.85 min	60%
Model IV (Anganwadi) N=43	120 min	2.79 min	44%

Table 5. Number of patients following up and abnormality detected

	Number of children asked to follow up	Number of Children reporting for follow up	Number of children with abnormality
Model I (Pre-school) N=155	27	2	2
Model II (Health centre) N=68	19	16	6
Model III (Immunization Facility) N=35	15	9	7
Model IV (Anganwadi) N=43	9	4	2
Total(%)	70(23.2)	31(44.2)	17(54.8)
ABNORMALITY DETECTED		Refractive Error	13
		Squint	3
		Infantile Glaucoma	1

In the immunization model III (opportunistic screening) of rural area, the abnormal Red reflex test pick up and the follow up too was better. Since the caretakers of the children coming for immunization are already a sensitized group for preventive care, it was easy to orient them to come for vision screening and hence there was a good follow up. A study[16] conducted in Brazil reported that early vision screening during vaccination campaign was a simple, rapid and effective opportunistic screening for visual disorders.

Each model had its own advantages and challenges. Model 1(n=155), being a preschool, gathering large number of children of the target age group was relatively easy.

Since the team went to the community, all children who attended school on that day, by default ,were screened. Help from preschool teachers in registration and organization was also significant. However follow-up was poor (7.4%). This may be due to the fact that most parents are comfortable going to the health facility they routinely follow up with, rather than the recommended referral center. In Model II 68 children were screened at the health centre. The average age was higher because logistically, it was possible for the teachers to bring only those children who were big enough to walk, or queue up at the centre with minimal supervision. The children were exposed to a health care set up and this exercise doubled up as an educational excursion for them. However, there was significant attrition in the number of children who turned up. Only those who got parental permission came. This approach was dependent on how many chose to come for the screening-hence not all children who attended school on that day got screened. The average time taken per child was least in this cohort as the children were bigger and more cooperative. The follow-up rate was also the best (84%). This could be attributed to the fact that an elder child was more likely to give a direct feedback to his/her parents. Also, the children who came to healthcare centre for screening may have a felt need to begin with. In Model III opportunistic screening was done for 35 children who came for immunization. Though it was not the most time efficient approach(Table 4) , the team found the parents extremely receptive to eye care and health education. In majority cases, siblings were also screened. In the first 2 models, direct interaction with parents was minimal. Model III approach had a good follow-up (60%) which could be conveniently

scheduled as per the child's next immunization visit. The yield was highest, (43%) making this approach the most useful, in terms of impact. This could also be due to the fact that during immunization, the parents who had specific eye concerns or suspected eye problems in their children, were more prompt to come for vision screening, to begin with.

The Model IV (Anganwadi) also had a pre registered list but there was confusion in registered names and pet names of children enrolled and there was only one Anganwadi worker (AWW) to help in the screening. Success of such models depend on the willingness of the AWW involved. Logistically, it was noted that getting so many Anganwaadi children screened would need more support staff than the routine staff at the Anganwadi. The follow-up rate was poor (less than 50%) , probably because there was no direct interaction with the parents or guardians . In the current study, it was also observed that most parent or guardians were daily wage workers. Hence coming for the follow up was a challenge.

4. CONCLUSION

Four different approaches to execute red reflex screening in 0-6 yr children in India were evaluated. Single day screening of population based cohort is more time efficient but opportunistic screening using universal immunization programme model had maximum yield.

This work aims at early vision screening of preverbal/preschool children aged 0-6 years in urban and rural settings in India. This initiative could improve not only the visual quality, but also the quality of life of many children in the country.

CONSENT

As per international standard, parental written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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