PREVALENCE OF OCULAR MORBIDITY IN CHILDREN AGED 15 YEARS OR YOUNGER IN TRIBAL AREA OF JAWADHI HILLS, SOUTH INDIA, A CROSS SECTIONAL STUDY

DISSERTATION SUBMITTED TOWARDS FULFILLMENT OF THE RULES AND REGULATIONS FOR THE M.S. BRANCH III OPHTHALMOLOGY EXAMINATION OF THE TAMILNADU

DR. M.G.R. MEDICAL UNIVERSITY

TO BE HELD IN APRIL, 2015

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BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled **"Prevalence of ocular morbidity in children aged 15 years or younger in Tribal area of Jawadhi hills, South India, a cross sectional study"** done towards fulfilment of the requirements of the Tamil Nadu Dr MGR Medical University**,** Chennai for MS Branch III Ophthalmology examination to be conducted in April 2015, is the bonafide original work of Dr. Mahesh.K.M, Post Graduate student in Ophthalmology, Christian Medical College, Vellore.

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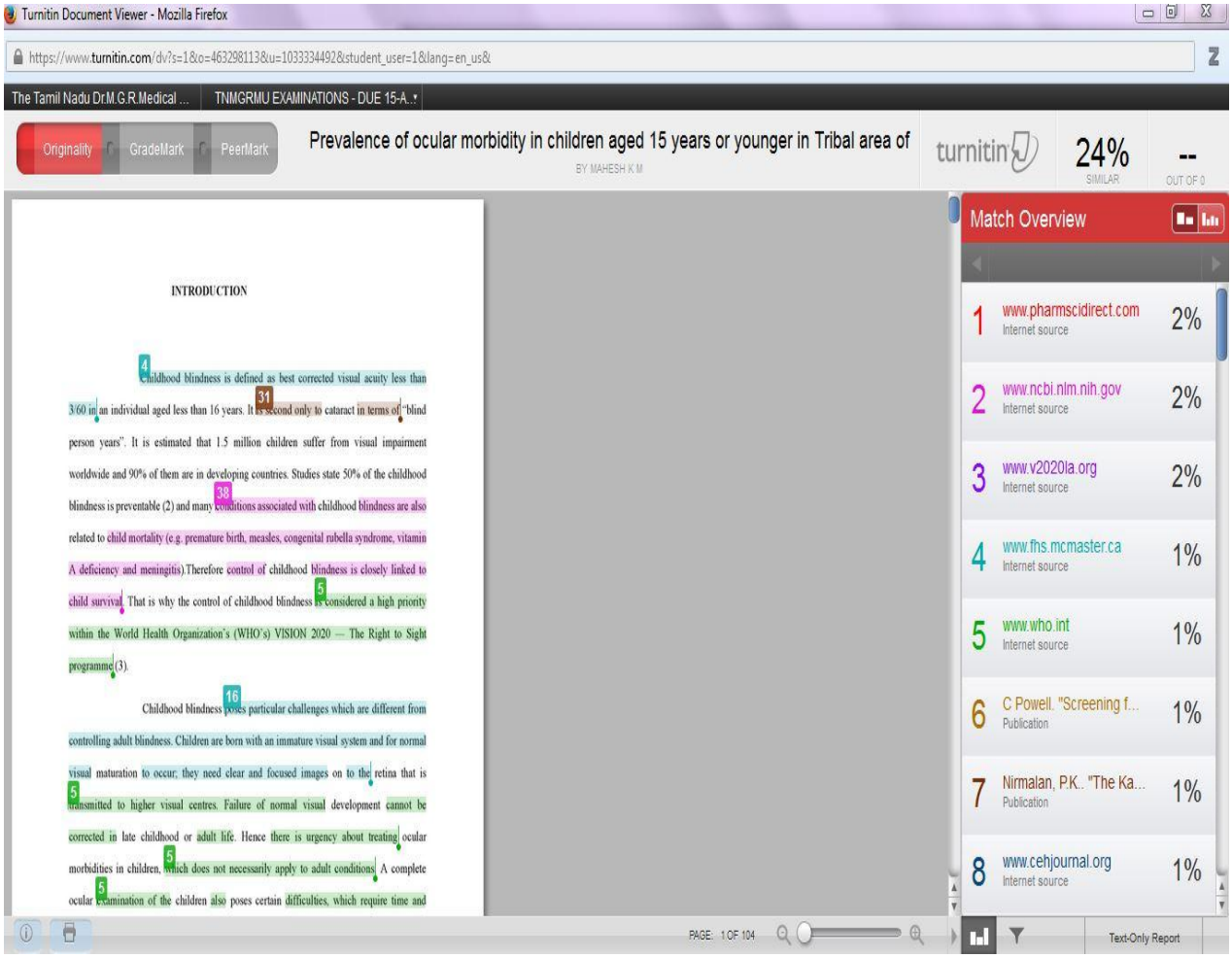

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INTRODUCTION

INTRODUCTION

Childhood blindness is defined as best corrected visual acuity less than 3/60 in an individual aged less than 16 years.(1) It is second only to cataract in terms of "blind person years".(2) It is estimated that 1.5 million children suffer from visual impairment worldwide and 90% of them are in developing countries.(1) Studies state 50% of the childhood blindness is preventable(3)and many conditions associated with childhood blindness are also related to child mortality (e.g. premature birth, measles, congenital rubella syndrome, vitamin A deficiency and meningitis).Therefore control of childhood blindness is closely linked to child survival. That is why the control of childhood blindness is considered a high priority within the World Health Organization's (WHO's) VISION 2020 — The Right to Sight programme. (1)

Childhood blindness poses particular challenges which are different from controlling adult blindness. Children are born with an immature visual system and for normal visual maturation to occur; they need clear and focused images on to the retina that is transmitted to higher visual centres. Failure of normal visual development cannot be corrected in late childhood or adult life. Hence there is urgency about treating ocular morbidities in children, which does not necessarily apply to adult conditions. A complete ocular examination of the children also poses certain difficulties, which require time and experience on the part of the examiner. Hence strategies to manage paediatric ophthalmic disorders must be initiated as early as

possible, with interventions at all the three levels of prevention. Possible measures include optical, orthoptic, medical and surgical interventions.

The Registrar General of India has estimated India's population at 1095.7 million (2005), with a projected increase to 1254.0 million in 2015. The proportion of children in the age group of < 16 years is expected to constitute 33.5% of the total population in India. (4)At the same time, the infant mortality rate has declined from 74 (1995) to 57 (2007), which implies that a larger proportion of infants born premature and or with low birth weight have been saved due to technical advances in the neonatal and child care services in the country. (5)But in the context of eye care programmes, these children are at a greater risk of developing refractive errors, cerebral visual impairment, amblyopia, strabismus, and retinopathy of prematurity (ROP).(6)

It is estimated that India alone accounts for more than 200,000 blind children. The prevalence of childhood blindness in India is estimated to be five times that of developed nations. The pattern of ocular morbidity varies in different parts of the world and is influenced by racial, geographic, socioeconomic and cultural factors. Next to Egypt; India has the highest incidence in terms of blindness.

A study from southern India has reported the prevalence of childhood blindness to be 6.5 of 10,000 children(7) and other studies have reported about 30% of the childhood blindness in India to be preventable or avoidable. By using the concept of blind person-years, the childhood blindness results in a total of 11.2 million blind person years, as compared with 22.5 million blind person-years for cataracts in India.(8) Data regarding the prevalence of childhood blindness that is available from some regions of India: Andhra Pradesh (0.65/1000), West Bengal (0.51/1000) and Delhi (1/1000) and more recently from Maharashtra confirm the above numbers. (9)

The health status of the child serves as a sensitive indicator of the overall health of the community. Factors responsible for causing higher morbidity rates in children are those related to health care services and their uptake by the population and also factors that are entwined in the socio-cultural fabric of the community. However, the data from rural India demonstrates a much higher morbidity in rural areas than in urban areas, and it is particularly high among tribal children.

Ocular disease in children is an important cause of medical consultation, which requires prompt attention because of their impact on a child's development and education. It reduces employability and productivity, which has a direct impact on the economic growth of the nation, as well as in terms of gross domestic product.(10)

There are a numerous publications about the prevalence and magnitude of visual impairment in general population, but there are few data on the prevalence, magnitude and causes of childhood ocular morbidity based on population based studies, which would be of value to Ministries of Health for prioritizing, planning specific interventions, and for monitoring and evaluation of childhood blindness.(11) Programs to screen for paediatric ocular disorders have been initiated by the World Health Organisation (WHO) and the International Agency for Prevention of Blindness (IAPB) seems to be active in the developed world, but not in the developing countries, where it is much more needed.(12)

According to population based studies done in India, the prevalence of ocular morbidity in children varies from 1 to 5%(7,13,14) and data analysed from various

school based studies shows a prevalence of 13 to 45%.(15–27)The subject gains more importance in tribal children, due to certain adverse realities like insufficient food intake, frequent infections, lack of access to health services, illiteracy, unhygienic personal habits, adverse cultural practices, *etc*.

In a society where primitive agricultural practises is the main source of income there is insecurity in food and basic need supply to the entire family, hence these children predominantly suffer from nutritional deficiencies. The absence of clean drinking water and sanitary conditions, poor child health care services in the vicinity of the villages and ineffective coverage of national health policies in these tribal regions make the children vulnerable to the prevalence of deficiency diseases.

With this background our study was conducted with the objective of determining the pattern of ocular morbidity in children belonging to the age group of 15 years or younger, in Jawadhi hills, a tribal area in Southern India.

AIM

Prevalence of ocular morbidity in children aged 15 years or younger in tribal area of Jawadhi hills, South India

LITERATURE REVIEW

LITERATURE REVIEW

CHILDHOOD BLINDNESS

UNICEF defines a child as an individual aged less than 16 years. The definitions for *visual impairment, low vision and blindness* are referenced from the 'International statistical classification of diseases, injuries and causes of death', 10th revision where: visual impairment includes low vision as well as blindness. (1)

'Low vision' is defined as visual acuity < 6/18, but equal to or better than 3/60, or a corresponding visual field loss < 20 degrees in the better eye with best correction; and '*blindness'* is defined as visual acuity < 3/60, or a corresponding visual field loss < 10 degrees in the better eye with best correction. (1)

WHO defines '*Blindness'* as a best corrected visual acuity less than 3/60 in the better eye and '*severe visual impairment*' as a best corrected visual acuity less than 6/60 in the better eye.(1)

WHO classification of Visual impairment

Category	Snellen visual acuity
Normal	6/6 to 6/18
Visual impairment	< 6/18 to 6/60
Severe visual impairment	< 6/60 to 3/60
Blind	< 3/60 to no light perception

Globally, there are about 1.4 million blind children and around three quarters of them live in developing countries.(1) Although the actual number of blind children is much lower than the number of blind adults, the number of blind person years due to childhood blindness is almost the same as the total number of blind person years due to age related cataract. *Blind person-years* are defined as the number of individuals with blind from a given disease multiplied by average number of year's person living blind with the disease.

PREVALENCE AND MAGNITUDE:

Data on the prevalence and magnitude of visual impairment in children are needed for planning and evaluating preventive and curative services for children. Childhood blindness is an important public health problem in developing countries due to its social and economic implication. Its prevalence varies from approximately 0.3/1,000 children in wealthy regions to 1.2/1,000 in the poorer regions of world. (11)It is more common in poorer areas for two main reasons: firstly, there are diseases and risk factors which can lead to blindness (e.g., vitamin A deficiency, trachoma, ophthalmia neonatorum, Onchocerciasis), and, secondly, there are fewer well equipped eye departments with ophthalmologists, nurses and ophthalmic paramedics who are trained in managing treatable causes of blindness (e.g., cataract and glaucoma).(29) The incidence is therefore higher and only fewer blind children have their vision restored.

INDIA:

Currently, in India there are reportedly 270,000 – 320,000 blind children. The prevalence of childhood blindness in India is estimated to be 0.5/1,000 children. Distribution of the causes for childhood blindness range from majorly 60,000 – 70,000

blind children due to posterior segment problems. Ocular trauma is the cause for 20-40% of one eye blindness and 9.2 million Children have vision < 6/18 in the better eye due to refractive errors.(9)

Childhood blindness alone accounts for 28.7% of the economic burden of blindness in India. The cumulative economic loss calculated for the lifetime of 0.25 million blind children assumed to have lost 33 working years of their life amounts to US$ 22.2 billion, from childhood blindness.

Corneal diseases accounts for 26.4% of childhood blindness in India and among them vitamin A deficiency is the leading cause (18.6%); measles, ophthalmia neonatorum, trauma, keratitis, and harmful traditional practices (applying plant juice) constituted the others. Thirty one percent of the children were affected by preventable and 16.3% by treatable causes. Vitamin A deficiency is more prevalent in the rural areas and it is not only a cause of morbidity from blindness but also of morbidity and mortality from diarrhoea and respiratory tract infections. Keratomalacia is a severe form of vitamin A deficiency and the prevalence of blindness due to keratomalacia may be underestimated because of the high mortality associated with blinding malnutrition.

The other major causes of childhood blindness were congenital globe anomalies (25%), retinal diseases (22.2%), optic atrophy, cataract, amblyopia, strabismus and glaucoma. A comprehensive eye care approach, including epidemiological research, community-based programs aimed at targeting preventable causes of blindness, provision of child eye care by trained personnel, and community-based rehabilitation programs, including low vision services and basic and clinical research for a better

understanding of the causes, was recommended for effective management of childhood blindness.

Constraints for developing services under childhood blindness:

The specific infrastructure for detection and management of childhood blindness has not been available at primary and secondary health care system of the country. At the tertiary level, very few canters (both Govt. and NGO) are equipped to manage childhood blindness. Posterior segment disease detection is presently not possible at the primary and even some secondary centres. Approximately, 150 ophthalmologists are trained to deal with posterior segment disorders. Because of inadequate trained ophthalmic human resources, many conditions like ocular injuries has been treated by non-ophthalmologists like general surgeons or physicians in most places.(9)

Most of the data available regarding childhood ocular morbidity are from studies conducted to assess causes of childhood blindness. The studies that had assessed childhood blindness were either blind school studies or school health screening or clinic record reviews. These studies are prone to selection bias and in no way reflects the true prevalence of ocular morbidity among children in the population. It is also important to note that only 10% of blind children attend blind schools. Those blind children who were not able to attend the blind schools are remaining blind in their home without knowing, whether it is treatable or not.

Over the last few years much information on the causes of childhood blindness has been collected using a methodology developed by the International Centre for Eye

Health, London, England, in collaboration with WHO. The causes are classified according to the main anatomical site of the abnormality, as well as the underlying aetiology. The main advantage of having two classification systems is that data on the anatomical site can be collected for all children, while etiological data's are more useful for planning relevant intervention programmes.

WHO Anatomical classification of causes of childhood blindness

•Whole globe (e.g. Anophthalmos / Microphthalmos)

• Cornea (e.g. Corneal scarring, Keratoconus)

• Lens (e.g. Cataract, Aphakia)

•Uvea (e.g. Aniridia)

•Retina (e.g. Retinal dystrophies)

•Optic nerve (e.g. Atrophy)

•Glaucoma

• Conditions where the eye appears normal (e.g. Refractive errors, Cortical blindness, Amblyopia).

WHO Aetiological classification of causes of childhood blindness

• Hereditary (at conception), e.g. genetic, chromosomal abnormalities

• Intrauterine (during pregnancy) e.g. rubella

• Perinatal (e.g. retinopathy of prematurity, birth injury, ophthalmia neonatorum)

• Childhood (e.g. measles, trauma, Vitamin A deficiency)

• Unknown/cannot be determined

AVOIDABLE CAUSES OF BLINDNESS:

The term avoidable includes both preventable and treatable causes. Conditions amenable to primary prevention include measles infection, vitamin A deficiency, ophthalmia neonatorum, the use of harmful traditional eye medication remedies, and also congenital rubella syndrome. Conditions that could have been treated early to prevent blindness (i.e. secondary prevention) include glaucoma and ROP. Causes of blindness where sight can be restored (i.e. tertiary prevention) include cataract and selected cases of corneal scarring. The provision of magnifiers and other low-vision devices is also important in restoring useful visual function.

The available data suggest that, worldwide, corneal scarring is the single most important cause of avoidable blindness, followed by cataract and ROP. Control of these conditions is given priority in WHO's VISION 2020 programme, together with correction of significant refractive errors and provision of services for low vision.

Approaches to the Control of childhood Blindness

1. Strategy Approach

Primary Prevention—Prevent the disease from ever occurring.

- Vitamin A deficiency - vitamin A supplements, nutrition education
- Ophthalmia neonatorum – povidone iodine prophylaxis
- Retinopathy of prematurity – good neonatal care
- Cataract - Rubella and measles immunization

- Refractive error – vision screening programs, health education on eye hygiene

Secondary Prevention—Prevent loss of vision from established disease.

- Vitamin A deficiency – treatment with vitamin A
- ROP – Screening of the babies at risk
- Cataract – early detection and surgery
- Refractive errors – refraction and spectacles

Tertiary Prevention—Restore vision to a blind patient.

- Cataract – surgery and regular follow up
- Corneal Scarring—Keratoplasty
- Low Vision Services—Low vision aids

2. Disease-Oriented Approach

Conditions found everywhere.

- Vitamin A prophylaxis
- School screening for refractive errors

Focal blinding diseases

- Nutrition improvement and Vitamin A supplementation for Xerophthalmia
- Prompt recognition and treatment of infective corneal ulcers
- Avoid trauma

More difficult blinding diseases

- Retinopathy of prematurity
- Congenital glaucoma

3. Services Approach (Delivery of Care)

Primary Level of Health Care

- Community level eye care with prevention and treatment of focal blinding diseases and case finding of children with treatable visual loss

Secondary Level of Health Care

- Eye Clinic with refractive, medical and surgery services

Tertiary Level of Health Care

- Referral Specialist services and Training Centre

OCULAR MORBIDITY

Ocular morbidity is described as eye diseases that are either significant to the individual (the individual is concerned enough about the condition to seek care) or to professionals (an eye health professional determines that the individual would benefit from advice, further review or treatment).(30)

Childhood eye morbidity is defined as "Any eye disease or condition that requires ophthalmic care and treatment which if untreated can often progress to serious and sight-threatening disease".

Children are affected by various eye disorders like refractive errors, squint, Vitamin A deficiency, trauma, eye infections, cataract and congenital anomalies. Uncorrected refractive errors form the major cause of visual impairment and blindness in most developing countries including India. This along with Vitamin A deficiency forms a major preventable cause of blindness in the young age group i.e. <20years.

Common childhood ocular morbidities(14)

Common	Refractive errors ,vitamin A Deficiency, allergic eye disease, vernal keratoconjunctivitis, infective conjunctivitis, trachoma, trauma, blepharitis and strabismus
Uncommon	Amblyopia, ptosis, glaucoma, proptosis, cataract (congenital, developmental or traumatic) and corneal opacities
Rarer	Retinal degenerations, congenital anomalies of eye, uveitis cancers of eye and adnexa, systemic diseases and their ocular manifestations

STUDIES ON OCULAR MORBIDITY IN CHILDREN

POPULATION BASED STUDIES

Most of the studies done on pediatric ocular morbidity either in India or western countries are school based. Very few population based studies have been done worldwide.

In a population based study by Batchala et al (14)(2009), among children (5-15 years) in rural Karnataka, the prevalence of ocular morbidity was reported to be 9.93%. Vitamin A deficiency (4.3%) was the most common ocular morbidity followed by allergic conjunctivitis (3.13%) and refractive errors (0.63%). Vitamin A deficiency was seen more commonly in males (73.53%) than females (26.47%) and this was highly statistically significant (p-value=<0.0005). Visual impairment was seen in 4 children (0.26%) and 62.5% were due to refractive error. Visual impairment due to an avoidable aetiology was seen in 87.5%. Co-morbidities were seen in 1.09 % of children.

A population based studyamong children (0 - 15 yrs) in rural Tamilnadu by Nirmalan et al(13) (2002) showed the prevalence of ocular morbidity to be 2.8% (16). Major causes for ocular morbidity were Bitot's spots (1.02%), refractive errors (0.6%), strabismus (0.4%), lid abnormalities including chalazion and hordeolum (0.3%), lens abnormalities including cataracts and surgical aphakia (0.08%), corneal scars (0.1%), and globe anomalies (0.05%). Out of 10,605 children initially screened by trained field workers, 1441(13.6%) were referred to tertiary eye hospital for further clinical examination. Lack of cycloplegic refraction and indirect ophthalmoscope usage by the ophthalmologist could have underestimated the prevalence of ocular morbidity. Only two thirds of children with eye problem had ever consulted a doctor for the same.

Another population based done in urban and rural areas of Andhra Pradesh by *Dandona et al*(7) (Andhra Pradesh Eye Disease Study) showed the prevalence of moderate visual impairment (>=6/60<6/18) to be 1.3% in children 0-15 years of age, of which more than 70% had refractive errors. (22) Visual impairment was statistically associated with increasing age group and decreasing socio-economic status.

In a population based study conducted in Mbeere district, Kenya by Kimani K et al (31)(2013) showed a prevalence of 6.3% in children 0-14 years (n=1696). The study showed the prevalence of ocular morbidity increases with age ($p<0.001$).

SCHOOL BASED STUDIES

Prasanna Kamath et al(26)in a comparative study between government and private schools in rural areas of Karnataka in 2012 reported an overall prevalence of ocular morbidity in children (6-15 yrs) as 44.77%. The initial screening was carried out in respective schools by trained ophthalmologist and those identified with ocular disorders were referred to base hospital for detailed examination. Vitamin A deficiency was the chief morbidity among the children (33.8%) followed by refractive errors (5.6%) and conjunctivitis (2.3%). Squint was least common morbidity (0.7%).Vitamin A deficiency were seen more commonly in girls(57%) than boys (43%), which was statistically significant($p<0.001$) . Refractive error was common among the private school going children (6.5%) and all of them were having spectacles. While refractive error among the government school children was 4.7% and none of them were previously detected or treated. The frequency of both ocular morbidity and refractive error increased as age advances, as reported in the study.

Above study was comparable to the one reported by *Chaturvedi et al*(20)among school children (5-15 years) in rural Delhi in 1999 to be more than 40% (9). Trachoma was the commonest ocular morbidity (18%), followed by vitamin A deficiency (10.6%), refractive error (7.4%) and squint (7.4%). Prevalence was seen more in children from underdeveloped parts of eastern Delhi and eye disorder was not significantly high in children with malnutrition.

In a study conducted by *Kalikivayi et al*(27)in 1993 -1995, reported a prevalence of 43.5% among school going children (3-18 years) at Hyderabad. The initial assessment was done by trained optometrists and children identified with disorders apart from refractive errors were referred to base hospital. The major cause was refractive error (41.4%) and low vision (VA < 6/18) was in seen 1.1% and blindness (VA< 6/60) in 0.5%. The prevalence of hypermetropia was found to be 22.6%, myopia in 8.6% and astigmatism in 10.3 %. The presenting visual acuity of 115 children was < 6/18 out of 3659 children, therefore to identify one child with visual impairment (<6/18), about 32 children need to be screened (10)

Gupta et al(19)in urban area of Shimla, a study conducted among school children (6-16 years) in 2001-2002 showed a prevalence of 31.6%. Refractive error constituted the major cause of morbidity (22.0%), followed by squint (2.5%), colour blindness (2.3%), vitamin A deficiency (1.8%) and conjunctivitis (0.8%).

Shrestha RK et al(16)in 2006 reported a prevalence of 34.2% among school children (5-16years) in Kathmandu. A total of 1816 students between 5 and 16 years of age were evaluated, out of which 959 (52.80%) were males and 857(47.20%) were females. Refractive error is the commonest problem accounting for 21.8%, followed by infective disorders, which accounted for 7.2%. 3.5% of them were noted to have

orthoptic problem which includes convergence insufficiency (1.5%), strabismus (1.3%) and amblyopia (0.7%), Colour blindness was 2.2%, glaucoma suspect 1.7% and congenital anomalies 0.9%. Xerophthalmia was seen in only one, accounting for 0.05% out of total. Refractive error was found to be only cause of amblyopia.

Some studies have shown lower prevalence of ocular morbidity as reported by *Rajesh Kumar et al* (17)in 2004 (24.6%) from Delhi among school children (5-14 years) (11). Commonest cause of ocular morbidity was refractive errors with a prevalence of 5.4% followed by conjunctivitis (4.6%), trachoma (4.3%) and other diseases. The prevalence of ocular morbidity showed a significant association with increase in birth order.

In a study conducted by *Jayanth D and Malathi K*(23)(2011) in rural Maharashtra among school children (10-16 years) prevalence was (27.65%).(12) Refractive error (10.12%) and vitamin A deficiency (3.53%) were the most common ocular morbidity among those studies. The prevalence of ocular morbidity showed a significant association between socio-economic status, education and occupation of parents.

Least prevalence of 13% was reported by *Prajapati P et al*(24)(2009) among adolescents (10-19 yrs) of Gandhinagar district (14). Refractive error was the most common ocular morbidity (5.2%), followed by vitamin A deficiency (3.8%), blepharitis (0.7%) and colour blindness (0.6%). Moderate visual impairment was in 5.2% of children.

A study conducted by *Harpal Singh et al* (21)(2007), prevalence of ocular morbidity among children (5-16 yrs) in Bhopal (central India) was shown to be 14.5%. Refractive error was the common cause of ocular morbidity (6.94%), followed by

vitamin A deficiency (1.98%) and strabismus (0.03%). Since significant number of children are going to school in India, a complete estimation of visual impairment in children can be assessed by population based studies rather than school studies.

In a study conducted by *Kumar et al*(15)(2013) among school children (6-16 years) in Uttar Pradesh, prevalence of ocular morbidity was 11.58% and refractory error (6.22%) was the major morbidity followed by Vitamin A deficiency (2.77%), conjunctivitis (1.47%), and stye (1.12%). Significant association was found between prevalence of ocular morbidity, and socio-economic status and education of parents.

Naik R et al(25)(2013) reported a prevalence of 9.66% among school children in Ahmednagar, Maharashtra. Refractive errors (7.57%) constitute the major cause of ocular morbidity followed by squint (1.55%), colour blindness (0.18%), vitamin A deficiency (0.36%), traumatic eye disorders (0.5%), and congenital disorders (0.2%).

In a school based study done by *Nepal et al*(18)(2003) in Kathmandu among 1100 children between 5 and 16 years of age reported 11% of children examined had some form of ocular morbidity. The commonest was refractive error (8.1%) followed by strabismus (1.6%), traumatic eye injury (0.54%), vitamin A deficiency (0.36%), and congenital abnormalities (0.36%). Visual impairment was seen in 33.4% of children with uncorrected refractive error.

Similarly low prevalence of ocular morbidity (15.6%) was reported by *Wedner SH et al*(22)in rural Tanzania, 1998 (15). Trachoma was the most common cause for the morbidity (5.57%), followed by night blindness (5.26%) and refractive error (1.01%). A simple screening by teachers, identified 80% of children with bilateral poor eyesight, re-valued by the eye team, with 91% specificity. The prevalence of ocular

morbidity varies at different places due to different factors prevailing at different places and presumably difference in study designs and definitions.

Population based studies	**Prevalence of ocular morbidity (%)**	**Prevalence of Refractive error (%)**	**Prevalence of vitamin A deficiency (%)**	**Comments**
Praveen K et al, (13)2002, rural Tamilnadu	2.8	0.6	1.02	Vitamin A deficiency more commonly seen
Batchala et al(14), 2009, rural Karnataka	9.93	0.63	4.3	Vitamin A deficiency more common in boys
School based studies	**Prevalence of ocular morbidity (%)**	**Prevalence of Refractive error (%)**	**Prevalence of vitamin A deficiency (%)**	**Comments**
Prasanna Kamath et al,(26) 2012, rural Karnataka	44.77	5.6	33.8	Vitamin a deficiency was most common in low SES
Kalikivayi et al,(27) 1995, Hyderabad	43.5	41.4		Blindness in 0.5%
Gupta et al,(19) 2002, urban Shimla	31.6	22.0	1.8	Refractive error most common cause
Rajesh Kumar et al,(17) 2004, Delhi	24.6	5.4	4.1	Refractive error, trachoma increased with age
Wedner SH et al, (22)1998,Tanzania	15.6	1.01	0.58	Trachoma major public health problem

HOSPITAL BASED STUDIES:

In a study conducted by *Chakraborti et al*(32)in a tertiary care centre, West Bengal among the children (<16 years) attending the eye OPD and emergency, reported conjunctivitis (34.19%) being the most common disease, followed by refractive error (9.15%), corneal disorders (8.09%), cataract (5.58%), uveitis (4.59%), vitamin A deficiency (1.96%) and squint (1.33%).

A hospital based study done by *Ava H et al*(33)among 676 children, who were admitted in the pediatric ophthalmic in-patient department, Bangladesh. The age range of the patients was 2 months to 15 years with a mean age of 5.8 years. Childhood cataract was the most common ocular disorder which accounts for 48.28% of the study subjects. Ocular injury was the second most common disease seen among these children (21.76%). Ptosis was the third common disorder, affecting 51(5.16%) cases. In this study out of 477 childhoods cataract 37.94% (181) cases were congenital cataract, 43.45% (208) were developmental cataract and 18.45% (88) were traumatic cataract.

Another hospital based study among children (0-15 yrs) in Nigeria by *Onakpoya OH et al* (34)showed ocular injuries were the most common disorders seen (21.7%), followed by allergic conjunctivitis (17.8%), infection of the eye and its adnexa (15.4%) and refractive errors (14.3%).

In a hospital based study among children (0-15 yrs) in Ethiopia by *Mehari*(35)showed conjunctivitis was the most common ocular disorder seen in 35% of the study subjects, followed by ocular trauma (11.8%), refractive errors (11.4%) and keratitis (10.5%).

DEVELOPED COUNTRIES:

In a systematic review on the prevalence and causes of visual impairment and blindness in the Americas and the Caribbean, done by B Munoz et al (36)reported corneal opacities were more common in countries where < 5 year death rates are > 30 per 1000 live births. In Bolivia, Dominican Republic, and Peru corneal opacities attributes to around 20% of blindness in contrast with none or very few cases in the United States, Chile, and Argentina. The aetiology of corneal opacities was found to be corneal ulceration after measles, herpes simplex infection, vitamin A deficiency, and ophthalmia neonatorum.

In countries with intermediate mortality where the survival of low birth weight infants has increased but technology for neonatal care is inadequate, Retinopathy of prematurity was an important cause of blindness. ROP was rare in Bolivia, Dominican Republic, and Peru, where the survival rate of premature babies are lower. In contrast studies from the United States have shown lower frequencies (8%–19%), the result of improvements in intensive neonatal care.

Cataract as a cause of childhood blindness was reported from all countries, with a lower frequency in the United States. The most common underlying causes of childhood cataract are congenital rubella and genetic disease.

Magnitude of blindness in children age 0–15, estimated as a function of under 5 years mortality in Americas and Caribbean (36)

Region	**Mortality for children<5 yrs**	**Estimated prevalence of blindness**	**Countries**	**Estimated number of blind <15 yrs**
North America	30 and under	0.3	Canada, USA	20 100
Central America	30 and under 31–94	0.3 0.6	Costa Rica, Panama Belize, El Salvador, Guatemala, Honduras, Mexico, Nicaragua	630 26 820
South America	30 and under 31–94	0.3 0.6	Argentina, Chile, Colombia, Paraguay, Uruguay, Venezuela Bolivia, Brazil, Ecuador, Guyana, Peru	11 610 37 680
Caribbean	30 and under 31–94 95-170	0.3 0.6 0.9	Bahamas, Barbados, Cuba, Jamaica, Trinidad Tobago, Dominican Republic Haiti	1530 1620 2700
Total		0.45	All countries	102 690

COMMON CHILDHOOD OCULAR MORBIDITIES OF PUBLIC HEATH IMPORTANCE

REFRACTIVE ERROR

Visual impairment due to refractive errors is one of the most common childhood morbidity and the second leading cause of treatable blindness.(37) It is estimated that globally 153 million people > 5 years of age are visually impaired as a result of uncorrected refractive errors, of which 8 million are blind. Furthermore, some 12.8 million in the age group 5–15 years are visually impaired from uncorrected refractive errors, a global prevalence of 0.96%, with the highest prevalence reported in south-east Asia. Vision disorders are the 4thmost common disability of children and the leading cause of handicapping conditions in childhood. Visual impairment from uncorrected refractive errors can have immediate and long-term consequences in children such as loss of educational and employment opportunities, as well as economic gain for individuals, families and societies, and impaired quality of life.

Various factors are responsible for refractive errors remaining uncorrected: lack of awareness and recognition of the problem at personal and family level; non-availability of refractive services for testing; insufficient provision of affordable corrective lenses; and cultural barriers to compliance. Existing information on the prevalence of refractive error is difficult to compare as published studies often use different methodologies for measuring refractive error. They also use convenience samples, such as school children, that are not necessarily representative of the population.

The **Refractive Error Study in Children (RESC)**, supported by WHO was designed to estimate the prevalence of visual impairment and its causes in children aged 5 to 15 years of age and of different ethnic origins. The trends of visual impairment (uncorrected visual acuity of 6/12 or less due to refractive errors) revealed in various places were 15.8% - Chile,(38) 12.8% - Shunyi China,(39) 9.0% -urban India,(40) 5.0% -rural India,(41) 2.9% -rural Nepal(42) and 2.74 % -South Africa.(43) An RESC study in India showed an overall, hyperopia was present in 7.7% of children and myopia in 7.4%. An upward trend of myopia was noted in the coinciding with school entry (7-8 years) and 11-14 years age around pubertal growth spurt.(40) In India a five year follow up of school vision screening reported that 3.8% of 5.39 million students had been identified and or refracted by the programme and that 0.8% of children had been provided with glasses. According to teachers 96.5% of these students were wearing their spectacles in class. (44)

VA 0.5* or worse in at least one eye in children aged 5 to 15 years(45)

Country	**N**	**Presenting %**	**Uncorrected %**	**Best corrected %**	**% due to refractive error**
China (Shunyi)	5884	10.9	12.8	1.8	87.8
China (Ghangzhou)	5053	10.3	22.3	0.6	95.6
Chile	5303	14.7	15.8	7.4**	62.1
Nepal	5067	2.8	2.9	1.4	55.1
South Africa	5599	1.2	1.4	0.3	66.4
Urban India	6447	7.4	9.0	2.1	80.9
Rural India***	4074	4.9	5.0	2.5	53.0

**Difficulties measuring visual acuity (VA) accurately, particularly in young children

***aged 7 to 15

Even in countries with well-resourced health systems uncorrected refractive error is a major cause of visual impairment in children which has a negative impact on academic performance. Poor academic performance can reduce choice of occupation and, therefore, socio-economic status in adult life. This can have a detrimental effect on both the individual and their community. It is with a view to address this avoidable cause of blindness that the government initiated the School eye screening program (SES) under the **National Program for Control of Blindness (NPCB).**

The National Programme for Control of Blindness was first launched in India, as a 100% centrally sponsored Programme in 1976. A vast number of blind people in a country denote an inefficient eye care service in the country. This is because about 80-90% of the blindness is either curable or preventable. NPCB was a cataract centred programme, till few years ago. However, currently it is funding for management of childhood blindness, keratoplasty, squint, low vision, retinopathy of prematurity, diabetic retinopathy, glaucoma and ocular trauma.

Objectives of NPCB:

The major objectives of NPCB were reducing the prevalence of blindness through identification and treatment of the blind, development of comprehensive eye care facilities in every district, development of human resources for providing eye care services, securing the participation of voluntary organizations, enhancing community awareness on eye care and setting up a referral system.

The Government of India is determined to control avoidable blindness and eye screening of school children is one such activity. The School Eye Screening (SES) programme was introduced in 1994, under NPCB. Due to various social, logistic and administrative reasons, the program initially focussed on screening of students in

middle and secondary school from 5th to 10th standard, because students of this age group are in the position to understand the need and value of vision screening. The planning of SES programme is carried out by respective District Health Societies (DHS) and it is usually carried out during April-September of each year.(46)

The activities under SES program include identification of schools, collection of information on number of students and teachers, training of school teachers, screening and referral centres, confirmation of "suspect" students by ophthalmic assistant / ophthalmologist, prescription of glasses, and provision of free glasses to students from poor socio-economic status. The cost of SES programme is borne by Government of India including provision of Rs 125/- for glasses for poor children through District Health Society funds.(46)

VITAMIN A DEFICIENCY

Vitamin A is a conjugated protein and a derivative of the carotenoid pigments from plants. Thus the vitamin A content of our diet comes directly or indirectly from the plants. In the human body, the retinal pigment epithelium plays an important role in the transformation of carotene into vitamin A for the needs of the visual process. Vitamin A and carotene are both absorbed in the small intestine, and their absorption is dependent on a normal fat metabolism. Disturbances of fat metabolism may give rise to signs or symptoms of vitamin A deficiency, even in the presence of an adequate intake.

The principal dietary sources of carotene are the green vegetables, lettuce, spinach, etc. Tomatoes, peppers, and fruits, which were once green but have ripened, also contain appreciable amounts of carotene. The next most important sources of carotene and vitamin A are milk and its products and eggs. The presence of vitamin A

as such is due to the conversion of carotene into vitamin A in the animal. The principal animal tissue supplying vitamin A is liver, as it contains the body stores.

The clinical manifestations of a severe vitamin A deficiency are subjective night-blindness and objective pathological changes in certain epithelial tissues. These changes are found most commonly in the eyes, respiratory tract, skin, and genito-urinary tract as well as in the ducts of many glands.

OCULAR MANIFESTATIONS:(47)

POSTERIOR SEGMENT OF THE EYE

a) Rod function

Diminution in the vitamin A supply to the rod cells of the retina results in impairment of dark adaptation function. This may be detected by rod scotometry, dark adaptometry and electroretinography long before the subject complains of night-blindness. Unfortunately, all these methods are not applicable to the susceptible preschool children because co-operation of subject is essential. They also require expensive and delicate equipment not suitable for field studies. The development of a simple sensitive biophysical test of rod function applicable to susceptible population would be a distinct advance in measuring the extent of the problem.

The symptom of night-blindness should always suggest the possibility of vitamin-A deficiency, but it may result from non-nutritional causes, such as congenital night-blindness and retinitis pigmentosa.

ANTERIOR SEGMENT OF THE EYE

a) Conjunctiva

The changes characteristic of vitamin-A deficiency are usually confined to the bulbar conjunctiva, but occasionally in long-standing cases the conjunctiva of the lower lid and adjacent lower fornix may be rough and wrinkled.

i) Conjunctival xerosis

This may be generalized throughout the exposed part of the bulbar conjunctiva or localized to a small part, which has the following characteristics:

(1) Dryness –the literal meaning of "xerosis". Dryness is judged by lack of the normal lustre or brilliance of the bulbar conjunctiva.

(2) Unwettability - Patches of xerosis emerge from their surroundings “like sandbanks at receding tide" when the child stops crying. This probably results from the disruption of the continuity of the preconjunctival film.

(3) Loss of transparency - On inspection with the slit-lamp, the translucent conjunctiva, which normally looks clear and crossed by blood vessels, appears to be milky owing to fine droplets.

(4) Thickening - There is a tendency to generalized thickening and stiffness of the conjunctiva.

(5) Wrinkling - These are small vertical folds in the conjunctiva best demonstrated by moving up the loose temporal conjunctiva against the lateral canthus on maximal lateral movement of the eyeball.

(6) Pigmentation - In prolonged xerosis, the lower fornix first becomes yellowish, then light grey and finally dark brown owing to the presence of chromatophores in the basal cell layer of the epithelium. This characteristic "gutter" pigmentation responds slowly to treatment, over a period of weeks or months.

ii) Bitot's spot – it is a small plaque of a silvery-grey hue with a foamy surface. It is superficial and is raised above the general level of the conjunctiva; it is readily removed by manipulation of the lids or direct wiping, revealing a rough xerotic conjunctival bed.

Bitot's spot is generally situated on the bulbar conjunctiva, frequently bilateral and temporal confined to the interpalpebral fissure close to the limbus. This typical location explains the protection of the material here from the wiping movements of the lids, close to the protruding limbus. The shape varies considerably, being often irregularly circular or oval. The classical triangular form with the base to the limbus is less common seen.These spots, together with the accompanying generalized xerosis, usually respond to vitamin-A therapy. Bitot's spot isnot pathognomic of vitamin A deficiency, but it is a useful indicator of VAD especially in young children.

b) Corneal changes

1) Active stage

Reversible changes are characterized by generalized corneal dryness, which lead to haziness of the cornea. Slit-lamp examination show an increase of fine pigment in the paralimbal portions of the cornea. There may be a discontinuity of the surface epithelium and diminished tactile sensitivity. Later, cellular infiltration of the corneal stroma increases the intensity of the haziness of the cornea, which frequently has a

milky appearance, markedly seen in the lower central part. In some cases there is a hypopyon in the lower part of the anterior chamber.

Irreversible changes are characterized by the following signs:

(a) Ulceration –Discontinuation of surface epithelium along with infiltration involving a part or the whole of the corneal thickness. Advanced degrees of stromal loss result in descemetocele and complete perforation with iris prolapse, which are more commonly seen in the lower central cornea.

(b) Keratomalacia - which consists of a characteristic softening (colliquative necrosis) of the cornea, invariably leading to deformation of the eyeball. The process is a rapid one with corneal melting into a cloudy gelatinous mass. Extrusion of the lens and loss of vitreous may occur. In untreated cases, endophthalmitis supervenes frequently.

b) Sequelae:

These result from the spontaneous or treatment assisted healing of the irreversible changes mentioned above. The least serious complication to vision is nebulae and small leucoma situated away from the pupillary area. If the iris has prolapsed there will be adherent leucoma with distortion of the pupil. Large leucomata cause loss of vision, fortunately often affecting only one eye with minimal changes in the other.

Keratomalacia, on healing, results in anterior staphyloma composed of the scarred remnant of the cornea incorporated with uveal elements, bulging forwards under the influence of raised intra-ocular pressure. If the damaged cornea ruptures then the contents are extruded, and a shrunken globe, phthisis bulbi, is the end result.

WHO treatment guidelines for Xerophthalmia in children,

Timing	**Vitamin A dosage**
< 6 months of age 6-12 months of age >12 months of age	50,000 IU 1,00,000 IU 2,00,000 IU
Next day	Same age specific dose
2 weeks later	Same age specific dose

Vitamin A deficiency disorders (VADD) is a major nutritional problem throughout the developing world. VADD occurs due to a chronic deficiency in the dietary intake of vitamin A and leads to lower body stores of Vitamin A for various physiological functions. Its presence as a public health problem is assessed by measuring the prevalence of deficiency in a population, represented by specific biochemical and clinical indicators of status (48).The current WHO estimates that there are approximately 127 million preschool children with VAD (serum retinol < 0.70 μmol/L) worldwide.(49)

Vitamin A deficiency is a common but preventable ocular morbidity in India, which manifests initially as Bitot's spots and conjunctival xerosis. A report estimated the prevalence of Xerophthalmia in the South East Asia was found to be in the range of 0.2-4.4% (Nepal 2.6%, India 2.8%, Myanmar 4%, Bangladesh 3.7%, Bhutan 0.7%, and Srilanka 2.8%). (50–52)India has the highest prevalence of VAD among South Asian countries. These results suggested high mortality rate, leading to an annual

330,000 child deaths. Studies confirmed 31% to 57% preschool children to be the victims of subclinical VAD.

Prevalence of Vitamin A deficiency (VAD) among children in South East Asia (53)

Country	Children < 6 years		
	No. Of deaths	Subclinical VAD %	Clinical VAD %
Afghanistan	50,000	53	-
Bangladesh	28,000	28	0.7
Bhutan	600	32	0.7
India	3,30,000	57	0.7
Nepal	6,900	33	1
Pakistan	56,000	35	-

In the study done by *PrasannaKamath et al*, (26)in rural areas of Karnataka (2012) reported a prevalence of vitamin A deficiency in children (6-15 yrs) as 33.8%, which was higher to the one reported by *Chaturvedi et al*(20)among school children (5-15 years) in rural Delhi (10.6%).

A prevalence of 3.8% was reported by *Prajapati P et al*(24)(2009) among adolescents (10-19 yrs) of Gandhinagar district (14), comparable to *Jayanth D and*

Malathi K(23)(3.53%) in rural Maharashtra among school children (10-16 years) and *Kumar et al*(15)(2.77%) among school children (6-16 years) in Uttar Pradesh. A study conducted by *Harpal Singh et al*, (21)among children (5-16 yrs) in Bhopal (central India) vitamin A deficiency was 1.98% and *Gupta et al*(19)reported 1.8% in urban area of Shimla.

Least prevalence of vitamin A deficiency was reported by *Shrestha RK et al*(16)(0.05%) among school children (5-16years) in Kathmandu and 0.36% in a study reported by *Naik R et* (25)*al* among school children in Ahmednagar, Maharashtra and similar results by *Nepal et al*(18)(0.36%) in Kathmandu.

Low vitamin A intake during infancy and childhood greatly raises the risk of VADD (48). Commonly manifesting as Xerophthalmia and night blindness, VADD can cause other considerable ocular and systemic problems like failure to thrive, anaemia, impaired immunity and mucosal defences leading to repeated infections and diarrhoea. Vitamin A deficiency is closely related to under-5 mortality.

WHO CLASSIFICATIONS OF XEROPHTHALMIA(54)

	MANIFESTATION	**WARNING INDICATORS FOR DETERMINING PUBLIC HEALTH PROBLEMS**
X N	Night blindness	1%
X 1A	Conjunctival Xerosis	0.5%
X 1B	Bitot's spot	0.5%
X 2	Corneal Xerosis	0.1%
X 3A	Corneal ulceration involving <1/3 of corneal surface	0.01%
X 3B	Corneal ulceration involving >1/3 of corneal surface	0.01%
X F	Xerophthalmic fundus	
X S	Corneal scar	0.05%

The **National Prophylaxis Programme against Nutritional Blindness due to Vitamin A Deficiency (NPPNB due to VAD)** was initiated in 1970 with the specific aim of preventing nutritional blindness due to keratomalacia. The Programme is 100 per cent centrally sponsored was initiated as an urgent remedial measure to control the high magnitude of xerophthalmic blindness in the country reported in the

1950s and 1960s. In 1994, under the National Child Survival and Safe Motherhood (CSSM) Programme, the NPPNB due to VAD was modified keeping in view of the vulnerability of Vitamin A deficiency in young children. Accordingly, each child has to receive 5 doses of VA before 3 years of age (children age 6-11 months, 1 dose of 100,000 IU of VA and in age 12- 36 months of age one dose of 200,000 IU of VA every six month).(55) The auxiliary midwife and other paramedical workers distribute the Vitamin A in two millilitre of orange flavoured syrup, by home visits to all children between the ages of one to five years. Records of distribution are maintained.

In a survey conducted by Semba R D et al(56) to assess to coverage of vitamin A prophylaxis in India, reported that only 20% of eligible children are supplemented with vitamin A, ranging from 10% to 40% per state. The study showed that children who missed the vitamin A prophylaxis were mostly stunted and underweight. The states with low vitamin A prophylaxis coverage had higher under-5 mortality and vice-versa.

The expanded coverage of vitamin A prophylaxis in Chandigarh have shown to reduce Xerophthalmia, diarrhoeal morbidity and mortality. The preschool children from poor families had shown to suffer from higher morbidity, mortality and blindness due to vitamin A deficiency. This can be prevented by improving the coverage of supplementation. The coverage of programme in more than 90% of preschool children in India can reduce the mortality by 25% attributable to vitamin A deficiency.

In a study conducted by N.Arlappa et al, to assess the prevalence of vitamin A deficiency among the pre-school children in rural areas of Madhya Pradesh, it was found that the overall coverage of vitamin a prophylaxis was only 33%. The reasons for not receiving the massive dose of vitamin A, as reported by mothers of children,

were either not being aware of the vitamin A supplementation (55%) or not being offered it by the health workers (34%).

While the general impression is that vitamin A deficiency is on the decline with more sustainable food based strategies, there are still pockets where blinding Keratomalacia happens not so infrequently. In our experience the tribal community in Jawadhi is one such vulnerable population. It is therefore justifiable that we assess prevalence of clinical VAD in this age as a pilot and get some information regarding the functioning NVAPP in this area.

BREAST FEEDING:

Consumption of human milk protects infants from several diseases and is very important for growth and development of infants. Human milk provides all the essential fatty acids to support the growth and development of the infant, especially docosahexaenoic acid (DHA) which is deposited in the membrane lipids of the brain and retina, where it is critical to visual and neural function. Human milk also contain factors that reduce the severity of retinopathy of prematurity in premature and in low birth weight infants that have been shown in various studies.

Human milk is species-specific, and it differs from all milk substituting products, making it superior for infant feeding. It contains, on average, 1.1% protein, 4.2% fat, and 7.0% carbohydrate and supplies 72 kcal of energy per 100 g. It also has antioxidant substances like vitamin C and E, and enzymes such as superoxide dismutase, catalase, and glutathione peroxidase. It plays an important role in maintaining the viability of human tissue cells and also modulating immune-mediated mechanisms in the body for healthy survival.

Malnutrition has been responsible for 60% of the 10.9 million deaths annually among children under five. Over two-thirds of these deaths, are often associated with inappropriate feeding practises. Malnourished children more frequently suffer the long term consequences of impaired development. Exclusive breastfeeding during the first 4 months of life is not seen in infants more than 35%, worldwide; complementary feeding is frequently begin either too early or too late, and foods are often nutritionally inadequate. Because poor feeding practices are a major threat to social and economic development, they are among the most serious barrier in health maintenance that influences this susceptible group.

As a global public health recommendation, infants should be exclusively breastfed for the first 6 months of life to achieve optimal growth, development and health. Thereafter, to meet their demanding nutritional requirements, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues for up to two years of age or beyond.

In a randomized study conducted by *Aksoy et al*, (57)in Turkey comparing ocular morbidity in first or second grade primary school students according to feeding types in their 6 months of life. The study found significant refractive errors in (23%) subjects in the non-breast group. There was no significant refractive error in the breastfed + formula fed group or the only breastfed group.

In a study done by Tarwotjo et al,(58) among the Indonesian children (n=358) under 5 years of age, found that breast feeding was less common in the children with Bitot's spots than in controls (p<0 001).

West KP et al, (59)conducted a case-control study in southern Malawi, among children (n=303) aged 2-6 years, to assess the association of breastfeeding and

Xerophthalmia. The study showed that the children with Xerophthalmia had begun weaning sooner and stopped breast feeding earlier as compared to controls which implies a protective role of breast feeding against Xerophthalmia in early childhood.

INTRAUTERINE INFECTIONS:(60)

The most common congenital intrauterine infections can be summarized by the mnemonic TORCH: Toxoplasma Gondi, others, rubella, cytomegalovirus, and herpes simplex virus. ‘‘Others’’ includes treponema pallidum, varicella--zoster virus, Epstein—Barr virus, human immunodeficiency virus, lymphocytic choriomeningitis virus, and West Nile virus. These are the important causes of childhood blindness, worldwide. Congenital toxoplasmosis and congenital rubella are the two major intrauterine infections that are responsible for childhood ocular morbidity.

Eye Manifestations of Intrauterine Infections(60)

Agents	Eye Manifestations of Congenital Infection
Toxoplasma	Chorioretinal scars, microcornea, cataract, optic atrophy, microphthalmia, retinitis, retinal detachment, vitritis, strabismus,
Rubella	Dacryostenosis, endotheliopathy, glaucoma, keratoconus, persistent pupillary membrane, cataract, salt and pepper retinopathy, primary optic atrophy, microphthalmos, microcornea
Cytomegalovirus	Corneal opacity, chorioretinitis, optic nerve hypoplasia, optic nerve coloboma, optic atrophy, anophthalmia
Herpes simplex Virus	Conjunctivitis, keratitis, iridocyclitis, iris atrophy, posterior synechiae, cataract, retinitis, chorioretinitis, chorioretinital scarring, white vitreous masses, optic neuritis, optic atrophy
Lymphocytic chorioretinitis virus	Chorioretinal scars, optic atrophy, nystagmus, optic nerve dysplasia, esotropia, exotropia, microphthalmos, cataract, retinitis
West Nile virus	Chorioretinal scarring
Treponema pallidum	Cataract, glaucoma, pigmentary retinopathy, optic atrophy, Argyll-Robinson pupil, condyloma lata on the eyelids
Varicella--Zoster virus	Chorioretinitis, both atrophy and hypoplasia of the optic nerve, congenital cataract, Horner's syndrome
HIV	CMV retinitis, toxoplasmic chorioretinitis
Epstein--Barr virus	Congenital cataract

Unavailability of specific infra-structure and equipment for detection and management of childhood blindness at all levels of healthcare, inadequate trained ophthalmic human resources contribute to the constraints for developing services under childhood blindness. The data from rural India demonstrates a much higher ocular morbidity in rural areas than in urban areas, and it is particularly high among children from disadvantaged socio-economic groups. Tribal communities in India still are a deprived group. The current study is therefore being undertaken to ascertain the prevalence of ocular morbidity in children aged 0-15 years, in tribal areas of Jawadhi hills, South India.

STUDY AREA

Jawadhi Hills is located in the Thiruvannamalai District of Tamil Nadu state. Jawadhi Hills have a length of 32 kms and a maximum width of about 80 kms. It is a part of the Eastern Ghats of India. The total population of Jawadhi hills is 178,879 as per the 2011 census of India. Jamunamarathoor is the headquarters of the Jawadhi hill. The hills are sparsely populated; the majority of the inhabitants are Malayali tribal people, though other castes are also present. The inaccessibility of the Jawadhi Hills is prevented by better transportation facilities. In this area with several specific issues such as poor access, migrant population, unique lifestyle practices and fewer uptakes of medical services we hope to assess the utilization of eye care services for problems in children.

MATERIALS AND METHODS

MATERIALS AND METHODS

Study Design

It was a population based cross-sectional study.

Study Population

Study was conducted in Jawadhi hills, which are extensions of Eastern Ghats spread across the parts of Thiruvannamalai and Vellore districts. A total of 80,000 people, mostly Malayali tribes, live on this hill. The Jawadhi block comprises of 11 panchayats containing about 250 villages. The population cultivates “Samai” (fine rice), ragi and maize but they do not eat vegetables nor drink milk. Access to meat is usually limited to pork as pig rearing is common. Each cluster has a headman called “Ooran”, and about 13 such clusters have a “Nattan”. The entire tribe comes under a common leader, the “Guru”. The tribal’s consider themselves to be superior to the people from the plains, who are not allowed to enter their house.

The area has poor road access, lacks drinking water and has poor sanitation facility, typical of any tribal village in a developing country. There are 2 primary health (Jamunamarathoor and Namiampattu) canters for the entire population. There is no single established ophthalmologist in this hill and people with ocular problems generally come down the plains for management. The socio-economic status of the study region ranges from low-moderate, hence basic healthcare facilities especially eye care is sparsely available.

Subjects

Inclusion Criteria:

- All children in the age group of 0-15 years, who were willing to participate and for those whom consent from the parents could be obtained and child assent in those applicable.
- The family should be residing in the area at the least of six months prior to the study date.

Definitions:

- **Ocular Morbidity** is defined as an abnormality in any of the ocular structures, which may or may not be visually significant and which may or may not require / improve with treatment.
- **Myopia** was defined as a spherical equivalent of −0.50 dioptre sphere or greater in either eye.
- **Hyperopia** was defined as a spherical equivalent of +2.00 dioptre sphere or more in either eye.
- **Astigmatism** was defined as cylindrical power of −0.50 dioptre cylinder or greater in either eye.
- **Amblyopia** is defined as a difference of 2 lines or more in best corrected vision between the two eyes or a best corrected vision of 6/12 or worse in the affected eye

- **Strabismus:** Misalignment of the visual axis of either eye.
- **Anophthalmos**: Absence of eyeball from the orbit.
- **Microphthalmos**: Abnormally small eye, the axial length being less than 20mm.
- **Coloboma** occurs due to the failure of closure of embryonic fissure.
- **Retinal degenerations:** Acquired photoreceptor and or retinal pigment epithelial dysfunction
- **Retinal dystrophies**: Inherited Photoreceptor and or retinal pigment epithelial dysfunction.
- **Ptosis**: Abnormal drooping of the either lid

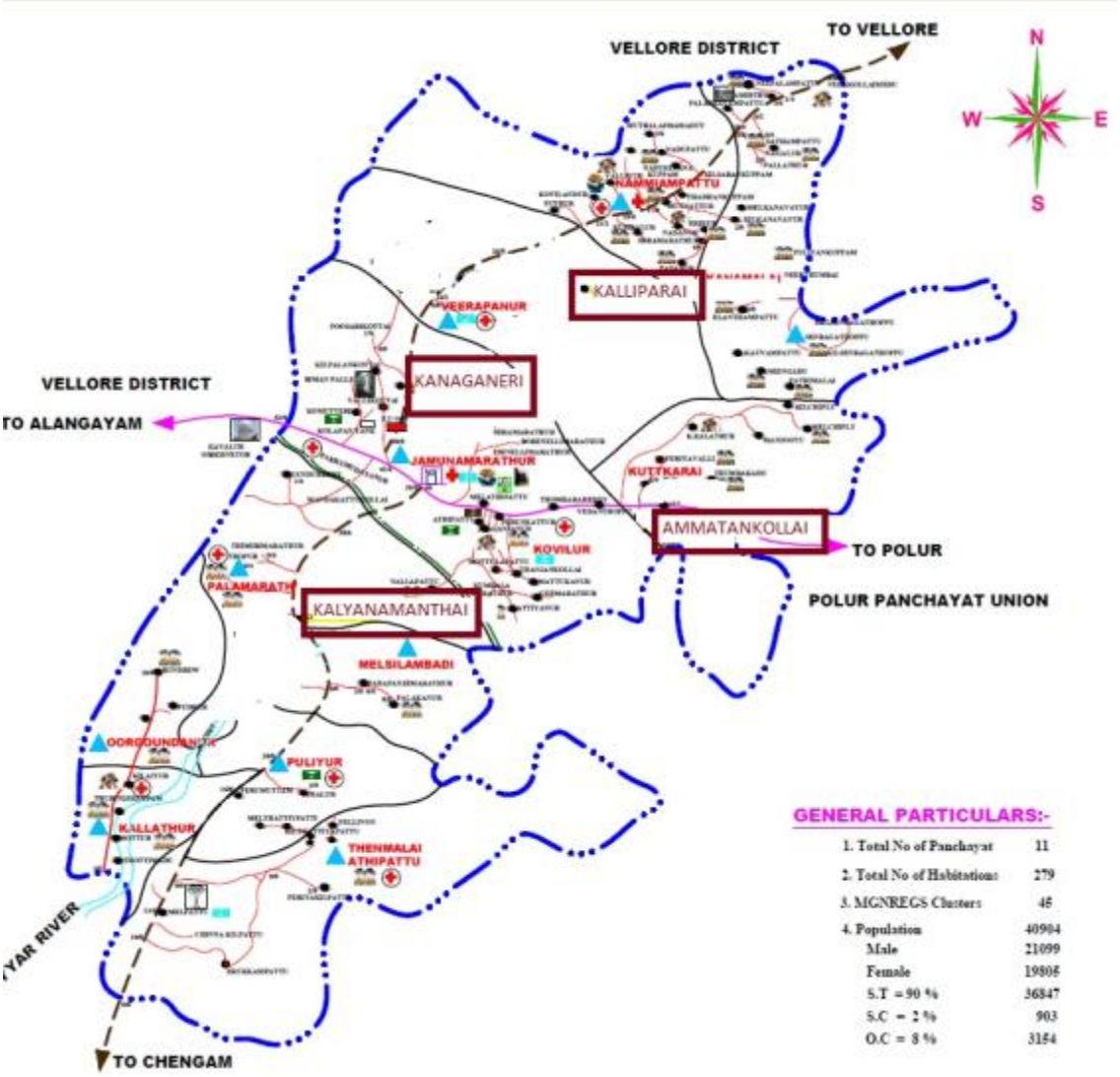
Institutional Review Board Clearance:

The study was cleared by the institutional ethics and research committee of the Christian Medical College (CMC), Vellore. Ref no: **IRB Min No: 8729 dated 06.03.2014**

Sampling technique:

All the villages were listed, alongside was listed the population of the village. The third column had the running cumulative population, the total of which was the total number of individuals in all 40 villages. From previous census this was roughly 1, 50,000 individuals. The 'Probability Proportional to Size' (PPS) model was then used to select the four villages (clusters) to yield the required number of children below the age of 15 years.

Survey:



The four villages selected were Ammatankollai, Kalyanamanthai, Kalliparai and Kanaganeri as marked in the map. The duration of the survey was 3 months. The first month was spent in standardising the optometrist trainees to senior optometrist in Department of Ophthalmology, Schell eye hospital, Vellore. The principal investigator held meetings with village heads for getting permissions, identified study clinic sites in

each village, testing the proforma in outpatient department of ophthalmology, Schell eye hospital, for administration of questionnaire. All these activities were done with the help of the Department of Community Medicine and Department of ophthalmology, CMC Vellore. The team performing visual acuity assessment, ophthalmic examination and equipment for the same was with assistance from the Department of Ophthalmology, CMC Vellore. The study clinics were held in March 2014 and the field visits over April and May 2014.

Place:

The study was carried out at predetermined examination sites in the selected villages which included primary school premises and Balwadis. In one village (Kalliparai), since there was no school or balwadi, we planned to conduct the study in the neighbouring village (primary school). But on the day of study, since none of the parents reported, the team had to go directly to the concerned village and examination was done in village head's house. In another village (Kalyanamanthai), the team had to go to high school in the neighbouring village for screening the children, as they were giving their annual examination and not able to come to balwadi (actual study site). Referred patients were asked to come to the Department of Ophthalmology, Schell Campus for the evaluation / treatment.

Pilot study:

It was done in a village (Jawadhi hills) among the school children (120 children), not included in the final study to evaluate planned process of validation of questionnaire, identification of morbidity, and field testing of instruments. Lessons learnt from the pilot study were incorporated in the final study.

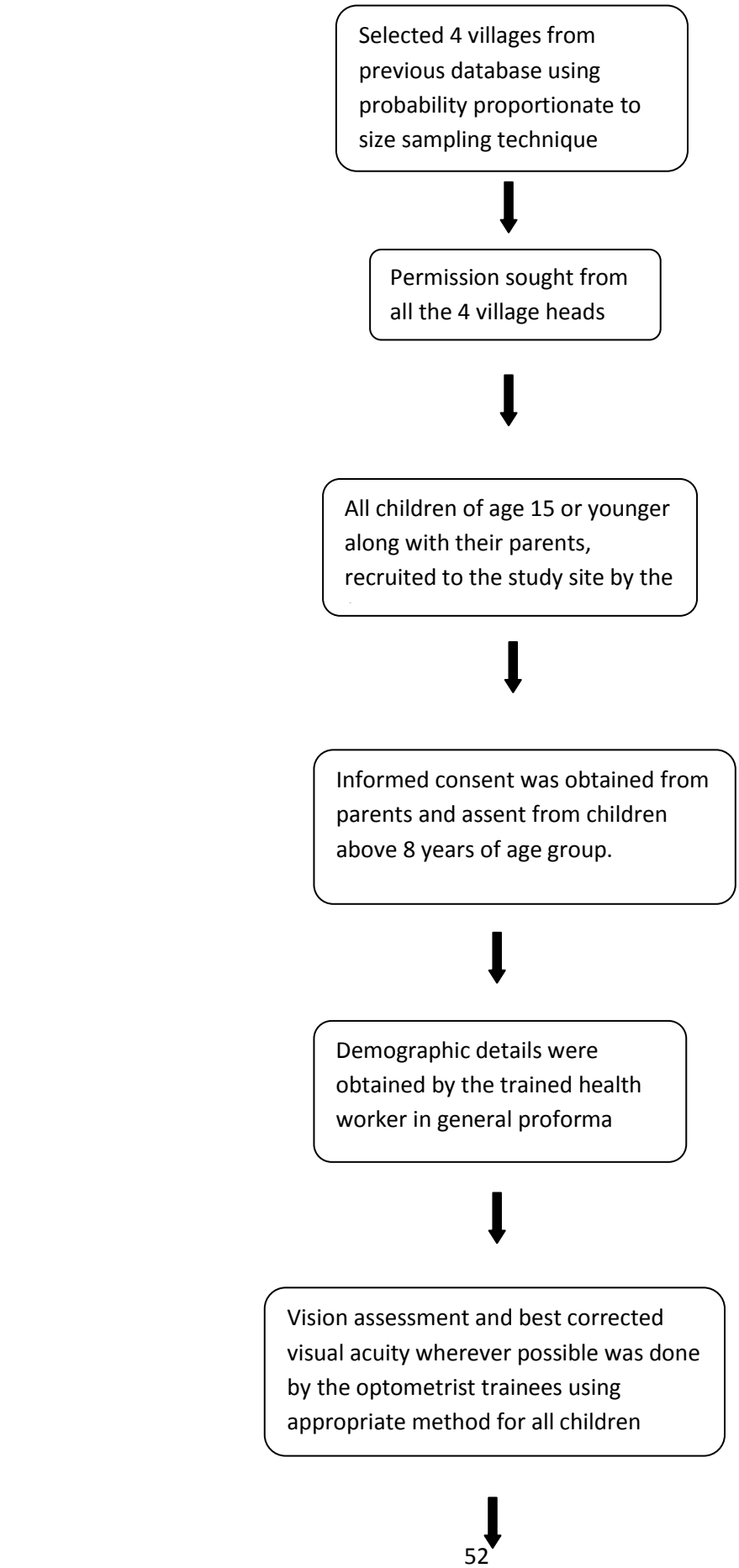
Project team:

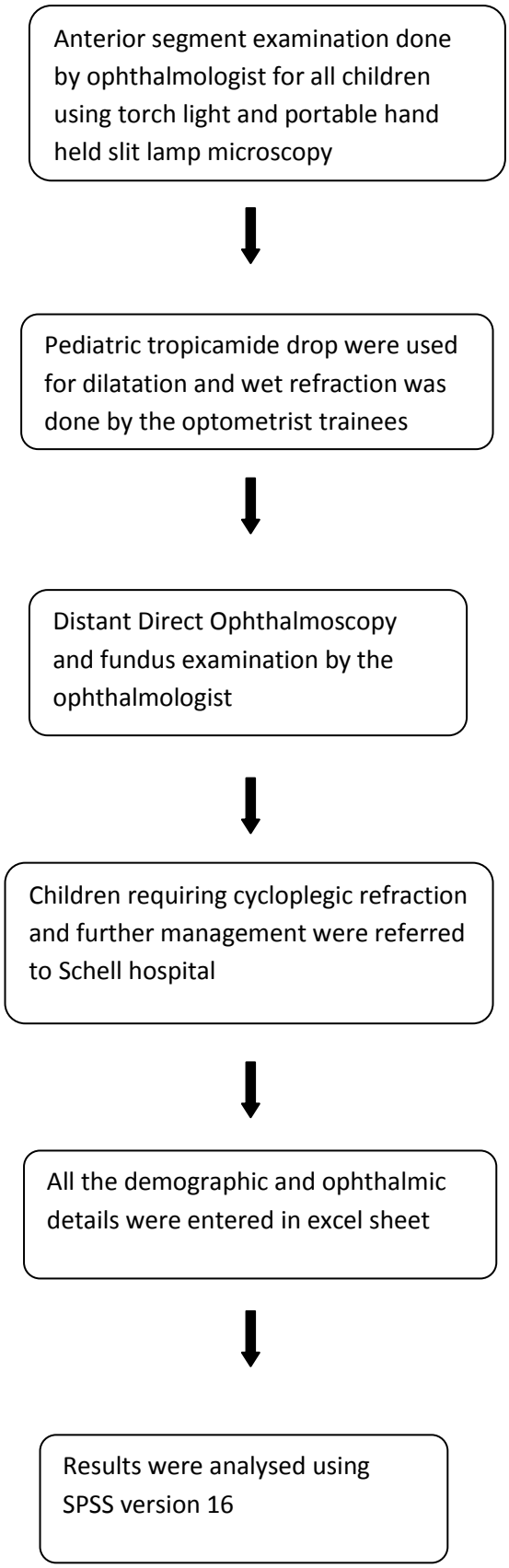
The team comprised of the **field worker** who organised the villagers and their children, one dedicated **trained health worker**, who administered the questionnaire, three **optometrist trainees,** who performed vision assessment including wet refraction and the **ophthalmologist** (the principal investigator) who performed the ophthalmic examination.

Training:

The three optometrist trainees were asked to assess vision in 30 children (< 2 years) individually and their methods were compared to a senior optometrist, who had trained them before commencing the field work.

Survey Flow Chart:




Anterior segment examination done by ophthalmologist for all children using torch light and portable hand held slit lamp microscopy
Pediatric tropicamide drop were used for dilatation and wet refraction was done by the optometrist trainees
Distant Direct Ophthalmoscopy and fundus examination by the ophthalmologist
Children requiring cycloplegic refraction and further management were referred to Schell hospital
All the demographic and ophthalmic details were entered in excel sheet
Results were analysed using SPSS version 16

Identification of study subjects:

The information of the population was sought from the previous study done by the Community health department, CMC Vellore. Before the commencement of the study the principal investigator visited each village individually and sought permission from the village heads – 'ooran' for conducting the study at the said villages. The intended process of examination was clearly explained and a verbal consent was obtained. The parents were informed ahead of study period to bring their wards for the eye examination and also about study protocol. Permission was sought from the school/balwadi principal/head to conduct the study in their premises and also to exempt the children for a said amount of time that was needed for the examination. On a convenient pre-determined date the team reached the village's priory and set up their equipment at local primary school / Balwadi which served as the centre for examining the children. A list of all the families residing in the four villages was printed out and given to the respective village field workers, who visited each eligible individual on the list from house to house and invited them to the study site.

Procedure for questionnaires:

On the day of the study, the field worker recruited eligible children, who came to the survey site (Photo 3) with their parents. The trained health worker provided the information sheet to the parents as in Appendix B and consent was obtained (Photo 2) from them after explaining the full procedure as in Appendix B. The parents were informed of the after effects of dilating drops and no parents objected. Assent was obtained in all children above 8 years of age group as in Appendix B. The trained health worker administered all the questionnaires. Appendix C comprised the general proforma and Appendix D had ophthalmological proforma, which was administered to

all study patients. The child's information was entered in a register for future study references and a dedicated study number was assigned for each child at this stage. The parent / guardian were then interviewed by the trained health worker and the child's demographic data was collected. Socio economic status of the respective family was obtained from database in Department of Community medicine, CMC Vellore. A detailed history of both the child and the family including developmental and ocular history was then recorded by the ophthalmologist.

Procedure for Visual Acuity assessment:

The team consisting of 3 optometrist trainees were involved in assessing the vision and performing refraction for children. (Photo 4) Each child was first tested for visual acuity by the trainees using technique suitable for the age, depending on child being verbal or non-verbal. The methods employed were Flash light method, Cardiff cards and Snellen charts depending on the appropriate age group. Best corrected visual acuity in verbal children was done when possible.

Age group	**Vision assessment method**
0-1 year	Flash light*
>1 year – 5 years	Cardiff cards+
> 5 years	Snellen chart

*Correlation of Fixation pattern with Visual Acuity

Visual Acuity	Fixation pattern
5/60	Gross eccentric fixation or affixation
6/60	Unsteady central fixation
6/24-6/60	Central steady fixation, but will not hold fixation when cover is removed
6/9-6/18	Central steady fixation will hold with deviating eye but prefers fixation with the other eye
6/6	Alternates spontaneously, holds well with both eyes, cross fixation, homonymous fixation.

+ At ½ and 1 meter distance and converted to Snellen equivalent

Procedures comprising ophthalmic examination:

The child was subjected to routine anterior segment eye examination by the ophthalmologist using flash light examination (LED torch light) and the hand held slit lamp. Following this the child's pupil was dilated using paediatric tropicamide (0.4%) dilating drops and the child was made to wait for half an hour for the medication to take action. Once pupil was dilated, posterior segment was examined using indirect ophthalmoscopy with 20D lens. (Photo 5)

Instrumentation for ophthalmic examination

Anterior Segment Examination	Portable hand held slit lamp microscopy (Heine HSL 150)
Distant Direct Ophthalmoscopy	Direct ophthalmoscope (Heine) B200
Posterior examination	Indirect ophthalmoscope (Appasamy-AAIO-7)

The participant received a free vision check as a result of participation, a free eye examination and if necessary free examination at the eye hospital for further evaluation or management if a treatable condition was detected. Some basic eye drops were given free of cost for minor complaints.

Statistical methods

Sample size:

Large multi-staged population based studies found a low prevalence of ocular morbidity ranging from 1.3% to 2.8% and school based studies found prevalence of 13% to 44.7%. In our study, the ophthalmologist examined all the children whether or not they had impairment of vision. These children belonged to the tribal population which is suspected to have a higher morbidity rate. So, we have assumed a prevalence of 20% which is between the two values from different study designs.

N = **$4pq/d^2$**

p - Prevalence (from previous study)

q - 100 – p

d - Allowable error (25 % of p)

$4pq / d^2 = (4 \times 20 \times 80)/5x5 = 240$

Sample size=240 children; 15 years and below. Since it is a migratory population we included 30% more to get at least 240.

Statistical analysis

Primary outcomes:

- Prevalence of ocular morbidity (including both anterior and posterior segment pathology) with 95% confidence interval

Secondary outcomes:

- Prevalence of children with Vitamin A deficiency with 95% confidence interval
- Prevalence of children with visual acuity below 6/18 (low vision / blind)
- Prevalence of children with refractive errors with 95% confidence interval

Other outcomes:

- Percentage of children with amblyopia
- Percentage of children who need referral for surgery/occlusion/ spectacles
- Number need to screen to detect one child with uncorrected visual acuity < 6/18
- Proportion of children screened who had been also screened by the school eye screening program in the appropriate agegroup

Exposure variables:

- Socio economic status
- Highest education in parent
- Migration status
- Number of siblings
- Birth order
- Breast feeding history

Data Sources/measurement:

- Identification of individuals 15 years and younger: Database from Community health department, CMC Vellore
- Demographic details: general proforma as in Appendix C

- Visual Acuity and Refractive Error assessment: Ophthalmology proforma as in Appendix D
- Ophthalmic examination: Ophthalmology proforma as in Appendix D

Socio Economic Status determination: From the database of the previous study in CHAD. (28)

Analysis:

Frequencies of all the categorical variables were determined and for continuous variables mean and standard deviation were calculated.

We used Logistic Regression to assess the association of age of child, literacy of parent, SES, gender, birth order, breastfeed, previous eye examination with ocular morbidity and vitamin A deficiency

Statistical Analyses was done using SPSS version 16.0.

RESULTS

RESULTS:

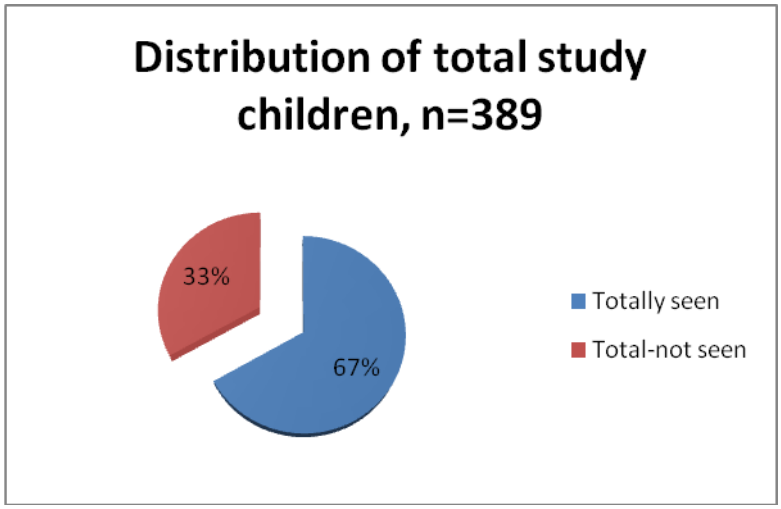
Our study was conducted on children aged 15 years or younger, belonging to 4 different villages in Jawadhi hills during the months of April and May 2014. These 4 villages had a total population of 1,105 including 322 children (29.14%) aged 15 years or younger as per the database. Of these 322, we screened 193 children (54.52%). We also saw 67 children who were not in the data base, but were permanent residents of these villages. Therefore, of the total of 389 children we were able to screen 260, making the coverage 66.84% (Table 1). The remaining 129 (33.16%) children could not be screened, as 81 (20%) had temporarily migrated out of the region during the period of the survey (were in hostels / out of station) and 48 (12%) were not willing to participate in the study.

A. DEMOGRAPHY, BIRTH & DEVELOPMENTAL HISTORY, CO-MORBIDITIES

TABLE 1: Number of Children Examined In the Study fromthe Four Selected Villages

Villages	**From the database**		**Newly seen, n (%)**	**Totally seen, n (%)**	**Total, N***
	Total, n	**Seen, n (%)**			
Ammatankollai	84	77(91.67)	0	77(91.67)	84
Kalyanamanthai	107	65(60.75)	32(32.99)	97(69.78)	139
Kalliparai	69	21(30.43)	21(50.0)	42(51.21)	82
Kanaganeri	62	32(51.61)	13(28.89)	45(53.57)	84
TOTAL	322	193(59.94)	67(25.77)	260(66.84)	389

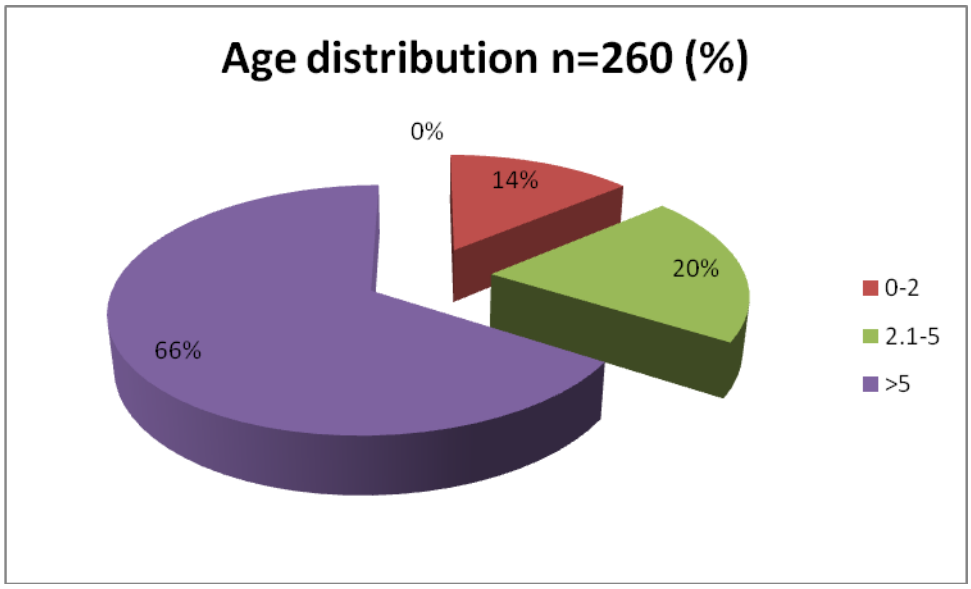
***** Total children (database + newly seen)



Children in the age group < 1 month to 15 years were examined. The mean age of our sample was 7.5 years (standard deviation (SD) 4.07 years). Most of the children were in the age group > 5years (66.0%) as shown in Table 2.

TABLE 2: Age Distribution of Children Examined In the Study

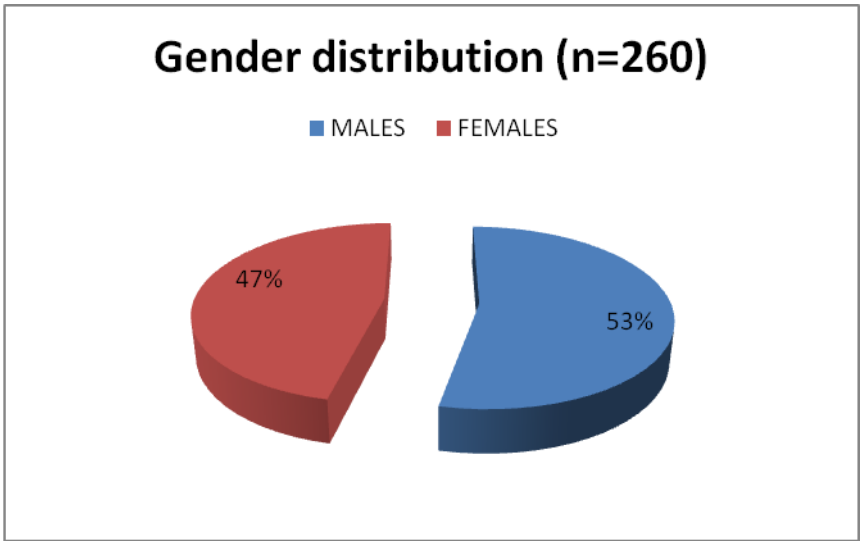
Age in years	**Number of children, n (%)**		**TOTAL n (%)**
	Males	**Females**	
0-2	17 (47.23)	19 (52.77)	36(13.9)
2.1-5	30 (57.7)	22 (42.3)	52(20.1)
>5	92 (53.5)	80 (46.5)	172(66.0)
Total, n	139 (53.5)	121(46.5)	260(100)



Out of 260 children 139 (53.5%) were boys and 121 (46.5%) were girls, as shown in Table 3.

Table 3: Gender distribution of the study population

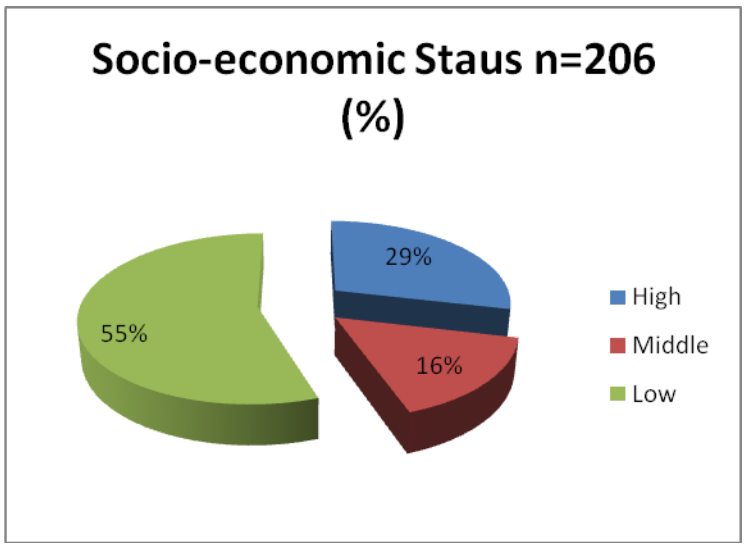
GENDER	TOTAL	PERCENTAGE
MALES	139	53.5
FEMALES	121	46.5
TOTAL	260	100



Socio-economic status of 206 families were only available in database, of which 114(55.3%) were in low socio-economic status. (Table 4)

Table 4: Socio-Economical Status of the Family of the Child

Socioeconomic status	**Total, n (%)**
High	59(28.6)
Middle	33(16.0)
Low	114(55.3)
TOTAL	206(100)

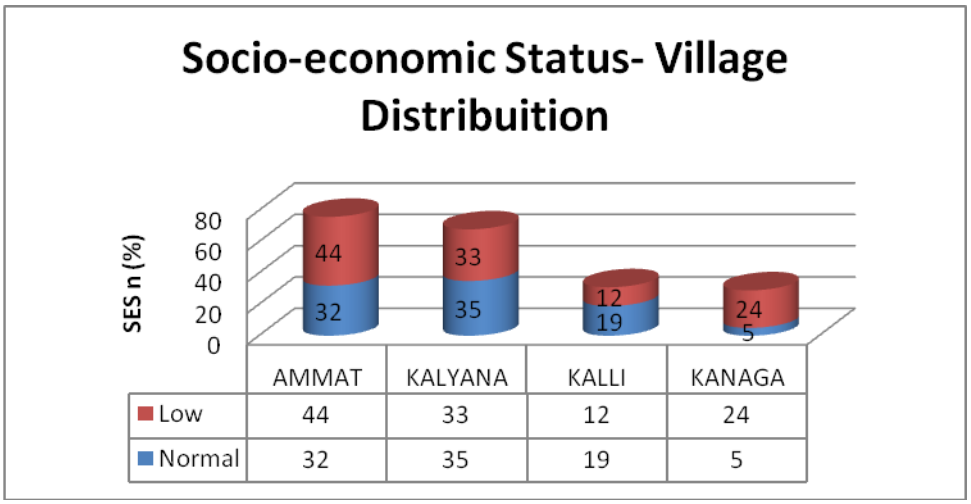


Out of 260 children, only 206 children's family socioeconomic status was available from our database. Most of the families belong to the lower socio-economic groups (55.4%) in all 4 villages, which was statistically significant [chi-square test, value= 13.7, (p=0.003)].

Table 5: Socioeconomic Status – Village Distribution

VILLAGES	Socio-Economic Status		Total
	Normal*	LOW	
AMMATANKOLLAI	32	44	76
KALYANAMANTHAI	35	33	68
KALLIPARAI	19	12	31
KANAGANERI	5	24	29
TOTAL, n (%)	91	113	204(100)

Normal* - high + middle



There was no statistically difference between the two groups (seen and unseen) in terms of age distribution (chi-square value=0.03, p=0.87), gender (chi-square value=0.04, p=0.84) or socio-economic status (chi-square value=0.64, p=0.42). (Table 6)

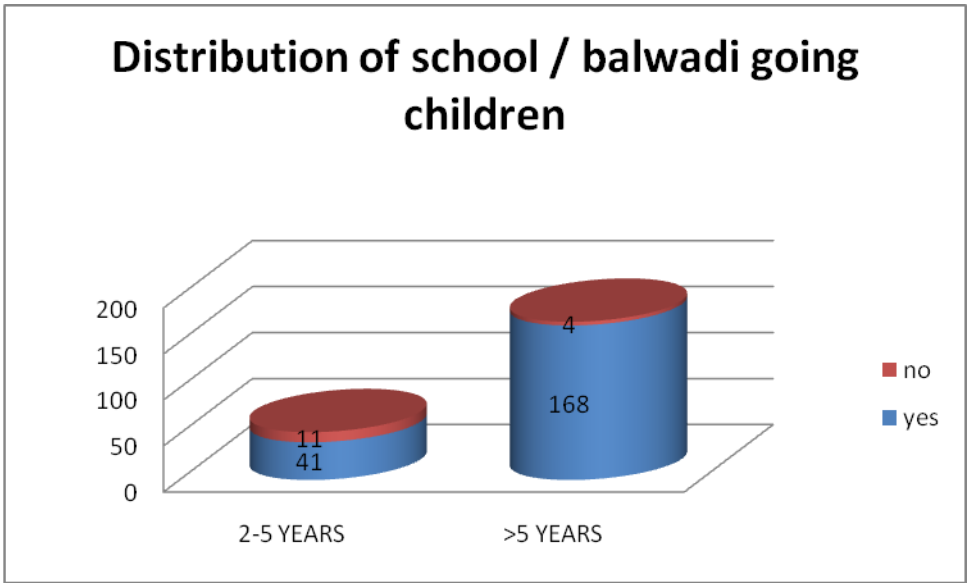
Table 6: Distribution of total children*

Total children*, n	Age groups in years		Gender		SES	
	<5	>5	Males	Females	Normal	Low
Seen	54	139	107	86	92	114
Not seen	35	94	73	56	21	95
Total , n	89	233	180	142	113	209

Out of 52 children in the pre-school age group 41(79%) were going to balwadi. Out of 172 children in the school going age group 4 (2.33%) were not going to school, as shown in table 7.

Table 7: Distribution of school / balwadi going children

AGE	SCHOOL/ BALWADI n, (%)		Total, n
	Yes	No	
2-5 YEARS	41(79)	11(21)	52
>5 YEARS	168(97.67)	4(2.33)	172
Total , n	209	15	224



Mostly mothers (61.2%) accompanied their ward to the study site to give consent, demographic and ocular history (Table 8). 63.5% of either one of the parent was literate (table 9).

Table 8: Distribution of the informant who accompanied the child during the study

Informants	Total, n (%)
Father	63(24.2)
Mother	159(61.2)
Grandparents	18(6.9)
Others	20(7.7)
Total	260(100)

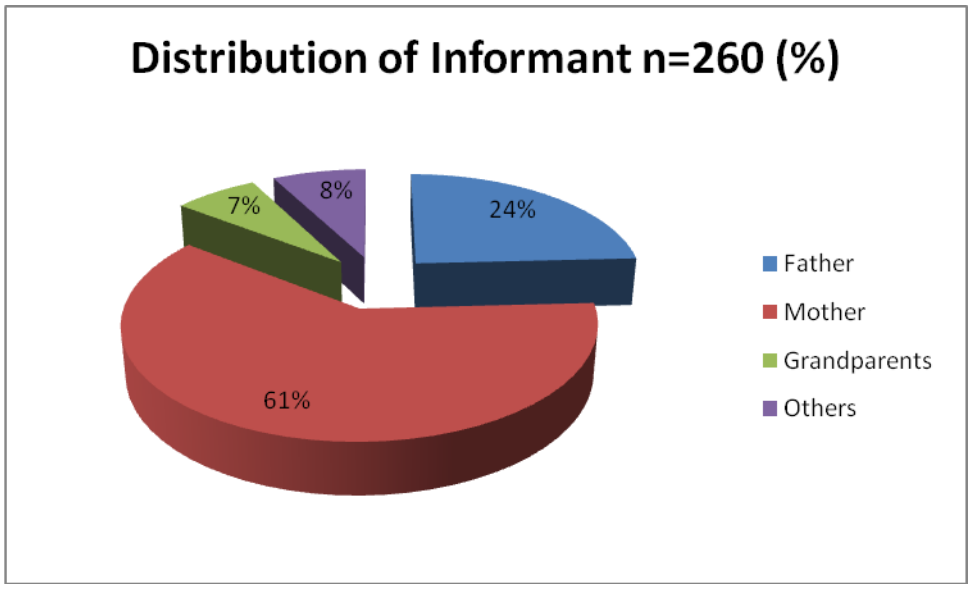
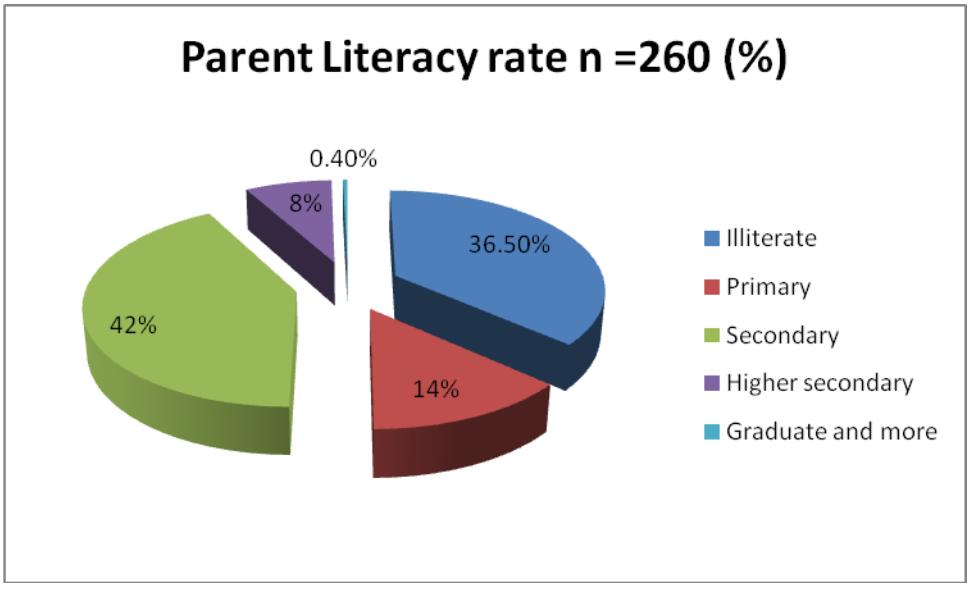


TABLE 9: Distribution of Parent Literacy

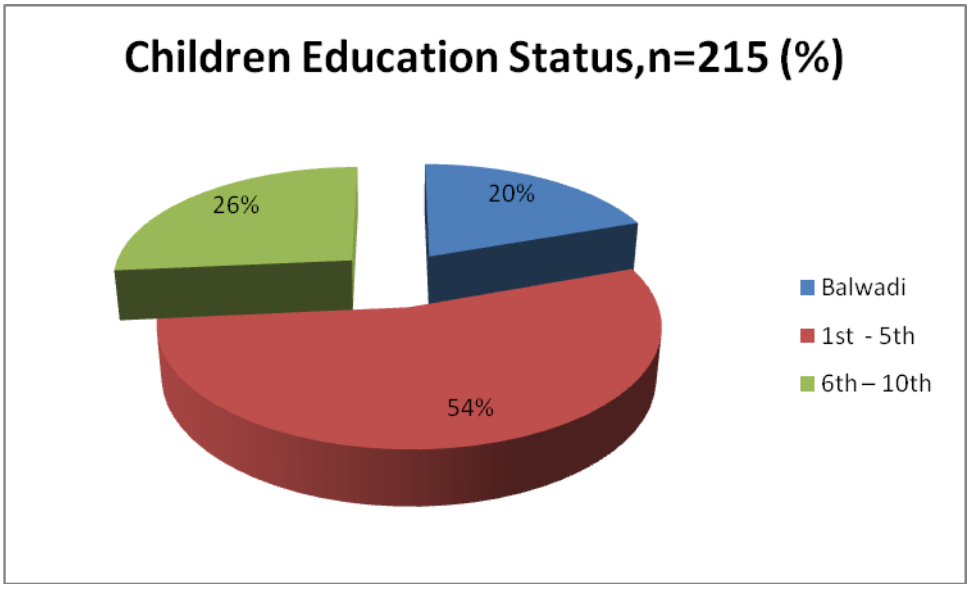
Parents literacy	Total, n (%)
Illiterate	95(36.5)
Primary	35(13.5)
Secondary	109(41.9)
Higher secondary	20(7.7)
Graduate and more	1(0.4)
TOTAL	**260(100)**



Out of 260 children, 42 children (16.2%) were going to balwadi and 173 children (66.5%) were going to school. (Table 10)

Table 10: Distribution of The Child's Education Status at the Time of the Examination

Education	Total, n (%)
Balwadi	42(16.2)
1^{st} - 5^{th}	116(44.6)
6^{th} – 10^{th}	57(21.9)
Total	215(82.7)



About 68.5% of children were of birth order of 1 or 2 (Table 11) and 68% of families had 3 or less children (Table 12).

Table 11: Birth order of the child in the family

Birth order	Total, n (%)
1^{st} -2^{nd}	178(68.5)
3^{rd} -6^{th}	82(31.5)
TOTAL	260(100)

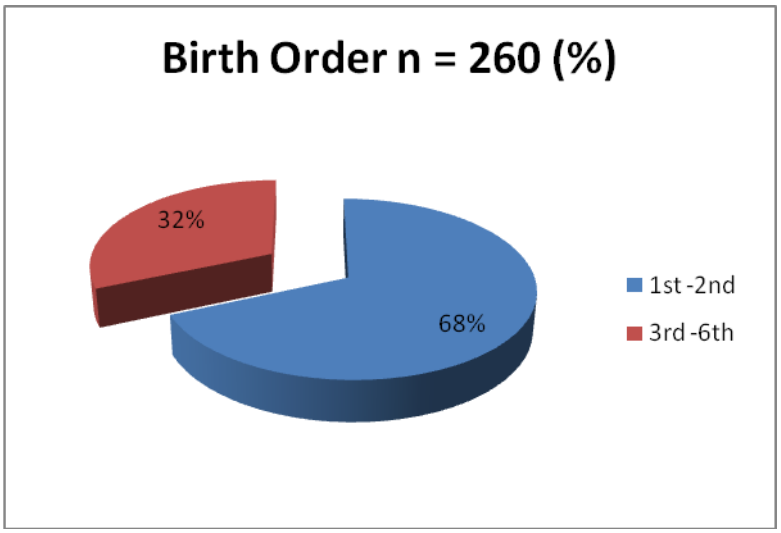
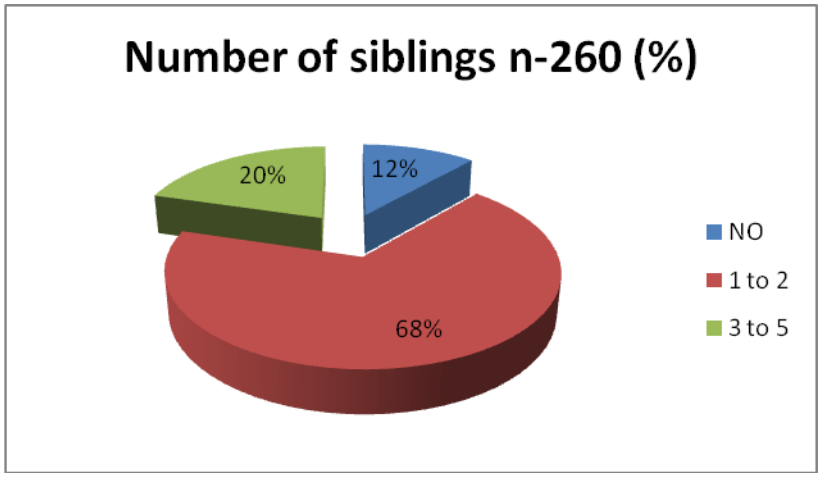


Table 12: Distribution of siblings.

Number of siblings	Total, n (%)
NO	30(11.5)
1 -2	177(68.1)
3-5	53(20.4)
Total	260(100)



Deliveries were mostly conducted at home, n= 229 (88%) and only 12 % (n=31) of deliveries were in hospitals (Table 13). 15% (n=5) of deliveries conducted in hospitals were by caesarean section (Table 14)

Table 13: Distribution of the nature of delivery of the child

Delivery	Total, n (%)
Home	229(88.1)
Hospital	31(11.9)
TOTAL	260(100)

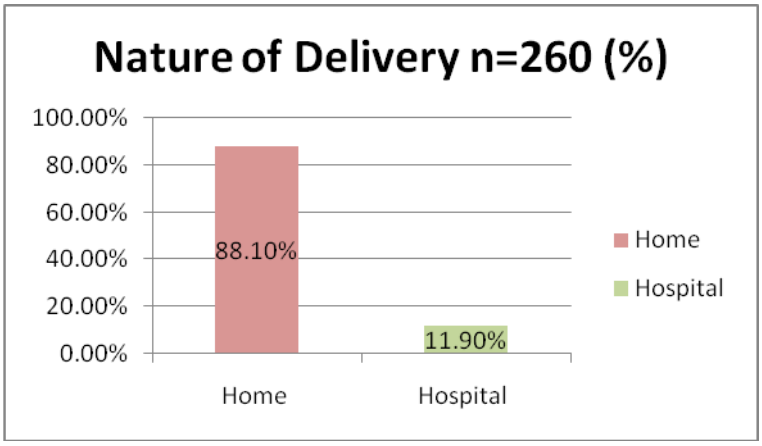
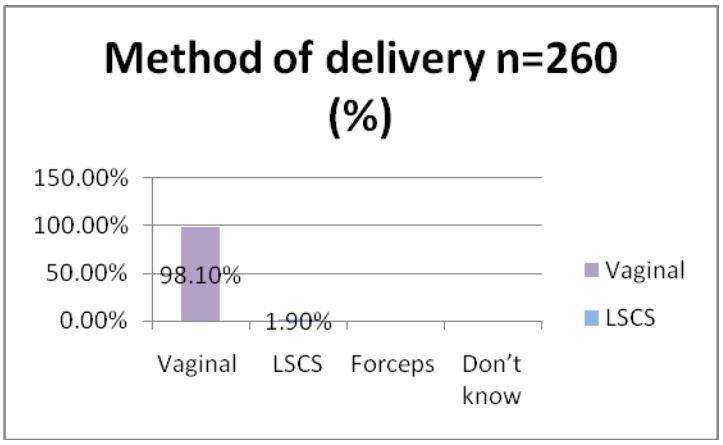


Table 14: Distribution of the Method of Delivery of the Child

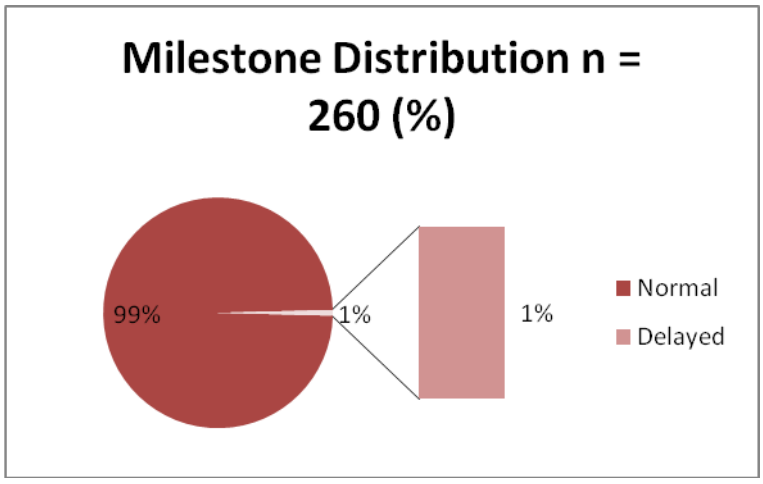
Method of delivery	Total, n (%)
Vaginal	255(98.1)
LSCS	5(1.9)
Forceps	0
Don't know	0
TOTAL	260(100)



Most of the children, 99% (n=258) in the study group reported normal developmental milestones (Table 15)

Table 15: Distribution of the child's milestones

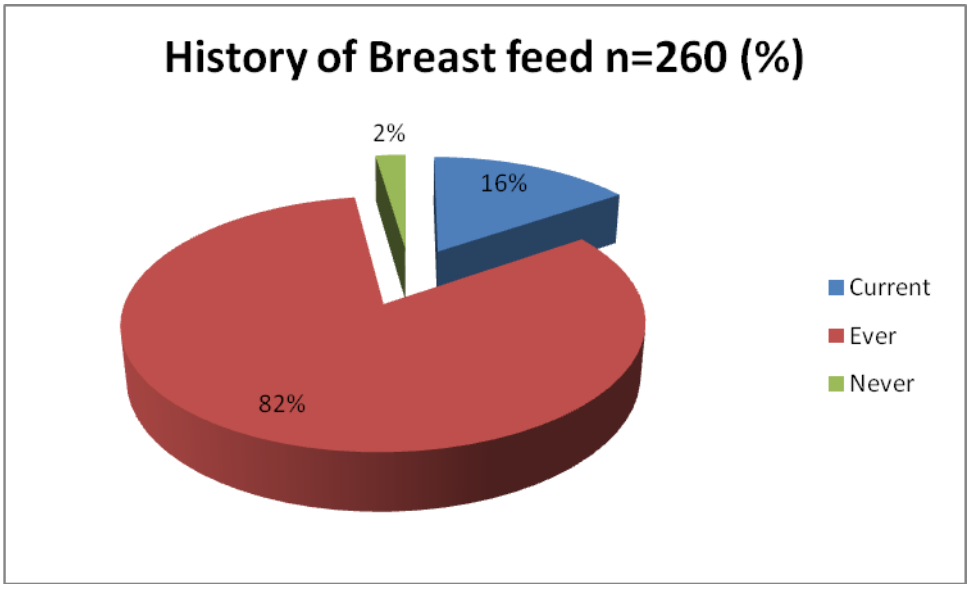
MILESTONES	**Total, n (%)**
Normal	258(99.2)
Delayed	2(0.8)
TOTAL	260(100)



Only 2.3% (n=6) of children were not breastfed and most of the children (45%) were breastfed for minimum of 2 years. Immunisation cards were found to be kept at the respective primary health canters. Most (98.5%) parents had no knowledge about vitamin A immunisation (Table 16)

Table 16: Distribution of child's breastfeeding history

Breast feed	Total, n (%)
Current	40(15.4)
Ever	214(82.3)
Never	6(2.3)
TOTAL	260(100)



Seven children of the total study population had co-morbidities like deafness (1), skin disease (2), hydrocephalus(1), liver disease(1), pyrexia of unknown origin(1) and intracranial space occupying lesion (1) (Table 17)

Table 17: Distribution of co-morbidities

Co-morbidities	**Total, n (%)**
Deafness	1(0.4)
Skin disease	2(0.8)
Thalassemia	1(0.4)
Hydrocephalus	1(0.4)
Liver disease	1(0.4)
Neurocysticercosis	1(0.4)
No co-morbidities	253(97.2)
Total	260(100)

Out of 11 children who were referred to Schell eye hospital for further management, only 2(18%) children came for assessment (Table 18)

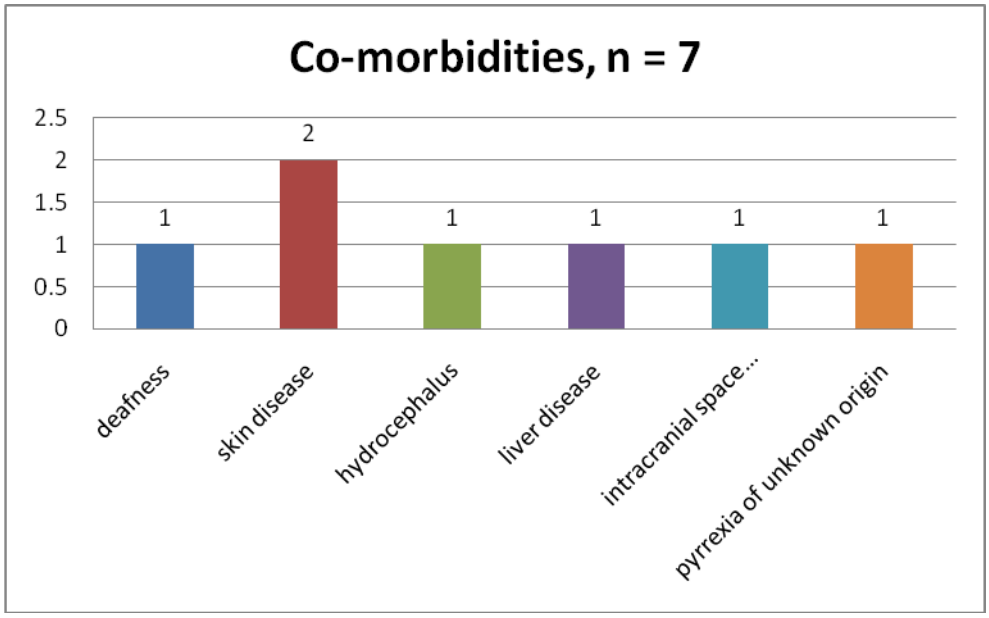
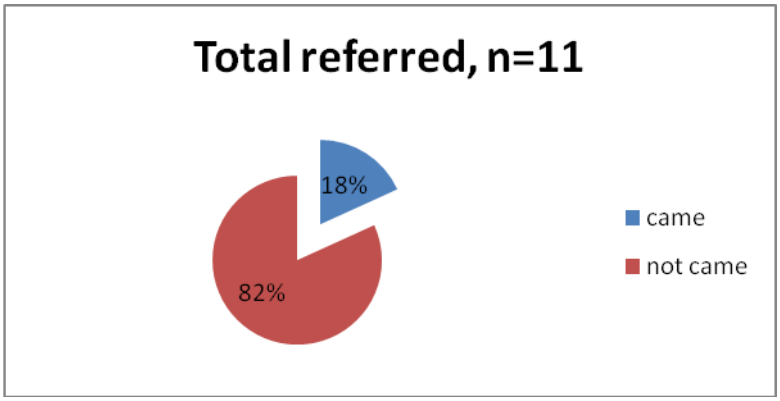


Table 18: Distribution of referred



B. OCULAR HISTORY

An ocular history of trauma was elicited in 3 children and another 3 children had watering. 1 child had complaints of defective vision, 1 child had redness and 1 child had discolouration of eyes(Table 19)

Table 19: Distribution of presenting ocular complaints

Ocular history	Total, n (%)
Trauma	3(1.2)
Defective vision	1(0.4)
Redness	1(0.4)
Watering	3(1.2)
Discolouration	1(0.4)
No complaints	251(96.4)
TOTAL	260(100)

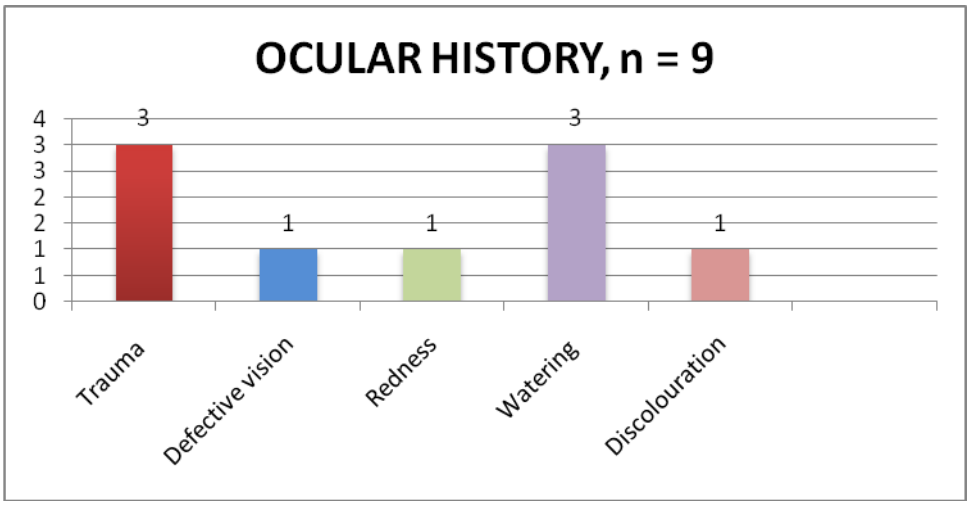
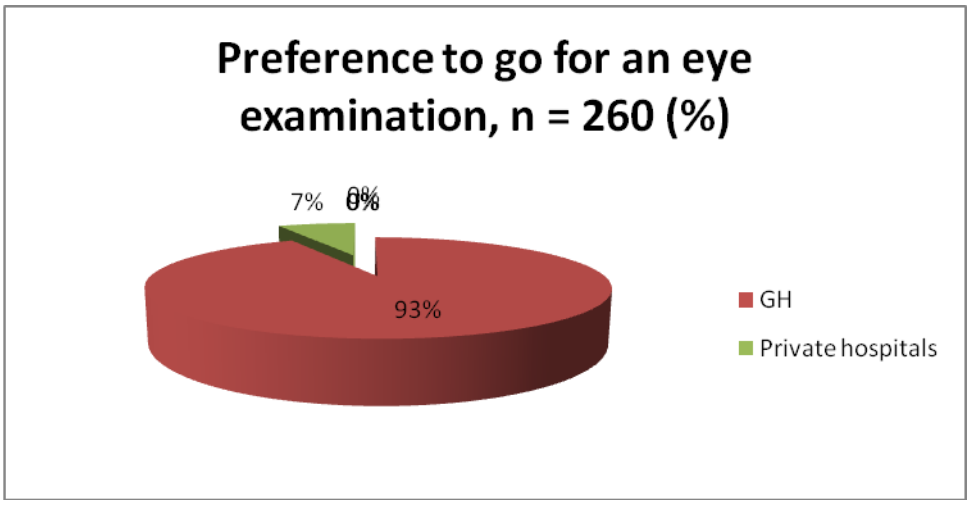


Table 20: Distribution of the Preference of hospital for previous eye examinations

Preference to go for an eye examination	Total, n (%)
GH	241(92.7)
Private hospitals	19(7.3)
Quacks	0
Private practitioner	0
Total	260(100)

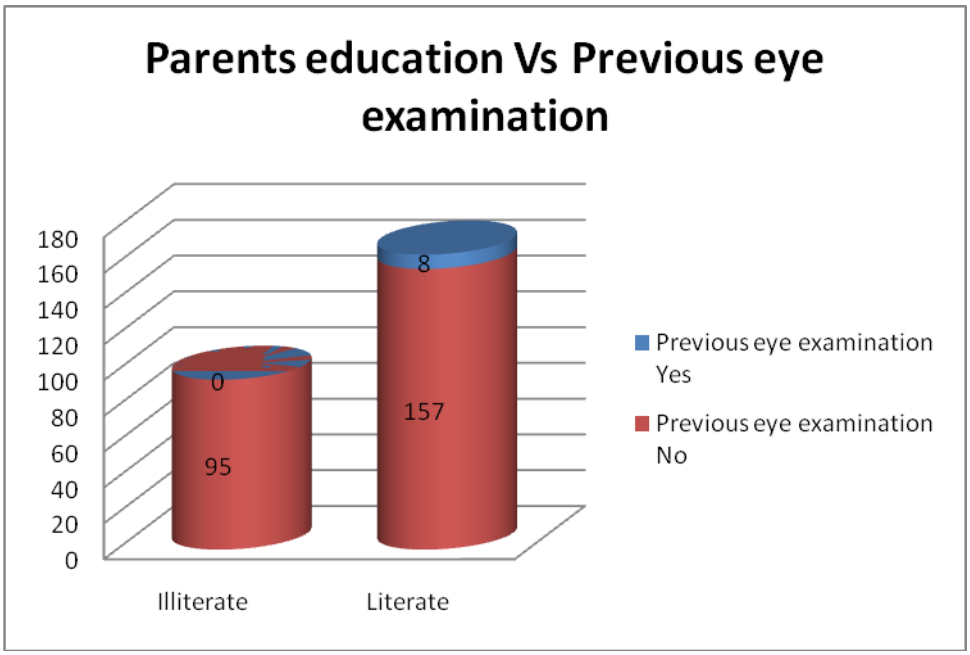


Looking at highest educational status among parents of 260 children, 95 (36.5%) were illiterate. Of 95 illiterate parents none of them had ever taken their ward for an eye examination previously. This association between parents education and

previous eye examination was found to be statistically significant [Chi square test value= 4.75, (p=0.03)].

Table 21:Association of Parents educational status and previous eye examination

Parents education	Previous eye examination, n (%)		Total, n (%)
	Yes	No	
Illiterate	0(0)	95(37.7)	95(36.5)
Literate	8(100)	157(62.3)	165(63.5)
Total	8(100)	252(100)	260(100)



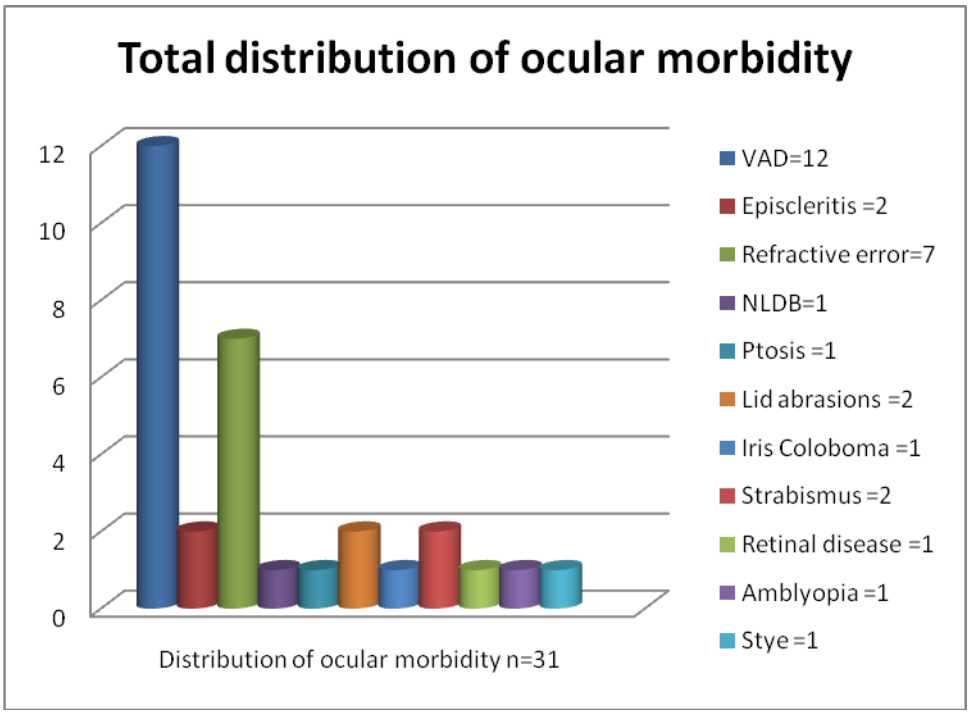
C.OCULAR MORBIDITY

In the 260 children studied, 28 children had ocular morbidity, making the prevalence 10.8% (95% CI 6.3 to 13.7%)

Vitamin A deficiency was the most common cause (25%), followed by refractive error (21.43%), episcleritis (7.14%), lid injuries (7.14%), strabismus (7.14%) and retinitis pigmentosa (3.57%). 3 (10.71%) children had more than 1 ocular morbidity.

Table 22: Distribution of Ocular morbidity

Ocular morbidity	**TOTAL, n (%)**
VAD	12(4.6)
Episcleritis	2(0.8)
Refractive error	7(2.3)
NLDB	1(0.4)
Ptosis	1(0.4)
Lid abrasions	2(0.8)
Iris Coloboma	1(0.4)
Strabismus	2(0.8)
Retinal disease	1(0.4)
Amblyopia	1(0.4)
Stye	1(0.4)
No morbidity	232(89.2)
TOTAL	263



In the 28 children who had ocular morbidity, 3 (10.71%) children had presenting vision < 6/18. Among the 3 children, one (3.57%) had presenting vision < 6/60 (blind according to Indian standards) from refractive error.

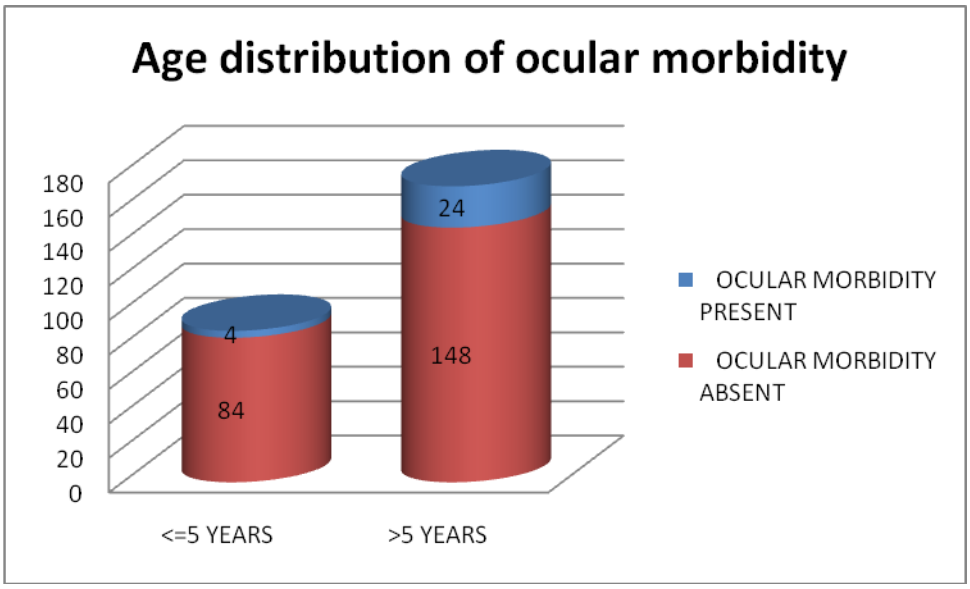
Table 23: Uncorrected visual acuity among patients with ocular morbidity

Ocular morbidity	UCVA			TOTAL, n
	GOOD	FAIR	POOR	
VAD	12	0	0	12
Episcleritis	2	0	0	2
Refractive error	5	1	1	7
NLDB	1	0	0	1
Ptosis	1	0	0	1
Lid abrasions	2	0	0	2
Iris Coloboma	1	0	0	1
Strabismus	0	2	0	2
Retinitis pigmentosa	1	0	0	1
Amblyopia	0	1	0	1
Stye	1	0	0	1
TOTAL	26	4	1	31

Out of 28 children with ocular morbidity, 24 were in the age group > 5 years, which was statistically significant [Chi square test value=5.4, (p = 0.02), (95% CI, 1.14-10.15)].

Table 24: Age distribution of ocular morbidity

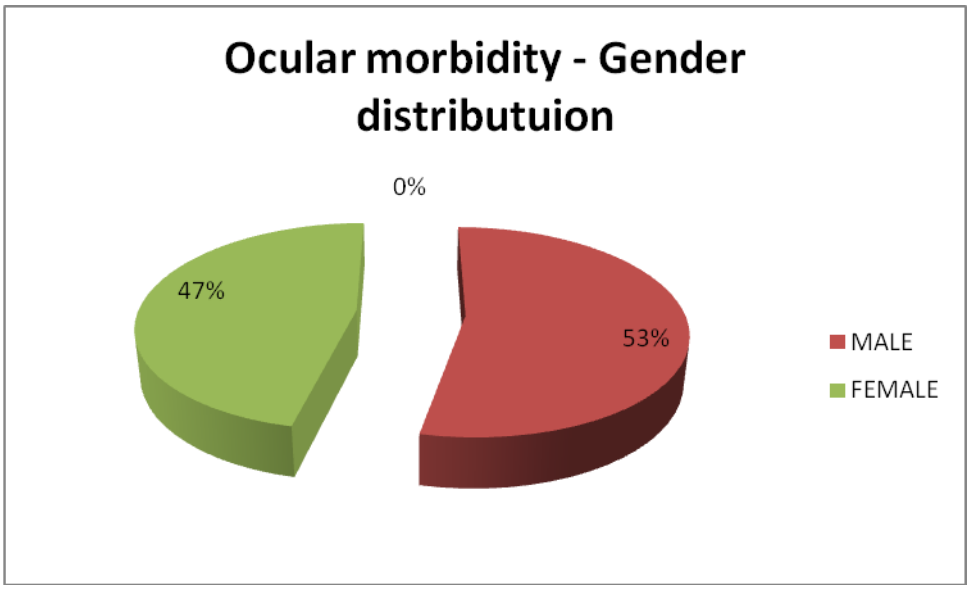
AGE	OCULAR MORBIDITY, n(%)		TOTAL, n(%)
	PRESENT	ABSENT	
<=5 YEARS	4 (14.3)	84 (36.2)	88(33.8)
>5 YEARS	24(85.7)	148(63.8)	172(66.2)
TOTAL	28(100)	232(100)	260(100)



The prevalence of ocular morbidity in the study children were 10.8% (n=28) and 65% were boys with ocular morbidity. The prevalence of ocular morbidity was homogenous with respect to gender [Chi square test value=1.5, (p=0.22)].

Table 25: Gender distribution of ocular morbidity

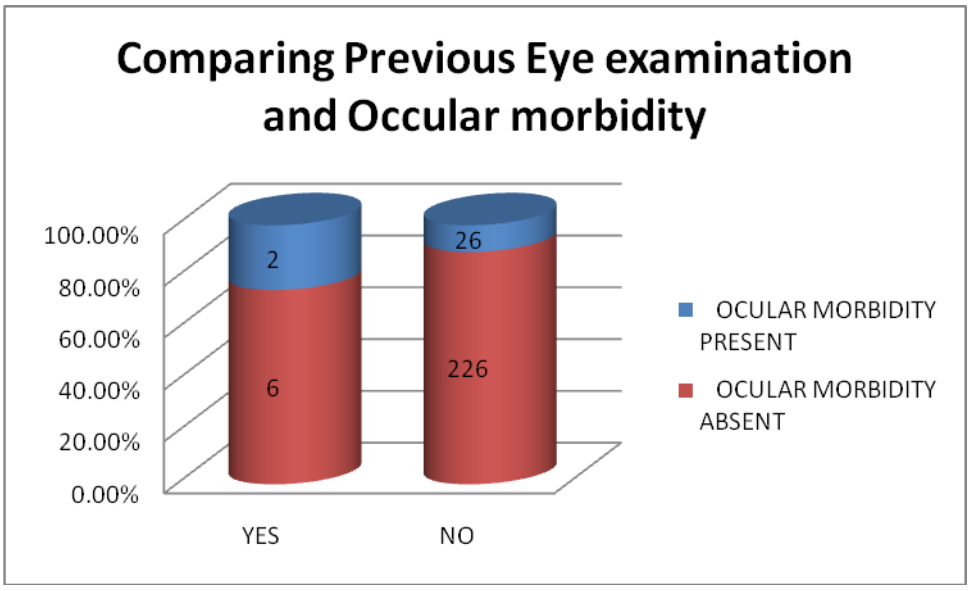
SEX	OCULAR MORBIDITY, n (%)		TOTAL, n (%)
	PRESENT	ABSENT	
MALE	18(64.3)	121(52.2)	139(53.5)
FEMALE	10(35.7)	111(47.8)	121(46.5)
TOTAL	28(100)	232(100)	260(100)



92.85 % (n=26) of children who had ocular morbidity (n=28) had not been subjected to any previous eye examination which was not statistically significant [Chi square test value=1.73, (p=0.21)].

Table 26: History of Previous Eye examination in the children with ocular morbidity

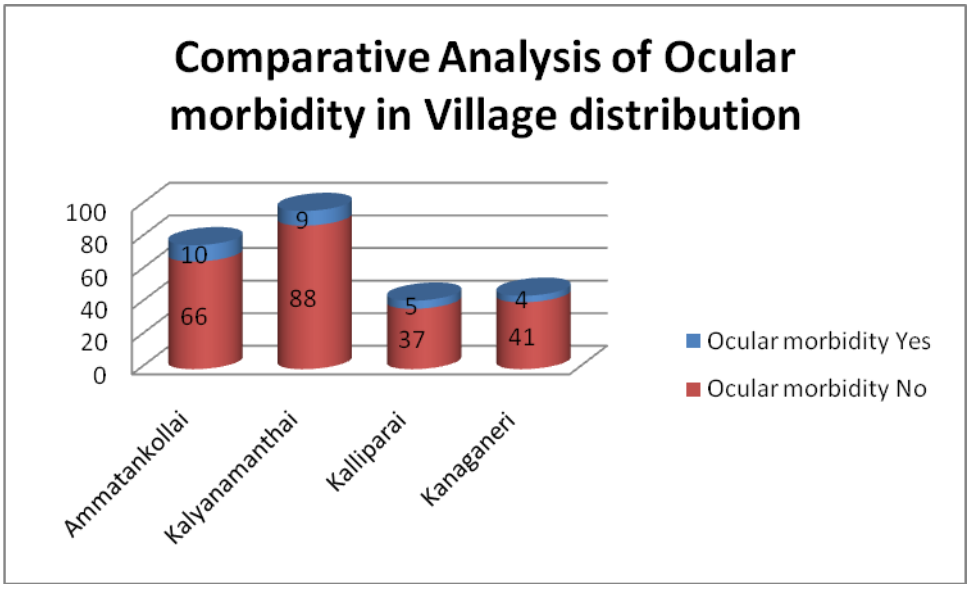
PREVIOUS EYE EXAMINATION	OCULAR MORBIDITY, n (%)		TOTAL, n (%)
	PRESENT	ABSENT	
YES	2(7.1)	6(2.6)	8(3.1)
NO	26(92.9)	226(97.4)	252(96.9)
TOTAL	28(100)	232(100)	260(100)



Out of 28 children with ocular morbidity, 10 (35%) were from Ammatankollai, 9 (32%) from Kalyanamanthai, 5 (18%) from Kalliparai and 4(15%) from Kanaganeri. The villages were homogenous with respect to prevalence of ocular morbidity [Fisher's test value=0.95, (p=0.84)].

Table 27: Distribution of Ocular morbidities in the study village

Village	Ocular morbidity, n (%)		Total, n (%)
	Yes	No	
Ammatankollai	10(35.7)	66(28.4)	76(29.2)
Kalyanamanthai	9(32.1)	88(37.9)	97(37.3)
Kalliparai	5(17.9)	37(15.9)	42(16.2)
Kanaganeri	4(14.3)	41(17.7)	45(17.3)
Total , n	28(100)	232(100)	260(100)



On performing uni-variate logistic regression, age > 5 years alone was found to be a significant risk factor for occurrence of ocular morbidity. Even after adjusting for gender, socio-economic status and parent educational level, children > 5 years had five

times the odds of having ocular morbidity as compared to <5 years. The wide confidence intervals in both the analyses are a reflection of the small sample size. Since the coverage of children from the original database was only 60% we looked at the difference between the demographic features of those seen and not seen.

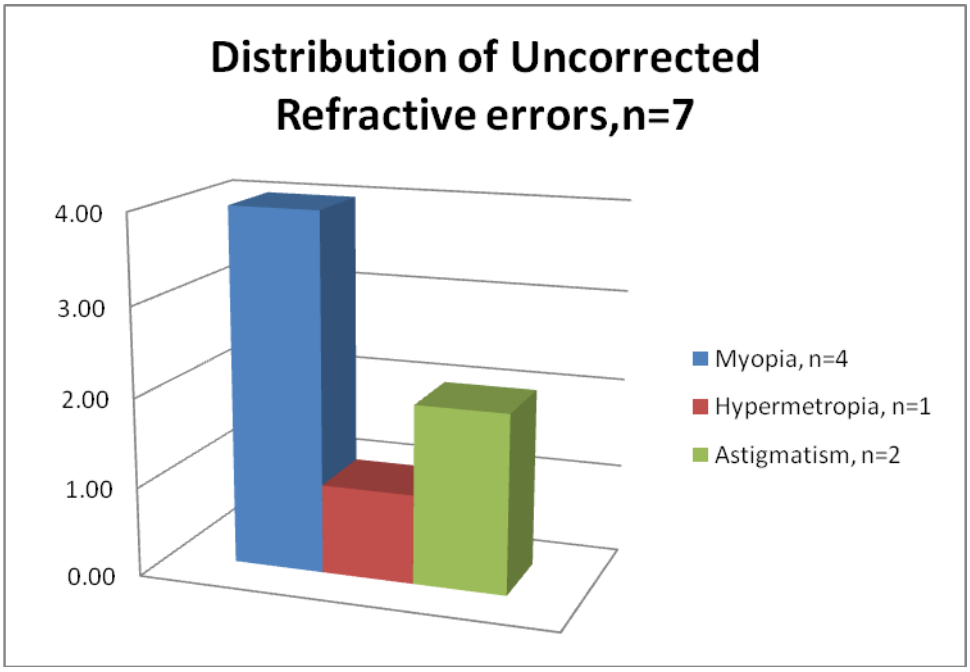
Table 28: Risk Factors for ocular morbidity

Risk Factors	ODDS RATIO CONFIDENCE INTERVAL	ADJUSTED ODDS RATIO CONFIDENCE INTERVAL
AGE <=5 years >5 years	1 3.04 (1.14 - 10.15)	1 5.28 (1.17 - 23.74)
SEX Male Female	1 0.61(0.27 - 1.37)	1 0.46 (0.17 - 1.31)
SES Normal Low	1 1.35(0.53 - 3.41)	1 1.13 (0.4 - 3.18)
PE Literate Illiterate	1 0.63(0.29 - 1.39)	1 0.53 (0.19 - 1.47)

Refractive error was seen in 7 (2.7%) children and myopia n=4, (57%) was most commonly seen, followed by astigmatism n=2, (29%) and hypermetropia n=1, (14%). Among those with astigmatism 1 had simple myopic astigmatism and 1 had compound myopia astigmatism.

Table 29: Distribution of the Uncorrected Refractive Errors

Refractive error	Total, n (%)
Myopia	4(1.5)
Hypermetropia	1(0.4)
Astigmatism	2(0.8)
Total	7(2.7)



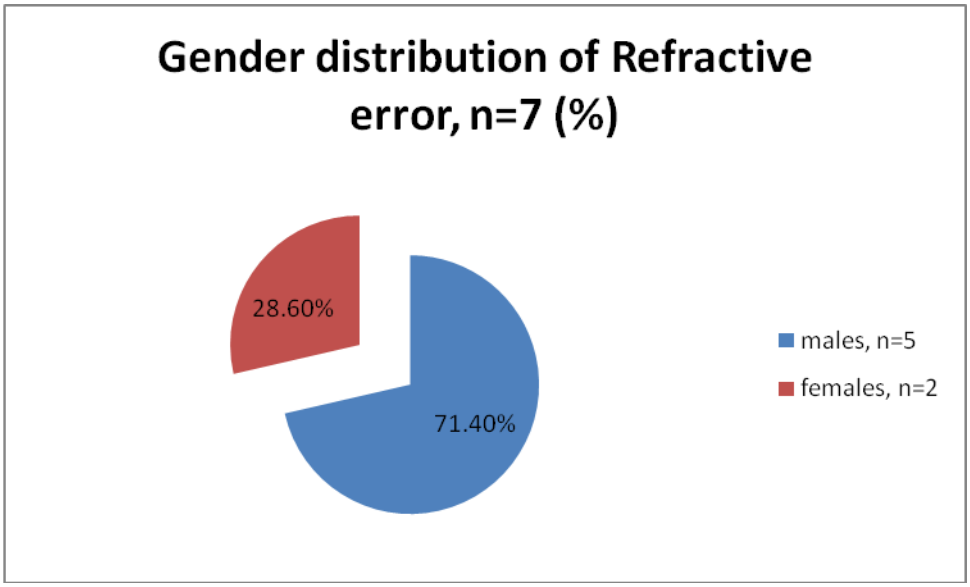
Refractive errors were mostly seen in the males, n=5 (71%) and 100% (n=7) were in > 5 years age group. There was no significant association with age [Chi square test value =3.7, (p=0.09)] and gender [Chi square test value = 1.8, (p=0.26)].

Table 30: Age distribution of uncorrected refractive errors

Age groups	Refractive errors, n (%)		Total, n (%)
	Present	Absent	
<=5	0	88(34.8)	88(33.8)
>5	7(100)	165(65.2)	172(66.2)
Total	7(100)	253(100)	260(100)

Table 31: Gender distribution of uncorrected refractive errors

Gender	Refractive errors, n (%)		Total, n (%)
	Present	Absent	
Males	2(28.6)	134(54.2)	139(53.5)
Females	5(71.4)	119(45.8)	121(46.5)
Total	7(100)	253(100)	260(1000



D.VITAMIN A DEFICIENCY

In children with Vitamin A deficiency (4.6%, 95% CI 1.6 to 6.3%), 2 (16.67%) were in <=5 years age group and 10 (83.23%) were in >5 years age group, which was not statistically significant [Chi square test value=1.66, (p=0.35)]**.** VAD is seen in males 10.3 times more than females and this was statistically significant [Chi square test,value=7.4,(p=0.007),95%CI-0.012-0.763].

Table 32: Age distribution of vitamin A deficiency

AGE GROUPS	**VAD, n (%)**		**TOTAL, n (%)**
	PRESENT	**ABSENT**	
<= 5 YEARS	2(16.7)	86(34.7)	88(33.8)
>5 YEARS	10(83.3)	162(65.3)	172(66.2)
TOTAL	12(100)	248 (100)	260 (100)

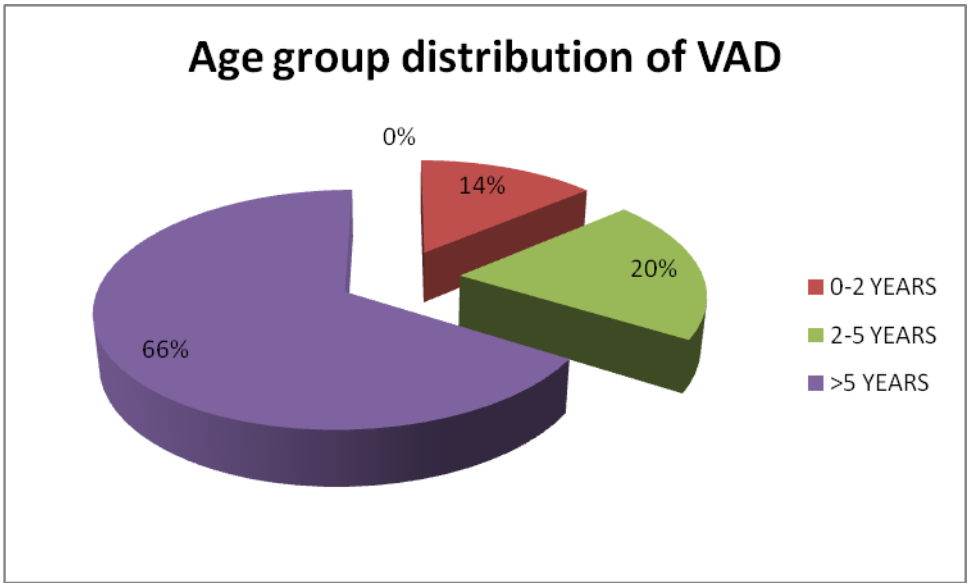
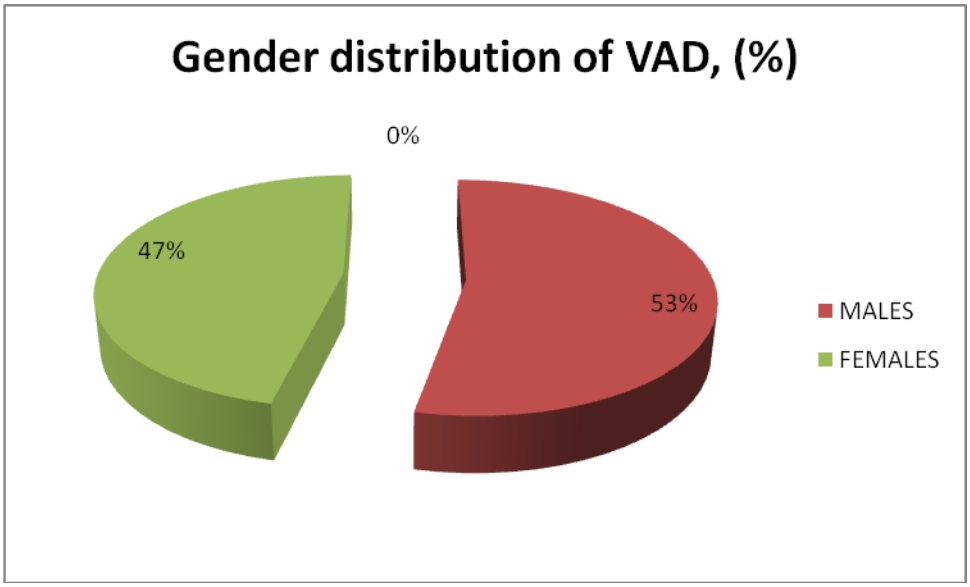


Table 33: Gender distribution of vitamin A deficiency

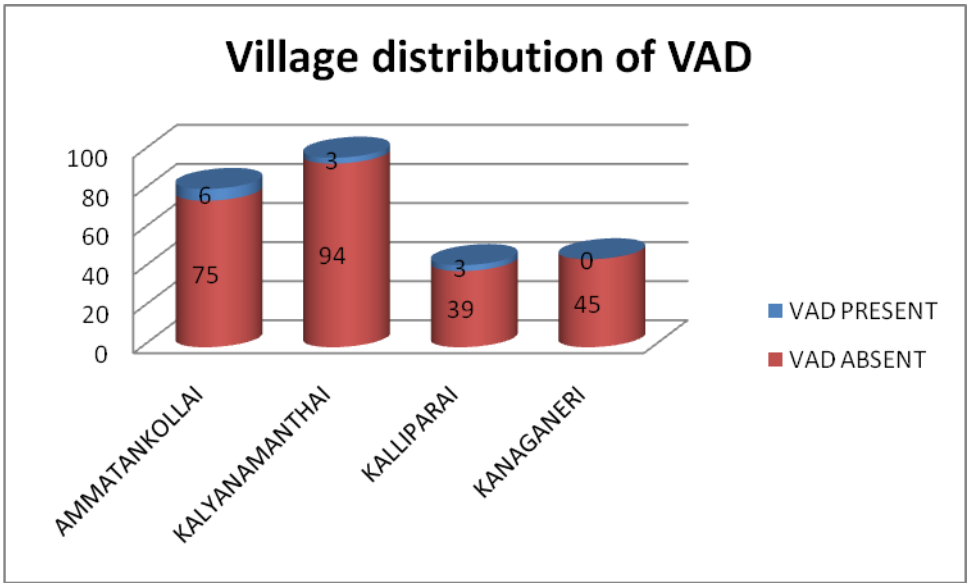
SEX	VAD, n (%)		TOTAL, n (%)
	PRESENT	ABSENT	
MALES	11(91.7)	128(51.6)	139(53.5)
FEMALES	1(8.3)	120(48.4)	121(46.5)
TOTAL	12(100)	248(100)	260(100)



Out of 12 children with vitamin A deficiency, 6 were from Ammatankollai, 3 from Kalliparai and 3 from Kalyanamanthai. They were homogenous with respect to prevalence of Vitamin A deficiency [Fisher's test, value=5.03, (p=0.13)].

Table 34: Village distribution of Vitamin A deficiency

VILLAGES	VAD, n (%)		TOTAL, n (%)
	PRESENT	ABSENT	
AMMATANKOLLAI	6(50.0)	70(28.2)	76(29.2)
KALYANAMANTHAI	3(25.0)	94(37.9)	97(37.3)
KALLIPARAI	3(25)	39(15.7)	42(16.2)
KANAGANERI	0(0)	45(18.1)	45(17.3)
TOTAL	12(100)	248(100)	260(100)



Out of 12 children who had vitamin A deficiency, all were breastfed. 1 child was breastfed < 24 months and 1 child is currently being breastfed.

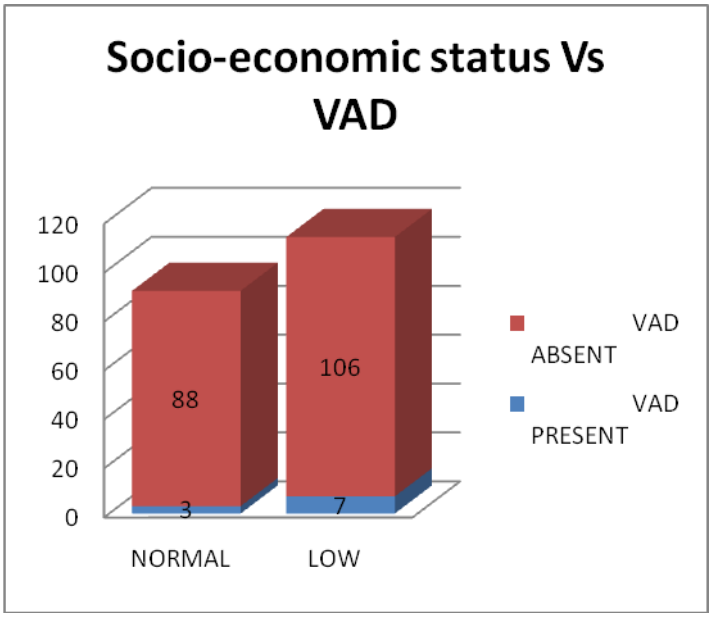
Table 35: Vitamin A deficiency and breastfeeding practices

BREASTFEED	VAD, n (%)		Total, n (%)
	PRESENT	ABSENT	
GIVEN	12(100)	242(97.6)	254(97.7)
NOT GIVEN	0(0)	6(2.4)	6(2.3)
TOTAL	12(100)	248(100)	260(100)

Out of 12 children with VAD, SES was not available for 2 from the database. 7 children with VAD were from low socioeconomic status, which was not statistically significant [Chi square test value=0.91, (p=0.52)].

TABLE 36: Socioeconomic status of children with VAD

SES	VAD, n (%)		TOTAL, n (%)
	PRESENT	ABSENT	
NORMAL	3(30.0)	88(45.4)	91(44.6)
LOW	7(70.0)	106(54.6)	113(55.4)
TOTAL	10(100)	194(100)	204(100)



E. VISUAL ACUITY

Best corrected visual acuity was fair in 10 (3.85%) children and in rest (96.15%) of them was good.

TABLE 37: Distribution of best corrected visual acuity (BCVA)

BCVA, better eye		**Total, n (%)**
<6/60	Poor	0
=> 6/60 <6/18	Fair	10(3.85)
>= 6/18	Good	250(96.15)
Total		260(100)

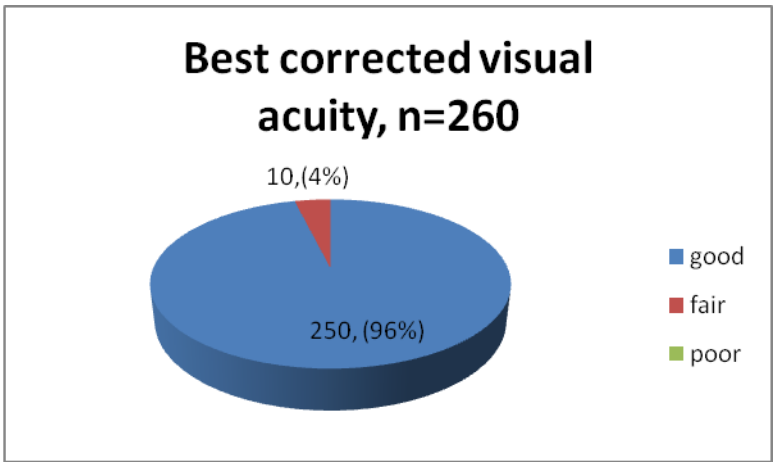


Table 38: Age distribution of BCVA

Age groups in years	BCVA, n			Total
	GOOD	FAIR	POOR	
0-2	28(77.78)	8(22.22)	0	36
2-5	52(100)	0(0)	0	52
>5	170(98.84)	2(1.16)	0	172
Total	250(96.15)	10(3.85)	0	260

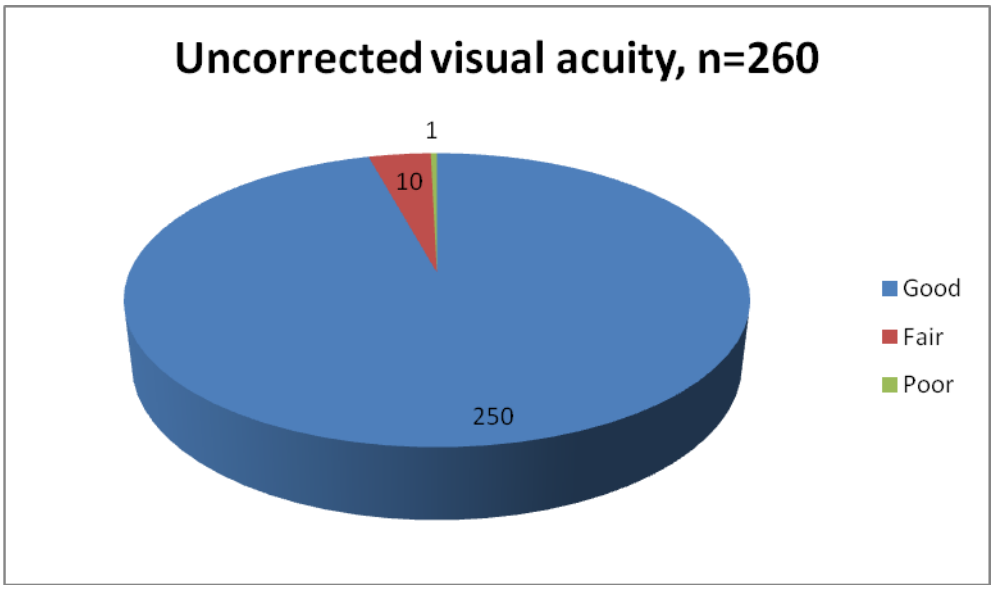
Table 39: Gender distribution of BCVA

Gender	BCVA, n			Total, n
	GOOD	FAIR	POOR	
Males	135(97.12)	4(2.88)	0	139
Females	115(95.04)	6(4.96)	0	121
Total	250(96.15)	10(3.85)	0	260

Out of 260 children, 250 (96.15%) had good BCVA and 10 (3.85%) had fair BCVA. Eight children (80%) with fair BCVA were in < 2 years age group and 6 (60%) were females.

Table 40: Distribution of uncorrected visual acuity (UCVA)

UCVA, better eye		**Total, n (%)**
<6/60	Poor	1(0.4)
=> 6/60 <6/18	Fair	10(3.84)
> = 6/18	Good	249(95.76)
Total		260(100)



Number need to screen:

From our study, we needed to screen 172 children aged > 5 years to detect 3 children with visual impairment and so we need to screen 57 children to identify 1 child with visual impairment who was hitherto uncorrected.

Table 41: Age distribution of UCVA

Age groups in years	UCVA, n			Total , n
	GOOD	FAIR	POOR	
0-2	28(77.78)	8(22.22)	0	36
2-5	52(100)	0(0)	0	52
>5	169(98.26)	2(1.16)	1(0.58)	172
Total	249(95.77)	10(3.85)	1(0.38)	260

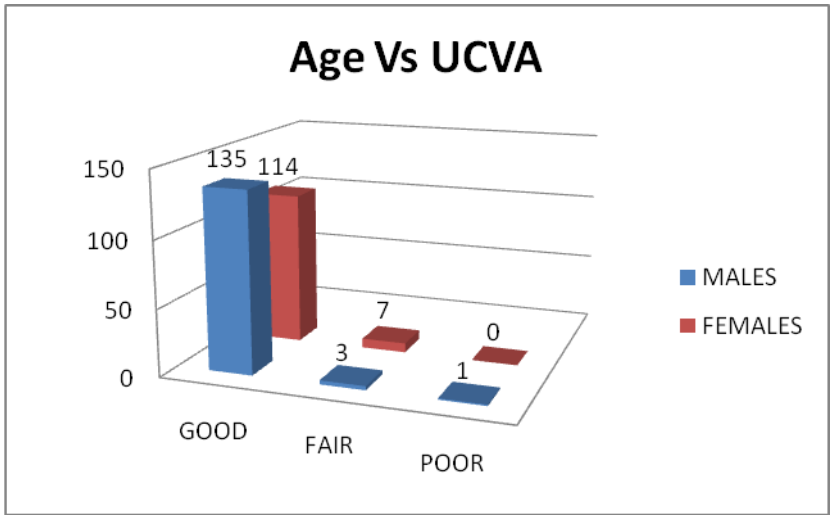
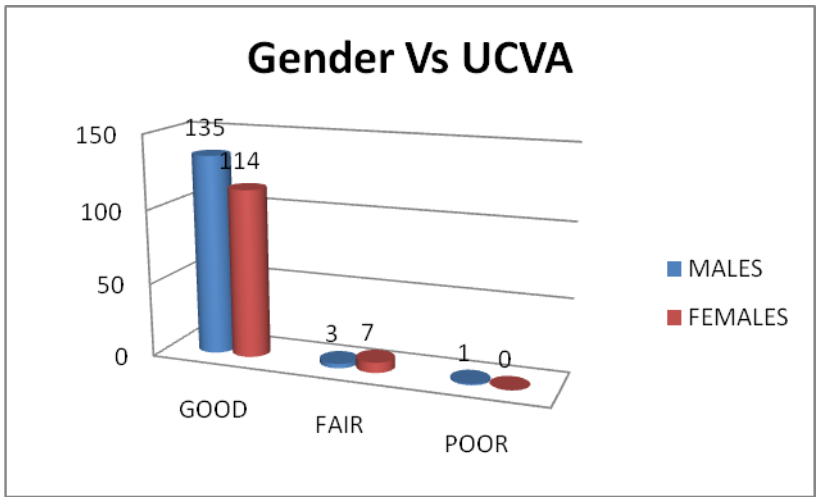


Table 42: Gender distribution of UCVA

Gender	UCVA, n			Total
	GOOD	FAIR	POOR	
Males	135(97.14)	3(2.16)	1(0.7)	139
Females	114(94.21)	7(5.79)	0	121
Total	249(95.77)	10(3.85)	1(0.38)	260



Out of 260 children, 1(0.4%) had poor vision uncorrected visual acuity. This male child in the age group of >5 years, had strabismus and uncorrected refractive error.

DISCUSSION

DISCUSSION:

Our study was a cross sectional study of permanently residing children in four selected villages of the Jawadhi hills up to 15 years of age. The tribal health care services of seem to differ from other areas in terms of availability of health care (88% still delivering at home) and specialised eye care (only two PHCs and one outreach from a private hospital, reflected by the 92.7% of respondents going to the PHC for eye problems).

The study methodology followed in our study was similar to Batchala et al(14) in almost all aspects, but different from Nirmalan et al,(13) where initially all children (10,605) were screened by trained field workers and only those suspected to have some sort of morbidity were referred to base hospital. There is a long standing tradition of migration for employment in the Jawadhi hill region. Out of the total population of 322 in the original database, 25% i.e. 81 children had either migrated from the villages or were residing in hostels for their education. This is further reflected in the fact that we found 67 more permanent resident children who were not enumerated in the original database. The final coverage was 66.84% (n=260) out of 389 children, which was much lower as compared to Batchala et al(14) in rural Karnataka where the response rate was 89.71%. In addition to the migratory nature there is reservation towards participations reflected by those unwilling to participate.

Mean age of children was 7.5 years, which was similar to (7.6 years) that seen by Nirmalan et al (13)in rural Tamilnadu. There was no gender difference in our study population, with almost equal participation from both males (53.5%) and females (46.5%), which was similar to both the above studies.

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In our study among the children in the pre-school age group, 79% were going to balwadi and in the school going age group only 4 children (2.33%) were not going to school. About 36.5% of children's parents were illiterate (had no schooling), which was lesser compared to Batchala et al(14), where illiteracy rate was 47.14% among the parents. Even though illiteracy was high among the parents in our study, it has reduced significantly in the next generation. Most of the families were of low socio-economic status (55.3%), higher compared to study by Jayant D et al,(23) in rural Maharashtra (12.38%) and there was no statistical difference among the 4 villages.

In the present study, prevalence of ocular morbidity was 10.8%, comparable to the population based study by Batchala R B et al (9.93%),(14) in rural Karnataka and higher compared to other population based studies reported by Kariapatti paediatric eye evaluation project - Nirmalanet al(13)in south Indian population (2.8%) and Andhra Pradesh eye disease study(7) – Dandona et al (1.3%). The higher prevalence of ocular morbidity in our study was influenced by the study model and methodology, comparable to the one by Batchala et al.(14) In other studies preliminary examination was done by field workers and only those suspected to have ocular morbidity were referred for further ophthalmic evaluation. Since detailed examination was done only by an ophthalmologist, there is a chance of underestimating the prevalence of ocular morbidity. We had the ophthalmologist and optometrist evaluate every child in their own area of residence. There are no studies in tribal children to make comparisons. The contrast in the region's cultural and socio-economic backwardness, reluctance to accept medical treatment and poor accessibility to medical facilities in the locality also may contribute to the higher prevalence of ocular morbidity as compared to Nirmalan et al.(13) With the homogeneity between the seen and unseen groups in terms of age,

gender and SES, it is reasonable to assume that the prevalence of ocular morbidity would not have changed dramatically had the coverage been better.

The prevalence of ocular morbidity in school based studies varies widely. Our prevalence was much lower than Kalikivayi et al (27)where the ophthalmologist examined all children; however the age group studied was only from 3 to 18 years. Other school based studies reported from India and Nepal showed prevalence ranging from 13 to 45%. Prevalence reported by Prajapati P et al (13%) (24)among adolescents of Gandhinagar district and 15.6% by Wedner SH et al(22) in rural Tanzania were closer to our findings, where all children were examined by ophthalmologist.

The prevalence of ocular morbidity is higher with age (p=0.01), as reported by Prasanna Kamath et al, (26)rural Karnataka and Kimani et al, Kenya.(31)This would be explained by the increasing incidence of refractive errors and trauma among adolescents. There was no significant association with gender, SES or parents' educational statusas seen in other studies – Batchala et al (14)(rural Karnataka) and Jayant et al (23)(rural Maharashtra).. However, a significant association with above risk factors was seen in other studies – Kumar et al (15)(Uttar Pradesh) and Jayant et al (23)(rural Maharashtra).The prevalence of low SES was much lower and the classification system different; similarly the percentage of parents who were illiterate was much lower in the study by Jayant et al.(23)

In our study, Vitamin A deficiency was the commonest ocular morbidity (4.2%) which manifested as Bitot's spots and conjunctival xerosis, comparable to the study by Batchala et al, (14)rural Karnataka(4.3%), (3.8%) Prajapati P et al (24)(2009) among adolescents (10-19 years) of Gujarat (14), Jayanth D and Malathi K (23)(3.53%) in rural Maharashtra among school children (10-16 years) and Kumar et al

(2.77%) (15)among school children (6-16 years) in Uttar Pradesh was reported, lesser compared to our study but higher compared to Nirmalan et al (1%), (13)rural Tamilnadu.

Least prevalence of vitamin A deficiency was reported by Shrestha RK et al(16) (0.05%) among school children (5-16years) in Kathmandu and 0.36% in a study reported by Naik R et al(25) among school children in Ahmednagar, Maharashtra where the coverage of Vitamin A supplementation is better.

In the school based studies done by Prasanna Kamath et al (26)(33.8%), in rural areas of Karnataka and Chaturvedi et al (20)(10.6%) among school children (5-15 years) in rural Delhi, an even higher prevalence was noted compared to our study.

The reason for the relatively high prevalence of Vitamin A deficiency in our study may be that the study was done in tribal area where majority of them belonged to low socioeconomic status and also because of food habits that is being followed in these areas. Samai rice is the staple diet of the region which is rich in proteins but has negligible amounts of Vitamin A. Due to the low socio-economic condition and lack of awareness owing to illiteracy of the parents, the consumption of vegetables and fruits rich in vitamins seem to be lacking in the population. Also, as the region is isolated from urban areas by geographic and cultural differences, Vitamin A deficiency is found to be the most prominent ocular morbidity in this belt.

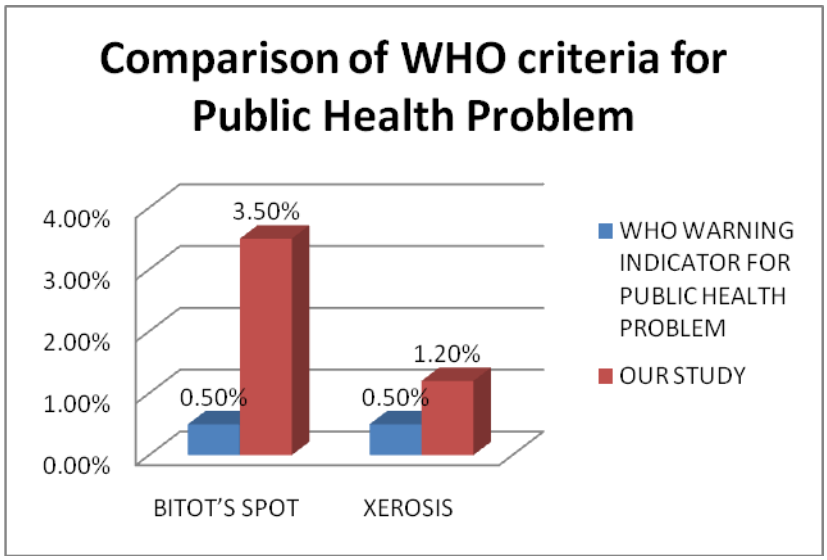
It was also significantly more in the male child than in female (p=0.007), similarly seen in Batchala et al, (14)rural Karnataka (p=0.0005).Other studies done in plains have shown vitamin A deficiency is more common in females than males. The parents had no knowledge or possession of the immunization chart of their child. It was reportedly maintained at the public health centre in Jamunamarathoor, headquarter

of Jawadhi hills. Hence no useful information could be extracted about immunisation or Vitamin A prophylaxis status of the child. The parents also had no knowledge of the type of immunization or the months it had to be administered.

The knowledge of Vitamin A prophylaxis (administration of orange syrup) was also lacking in the tribal area, as most parents had no memory of such an administration for their child. This factor has not been mentioned in other studies.

Comparison of WHO criteria for Public Health Problem and Study Distribution for Bitot's spot and Xerosis

DISORDER	WHO WARNING INDICATOR FOR PUBLIC HEALTH PROBLEM	OUR STUDY
BITOT'S SPOT	0.5%	3.5%
XEROSIS	0.5%	1.2%



According to World Health Organisation a public health problem exists when the prevalence of observations below a cut-off point that defines deficiency is considered unacceptable. In our study Bitot's spot was high, 3.07%. Conjunctival xerosis was seen in 1.15%. A study done by Prajapati et al (24)among school children in Gujarat, the prevalence of Bitot's spots was 1.74%. The above results emphasise the prevailing public health problem in the Jawadhi region which requires immediate attention and further study with higher sample sizes involving all the 250 villages in the area. The intervention should be carried out by creating awareness through health education, improving coverage of immunizations and Vitamin A prophylaxis to cover all pre-school children (>90%) and suitable treatment regimens of existing cases in areas of public health problem belt till food based strategies become sustainable in the long term. The immunisation card has to be given to the parents and they should be informed about the schedule to be followed. This might result in the parent being involved in their child's health care. With cost of vegetables being prohibitive the

Uncorrected refractive error was the second common morbid condition (2.7%) among our study children, higher compared to the one reported by Praveen et al (13)(0.6%) in South India. Higher prevalence of refractive error of 32% has been reported by Kalikivayi (27)in a study from South India

The children who presented with refractive errors were all above the age of 5 years (p=0.053), seen as increasing prevalence as age increases. This finding was consistent with other studies – Kamath et al (26)(rural Karnataka) and Mahapatro et al (Bhubanesar). At birth the child is hypermetrope and as growth progresses,refractive changes become more manifest towards adolescence.

School based studies Gupta et al at (19)Shimla had identified refractive error as the commonest morbidity among children (22%) in their study and Prajapati et alalso had observed it as the commonest with a prevalence of 40.1% in their study at Gandhinagar.(24) The insufficiency of medical help available in the locality of Jawadhi hills and cultural mindset of the tribal population is a major factor for these markedly high percentages of prevalence. Amongst the children suffering from uncorrected refractive errors, 57% of the parents were illiterate with lack of awareness of the importance of an eye examination for the child. The health education of parent on child eye disease and symptoms could bring about a significant improvement in the management of refractive errors

History of previous eye examination since birth was absent in 85% of the children. Screening for refractive errors is the most important part of School Eye Screening. The lack of previous examinations in this study is an indirect reflection of the poor performance of this program. This needs further studying as there are no reports to the best of our knowledge.

In our study only one child (aged more than 5 years) (1 in 172) had blindness (<6/60) due to uncorrected refractive error and 2 children (aged > 5 years) (0.8%) had low vision (<6/18 – 6/60). The major reasons for visual impairment seen in these children were strabismus and uncorrected refractive errors.

The low number needed to screen i.e.57, shows that this program needs to be strengthened as otherwise these children with low vision and blindness will be underperforming not only as students but also as adults in later years. The fact that prevalence of ocular morbidity is significantly higher among children over 5 years proves that it is sufficient to screen children in the school rather than in the population. There was a significant association between parent education and previous examination as well. Strengthening the screening program at school will hopefully reduce the influence of parental lack of awareness.

Of the 11 children referred to Schell eye hospital, only 2 (18%) reported for treatment. The rest of the children have not turned up for further examination in spite of counselling by the ophthalmologist and repeated instructions from field workers. The attitude is a reflection of lack of education of the parent and their health seeking behaviour. Whatever treatment is offered in their villages, it is better accepted, but the patient finds it difficult to travel long distances for health care. This brings to light the eminent need to provide specialised care in the Jawadhi area. The primary healthcare centres that are presently available are insufficient to manage the surge and existence of advanced health problems in this region.

CONCLUSION

CONCLUSION

- Nearly 1 in 10 children suffer from ocular morbidity and 1 in 57 have either low vision or blindness
- There was a significant co-relation between absence of previous eye examination in children whose parents were illiterate
- Vitamin A deficiency is the foremost ocular morbidity in the children of Jawadhi hills and a major public health problem
- The second most common morbidity is refractive error, mainly in children belonging to age of 5 years and greater
- Poor availability of eye care services in the hills coupled with poor eye health seeking behaviour magnifies the health problems.

LIMITATIONS

LIMITATIONS:

- The Jawadhi population is one which prefer to migrate to other districts in want of better living conditions, this reflects on the coverage of the study (66%)
- Paucity of literature in the previous years, especially of eye care in tribal population makes less opportunity for more meaningful comparisons
- The access to these villages being remote, referred children could not be completely managed

RECOMMENDATIONS

RECOMMENDATIONS:

- The prevalence of refractive errors in the school going age group (>5 years) strengthens the need for school eye screening in these children
- Vitamin A deficiency in this region needs immediate attention towards prophylaxis and treatment.
- The focus of health care should be on developing specialised eye care services in the vicinity of the villages to improve eye health seeking behaviour
- Health education on eye care and the seriousness of ocular morbidity and deficiency in the region must be imparted and the effect of low vision on the child's health must be stressed.

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APPENDIX A- IRB APPROVAL LETTER

OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA.

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Alfred Job Daniel, D Ortho, MS Ortho, DNB Ortho
Chairperson, Research Committee & Principal

Dr. Nihal Thomas,
MD., MNAMS., DNB (Endo), FRACP (Endo), FRCP (Edin), FRCP (Glasg)
Deputy Chairperson
Secretary, Ethics Committee, IRB
Additional Vice Principal (Research)

April 07, 2014

Dr. K. M. Mahesh
PG Registrar
Department of Ophthalmology
Christian Medical College
Vellore 632 004

Sub: **Fluid Research grant project:**
Prevalence of ocular morbidity in children aged 15 years or younger in Tribal area of Jawadhi hills, South India, a cross sectional study.
Dr. K. M. Mahesh, PG Registrar, Dr. Padma Paul, Dr. Deepa John, Ophthalmology, Dr. Anuradha Rose, Community Medicine, CMC, Vellore.

Ref: IRB Min No: 8729 [OBSERVE] dated 06.03.2014

Dear Dr. K. M. Mahesh,

I enclose the following documents:-

1. Institutional Review Board approval 2. Agreement

Could you please sign the agreement and send it to Dr. Nihal Thomas, Addl. Vice Principal (Research), so that the grant money can be released.

With best wishes,

Dr. Nihal Thomas
Secretary (Ethics Committee)
Institutional Review Board

Dr. NIHAL THOMAS
MD.,MNAMS.,DNB(Endo),FRACP(Endo),FRCP(Edin),FRCP(Glasg)
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board,
Christian Medical College, Vellore - 632 002.

Cc: Dr. Padma Paul, Ophthalmology, CMC, Vellore

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002.
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OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA.

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Ref: IRB Min No: 8729 [OBSERVE] dated 06.03.2014

Dear Dr. K. M. Mahesh,

The Institutional Review Board (Blue, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project entitled "Prevalence of ocular morbidity in children aged 15 years or younger in Tribal area of Jawadhi hills, South India, a cross sectional study." on February 19, 2014.

The Committees reviewed the following documents:

1. IRB Application format
2. Curriculum Vitae' of Drs. K. M. Mahesh, Padma Paul, Deepa John, Anuradha Rose
3. Information Sheet
4. Consent form
5. No of documents 1-4

The following Institutional Review Board (Blue, Research & Ethics Committee) members were present at the meeting held on February 19, 2014 in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore 632002.

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002.
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Deputy Chairperson
Secretary, Ethics Committee, IRB
Additional Vice Principal (Research)

Name	Qualification	Designation	Other Affiliations
Dr. T. Balamugesh	MBBS, MD(Int Med), DM, FCCP (USA)	Professor, Pulmonary Medicine, CMCH.	Internal, Clinician
Dr. J. Visalakshi	MPH, PhD	Lecturer, Dept. of Biostatistics, CMC.	Internal, Statistician
Dr. Ranjith K Moorthy	MBBS M Ch	Professor, Neurological Sciences, CMCH.	Internal, Clinician
Dr. Chandra Singh	MS, MCH, DMB	Professor, Urology, CMCH.	Internal, Clinician
Dr. Paul Ravindran	PhD, Dip RP, FCCPM	Professor, Radiotherapy, CMCH.	Internal, Clinician
Dr. Bobby John	MBBS, MD, DM, Ph D, MAMS	Professor, Cardiology, CMCH.	Internal, Clinician
Dr. Anup Ramachandran	Ph. D	The Wellcome Trust Research Laboratory Gastrointestinal Sciences, CMCH.	Internal, Basic Medical Scientist
Dr. Inian Samarasam	MS, FRCS, FRACS	Professor, Surgery, CMC	Internal, Clinician
Dr. Niranjan Thomas	DCH, MD, DNB (Paediatrics)	Professor, Neonatology, CMC	Internal, Clinician
Dr. Jacob John	MBBS, MD	Associate Professor, Community Health, CMC	Internal, Clinician
Dr. Rajesh Kannangai	MD, Ph D.	Professor & In-charge Retrovirus Laboratory (NRL under NACO), Department of Clinical Virology, CMCH	Internal, Clinician
Mr. Samuel Abraham	MA, PGDBA, PGDPM, M. Phil, BL.	Sr. Legal Officer, CMCH	Internal, Legal Expert

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Deputy Chairperson
Secretary, Ethics Committee, IRB
Additional Vice Principal (Research)

Dr. Shirley David	M.Sc, PhD	Professor, Head of Fundamentals Nursing Department, CMCH	Internal, Nurse
Mrs. Pattabiraman	B. Sc, DSSA	Social Worker, Vellore	External, Lay person
Mr. C. Sampath	B. Sc, BL	Legal Expert, Vellore	External, Legal Expert
Dr. Denise H. Fleming	B. Sc (Hons), PhD	Honorary Professor, Clinical Pharmacology, CMCH.	Internal, Scientist & Pharmacologist
Dr. Vathsala Sadan	M.Sc, PhD	Professor, Community Health Nursing, CMCH.	Internal, Nurse
Dr. Anuradha Rose	MBBS, MD	Assistant Professor, Community Health, CMCH.	Internal, Clinician
Dr. Nihal Thomas	MD, MNAMS, DNB(Endo), FRACP(Endo) FRCP(Edin) FRCP (Glasg)	Professor & Head, Endocrinology. Additional Vice Principal (Research), CMCH. Deputy Chairperson, IRB, Member Secretary (Ethics Committee), IRB	Internal, Clinician

We approve the project to be conducted as presented.

The Institutional Ethics Committee expects to be informed about the progress of the project, any **adverse events** occurring in the course of the project, any **amendments in the protocol and the patient information / informed consent**. On completion of the study you are expected to submit a copy of the **final report**. Respective forms can be downloaded from the following link: http://172.16.11.136/Research/IRB_Polices.html in

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APPENDIX B- PATIENT INFORMATION SHEET AND INFORMED CONSENT

Information sheet

Childhood visual loss and blindness is important because of the impact on the child's development, education, future work opportunities &quality of life. This handicap has serious social & economic consequences on the family and the society.

One in three blind persons of Indian origin loses their sight before the age of 20 years. It is therefore important to detect abnormalities in the eye and vision early. Eye power and malnutrition (Vitamin A deficiency) are major causes of blindness among the younger age groups, which are avoidable and curable. Early detection of such conditions helps in prompt treatment and prevention of serious complications.

The present study is being conducted with the objective to study the occurrence of such eye and various factors affecting it among the children (0 – 15 years) in Jawadhi hills.

Your child will be examined by the staff and doctor from the Department of Ophthalmology, CMC by routine methods. It also involves instilling of one drop of medicine to be able to see the back of the eye. The child may experience glare and difficulty with near vision for a few hours which will then be normal again. Rarely child can develop itching. Those who need spectacles will be provided spectacles, free of cost and those who require further evaluation will be referred to Schell Eye Hospital, CMC and managed at free of cost. If you are willing to allow your child to take part in the study, you can sign the consent form provided to you.

Name: Dr.Mahesh, Contact number: 8056225002, Office phone number: 0416-2281201

CONSENT FORM

Parent Informed Consent form for participation of their child in observational study

Study Title**: Prevalence of ocular morbidity in children aged 15 years or younger in tribal area of Jawadhi hills, South India**

Study Number:

Subject's Initials:

Subject's Name:

Date of Birth / Age: Gender:

(i) I confirm that I have read and understood the information sheet dated_____ for the above study and have had the opportunity to ask questions.

(ii) I understand that my child's participation in the study is voluntary and that I am free to withdraw my child at any time, without giving any reason, without this/her medical care or legal rights being affected.

(iii) I understand that eye drops will be used, which can cause glare, inability to see objects for few hours in general, and minor allergic reactions in rare instances.

(iv) I understand that the Ethics Committee and the regulatory authorities will not need my permission to look at my child's health records both in respect of the current study and any further research that may be conducted in relation to it, even if my child withdrawn from the study. I agree to this access. However, I understand that my child's identity will not be revealed in any information released to third parties or published.

(v) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).

(vi) I agree for my child to take part in the above study.

Signature / thumb impression of parent / legally acceptable:

Representative:

Date:

Signatory's Name:

CHILD's ASSENT

Name of Child: Date:

Oral assent: Given / Not Given

Thumb impression Signature:

Signature of the Investigator:

Date:

Study Investigator's Name:

Signature of the Witness:

Date:

Name of the Witness:

Principal Investigator

Name: Dr.Mahesh, Contact number: 8056225002, Office phone number: 0416-228120.

TAMIL INFORMATION SHEET AND CONSENT FORM

தகவலறிவிப்பு தாள்

குழந்தை பருவத்தில் ஏற்படும் பார்வை குறைபாடு மற்றும் பார்வை இழப்புக்கு அதிக முக்கியத்துவம் கொடுக்கப்படவேண்டும்.ஏனென்றால் இதன் தாக்கம் அதிகமானால் குழந்தைகளின் கல்வி, வேலைவாய்ப்பு, மற்றும் அவர்களின் வாழ்க்கை தரத்தை அதிகமாக பாதிக்கும். இதன் ஊனம் அவர்களின் குடும்பத்திலும் மற்றும் சமுதாயத்திலும் பொருளாதார விளைவுகளை ஏற்படுத்தும்.

இதில் உண்மை என்னவென்றால் இந்தியாவில் பார்வை இழந்தவர்களில் 30 சதவிதம் பேர் தங்களுடைய 20 வயதிற்குள் இழந்திருகிறார்கள். எனவே இளம் குழந்தைகளின் பார்வை குறைபாட்டை ஆரம்ப நிலையிலேயே கண்டறிந்து அதற்கு சிகிச்சை அளிப்பது முக்கியமாகும்.இளம் வயதினர் மத்தியல் ஒளி விலகல் பிழை மற்றும் ஊட்டச்சத்தின்மை (வைட்டமின் A குறைபாடு) போன்றவை பார்வை குறைபாட்டிற்கு முக்கிய காரணமாக இருக்கிறது. இது தவிர்க்க கூடியதும், குணப்படுத்த கூடியதாகும்.

பொது ஆய்வு மூலம் ஆரம்ப நிலையிலேயே கண்ணின் குறைபாடுகளை கண்டறிந்தால் ஆபத்தான கண் வியாதிகளுக்கு உடனடி சிகிச்சைஅளிக்க முடியும்.

தற்போது மேற்கொள்ளப்படும் ஆய்வு திருவண்ணாமலை மாவட்டத்தில் உள்ள ஜவ்வாது மலையில் வசிக்கும் 0 முதல் 15 வயது வரையுள்ள குழந்தைகள் மத்தியில் கண்ணில் ஏற்படும் நோய்கள் மற்றும் அதனால்

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ஏற்படும் பாதிப்புகள் குறித்த பல்வேறு காரணிகளை அறிந்து கொள்வதே இந்த ஆய்வின் நோக்கம்.

வேலூர், கிருஸ்துவ மருத்துவ கல்லூரியின் கண் மருத்துவ துறையை சார்ந்த கண் சிகிச்சை உதவியாளர்கள் மற்றும் மருத்துவர்கள் உங்கள் குழந்தையின் கண்களை பரிசோதனை செய்வார்கள்.அப்பொழுது குழந்தைக்கு ஒளி விலகல் பிழை பிரச்சனை இருப்பின் அவர்களுக்கு இலவசமாக கண்ணாடி கொடுக்கப்படும் அல்லது அவர்களுக்கு இன்னும் கூடுதலான பரிசோதனைகள் செய்யப்பட வேண்டுமானால் கண் மருத்துவமனைக்கு பரிந்துரைக்கபட்டு அவர்களுக்கு இலவச சிகிச்சை அளிக்கப்படும். நீங்கள் உங்கள் குழந்தையை இந்த ஆய்வில் பங்கேற்க விருப்பம் தெரிவிப்பதாக இருந்தால் உங்களிடம் தரப்படும் ஒப்புதல் பிரதியில் கையெழுத்திட வேண்டும் என கேட்டுக் கொள்ளப்படுகிறீர்கள்.

ஆய்வாளரின் பெயர்: டாக்டர்.மகேஷ்

தொடர்புகொள்ள: 8056225002

0416 - 2281201

தலைப்பு: தென்னிந்திய பிராந்தியத்தில் உள்ள ஐவ்வாது மலையில் வாழும் பழங்குடியினரில் 15 வயதுகுப்பட்ட குழந்தைகளின் கண்ணில் ஏற்பட்ட பாதிப்புகள் பற்றியது.

ஆய்வு எண்:

பங்கேற்பாளரின் பெயர்:

பிறந்த தேதி / வயது:

பொருள்_____ தேதி அன்று எனக்கு கொடுத்த தகவல் தாளில், மேற்கூறியுள்ள ஆய்வைக் குறித்து படித்து, எனக்கு ஏற்பட்ட சந்தேகங்கள் / கேள்விகள் கேட்க வாய்ப்பு கொடுக்கப்பட்டது.

இந்த ஆய்வில் பங்கேற்கும் எனது பிள்ளை என்னுடைய விருப்பத்தின் பேரில் தான் என்றும், எந்த நேரத்திலும் நிபந்தனையின்றி இந்த ஆய்விலிருந்து விலகிக்கொள்ளலாம் என்றும் , அப்படி விலகுவதால் என்னுடைய பிள்ளைக்கு எந்தவித பாதிப்பும் இருக்காது என்றும் அறிந்திருக்கிறேன்.

ஆய்வின் போது என்னுடைய பிள்ளையின் கண்களில் சொட்டு மருந்து போடப்படும் என்றும் அதனால் கண்களில் கூச்சம், கிட்டபார்வை தடை மற்றும் ஒவ்வாமை எற்பட வாய்ப்புக்கள் உள்ளது என்பதை ஆய்வாளர் மூலம் அறிந்து கொண்டேன்.

இந்த ஆய்வை நடத்தும் ஆய்வாளர் மற்றும் நிறுவனத்தின் நெறிமுறை குழுவினர்கள் அனுமதியின்றி என்னுடைய பிள்ளையின் சுகாதார விவரங்களை , அவன் / அவள் இந்த ஆய்விலிருந்து விலகினாலும் பயன்படுத்திக்கொள்ளலாம் என்று அறிவேன்.

இந்த ஆய்வின் மூலம் பெறப்பட்ட எனது பிள்ளை குறித்ததான விவரங்கள் மற்றும் முடிவுகளை அறிவியல் பயன்பாட்டிற்கு பயன்படுத்த தடையில்லை என்றும் அறிவேன்.

என்னுடைய பிள்ளையின் அடையாளங்கள் யாருக்கும் தெரிவிக்கப்படமாட்டாது என்று அறிவேன்.

என்னுடைய விருப்பத்தின் பேரில் , இந்த ஆய்வில் என்னுடைய பிள்ளையை பங்கேற்க சம்மதிக்கிறேன்.

சாட்சியின்பெயர்:

தேதி:

சாட்சியின் கையொப்பம் / கைரேகை பதிவு:

குழந்தையின் ஒப்புதல்

பெயர்: தேதி:

வாய்வழி ஒப்புதல்: கொடுக்கப்பட்டது / கொடுக்கப்படவில்லை

கைரேகைபதிவு: கையொப்பம்:

ஆய்வாளரின் பெயர்:

தேதி:

ஆய்வாளரின்கை யொப்பம்:

சாட்சியின் பெயர்:

தேதி:

சாட்சியின் கையொப்பம்:

APPENDIX C- GENERAL PROFOMA

General Proforma

Name: Age Gender:

Study no:

House no: Street code: Village code:

Informant: father/ mother/ grandparents/ others

Migrant status:

School / Balwadi going: Yes / No

If yes, which standard:

Parent's education: Illiterate

Primary

Secondary

Higher secondary

Graduate & more

Socio-economic status:

Number of siblings:

Birth order:

Antenatal: Fever/ Rashes/ HTN/ DM/ Drugs / others

Delivery: home / hospital

Immunization status: Complete for date / incomplete for age

Was child breast fed: current / ever / never

If in the past: duration (months)

Has child received any dose of Vitamin A prophylaxis: Yes / No

If yes number of doses:

Milestones: current (can do)

Walked at months:

Speech at months:

Co-morbidities: deafness / Mental retardation/ Physical handicap / Epilepsy/ others

History of: Trauma / Night blindness / ocular complaints / others

Previous eye examination: yes / no

If yes: hospital / school

If hospital, reason:

Where do you prefer to go for an eye problem?

APPENDIX D - OPTHAL PROFOMA

Ocular Morbidity Proforma

Name: Age | | | | study no:

Right eye **Left eye**

Visual acuity

Flash light/Cardiff/Kay picture/snellen's

BCVA

Anterior segment:

Whole globe: Phthisis

Anophthalmos

Removed

Others

Lid: Ptosis

Ectropion

Entropion

Others

Strabismus: Esotropia

Exotropia

Others

Conjunctiva: Bitot's spot

Xerosis

Pterygium

Others

Cornea: Horizontal Diameter

Scar - Visual axis

Other site

Anterior Staphyloma

Others

Uvea: Aniridia

Coloboma

Anterior Uveitis

Others

Lens: Cataract

Aphakia

Others

Posterior segment:

Retina: Pigmentary changes

Macular scar

Retinal Coloboma

Others

Optic nerve: Atrophy

Hypoplasia

Others

Globe appears normal

Refractive error: Myopia

Hypermetropia

Astigmatism

Amblyopia

Cortical Blindness

Idiopathic Nystagmus

Normal

Diagnosis Anterior segment

Posterior segment

Schell referral: yes / no

Reason for referral:

APPENDIX E: COLOUR PLATES

PHOTO 1: FUNDUS EXAMINATION BY THE OPHTHALMOLOGIST

PHOTO 2: OBTAININIG PARENTAL CONSENT

PHOTO 3: STUDY SITE – BALWADI

PHOTO 4: REFRACTION DONE BY OPTOMETRIST TRAINEE

APPENDIX E: EXCEL DATA SHEET (MINIFIED)