OPHTHALMIC RESEARCH IN ICMR

Blindness is an important symptom of many eye disorders. Lopez and Murray have estimated the load of blindness as 23 million for the world and 9 million for India comprising the three major disorders namely cataract, glaucoma and trachoma. The Disability Adjusted Life Years(DALYS) for the major eye disorders has been estimated at 27 million for the world and 7 million for India. Blindness is one of the major health problem especially in developing countries like India where it leads to loss of many man hours. ICMR in the past decades has carried out numerous studies on the prevalence, epidemiology and treatment of various causes of blindness in the country.

BLINDNESS

Transient or permanent blindness is the result of most of the disease process in the eye. Hence may different disease level to blindness as their final outcome. This blindness prevalence gives an estimate of all the severe eye disorders in a particular community.

The first major project of the Council in the field of blindness was on **trachoma** which was initiated in 1956 as the trachoma control pilot project with the assistance of WHO and later UNICEF. This survey estimated the total number of economically blind (vision less than finger counting 2 meters with both eyes) at 3 million in rural areas.

Nutritional blindness due to vitamin A deficiency was another identified health problem which was responsible for a large proportion of preventable blindness in the country. National Institute of Nutrition, Hyderabad has carried out a number of studies related to vitamin A deficiency, its effects and its management. Studies were mainly focused on the pre-school children which was a high risk group for vitamin A deficiency. One of the outstanding achievements of these studies was the demonstration of the value of a 6 monthly massive oral dose of vitamin A in preventing the severe form of vitamin A deficiency (Keratomalacia), a frequent cause of blindness. This preventive therapy was incorporated in the fourth Five Year Plan by the Govt. of India and has been adopted in a nation-wide programme.

In the early 70s, a study was conducted in the **North-Eastern region** to find out the prevalence of corneal blindness. A total of 80,000 persons were screened in Dibrugarh. The prevalence of corneal blindness was found to be 1.7% with the highest prevalence found amongst males in the 0-9 years age

group. Vitamin A deficiency and trachoma were the predominant causes.

COLLABORATIVE STUDY ON BLINDNESS

In view of the importance of the problem of blindness and the lack of precise information on the prevalence of this disability in the country, the Council initiated a coordinated project in 1970 to determine the prevalence of blindness. Seven centres located in different parts of India were selected namely Ahmedabad, Cuttack, Delhi, Indore, Madurai and Varanasi. The main aim of this project was to estimate the prevalence and etiology of blindness in the country.

This study involved a community based survey of 3,95,788 persons who were administered a standardised questionnaire and uniform examination procedure was adopted at all the centres. The coverage for urban and rural areas was in the ratio of 2:3.

The study estimated blindness in three different categories namely economic blindness (visual acuity of 6/60 or less in the better eye with spectacle correction or the field of vision reduced to less than 20o in the better eye), total blindness (visual acuity less than 3/60 in the better eye), and unilateral blindness (visual acuity less than 3/60 in one eye and better than 6/60 in the other with best correction by spectacle).

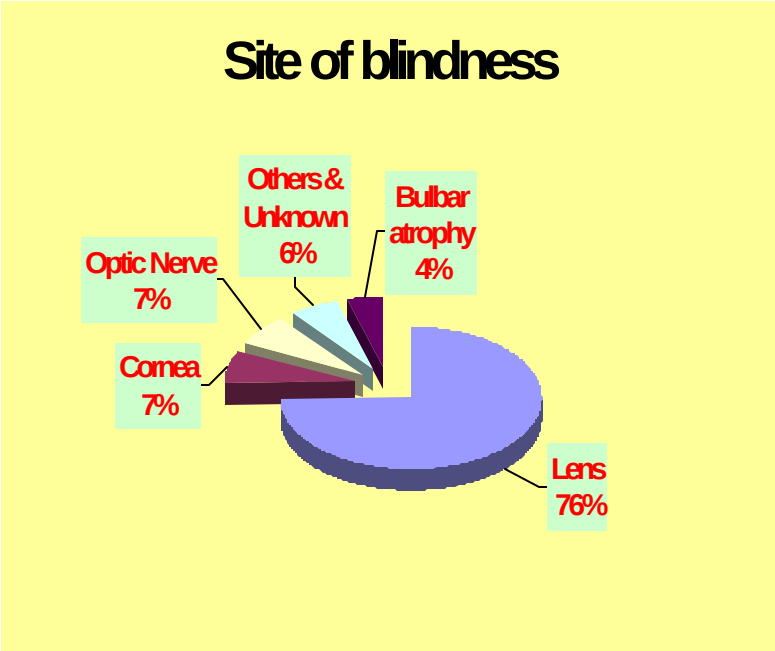
Table 1
Prevalence of Blindness (per thousand)

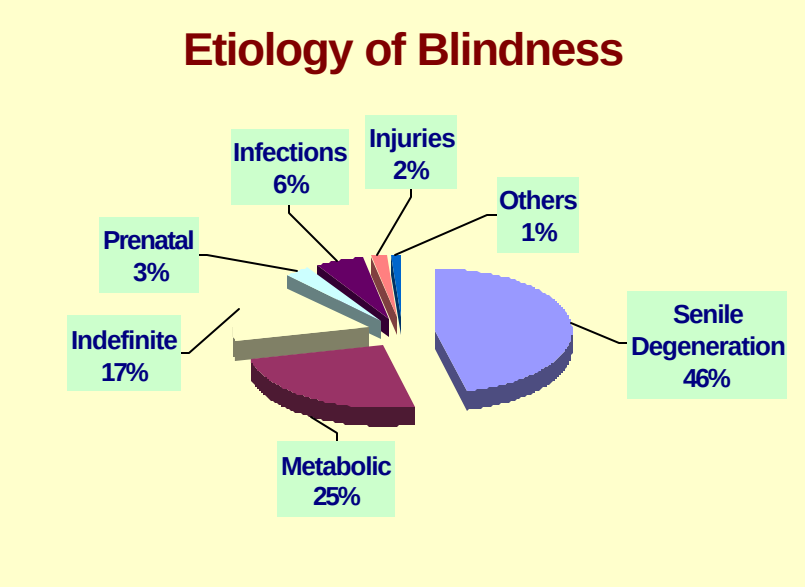
Type of Blindness	Urban	Rural	Total
Total Blindness	4.43	5.99	5.40
Economic Blindness	11.14	15.44	13.83
One Eye Blindness	8.23	7.00	7.46

Total Blindness = Visual acuity less than 3/60 in better eye with spectacle correction
Economic blindness= Visual acuity less than 6/60 in the better eye with spectacle correction
One eye blindness= Visual acuity less than 3/60 in one eye and better than 6/60 in the other eye with spectacle correction

It was estimated that the prevalence of economic blindness in India was 14 per 1000 population(Rural-15.44; Urban-11.14) and total blindness was 5.40 per thousand(Rural-5.99; Urban-4.43). A subsequent survey sponsored by WHO in 1986 also provided a similar prevalence level. For the year 2000 it may be computed that there are approximately 14 million persons with vision 6/60 or less in the country.

The survey indicated that diseases of the anterior segment of the eye are the most common causes of blindness in India. Lenticular opacities(cataracts) were identified as the cause of blindness in more than 70% of cases followed by corneal blindness and optic nerve diseases each of which accounted for one seventh of all blind eyes. The other sites (retina, uvea, macula, unknown) accounted for the remaining15 percent. Etiologically senility and metabolic disorders like diabetes are the most common causes of blindness. Next was indefinite category in which the ophthalmologist could not decide the actual cause of blindness. Amongst the lenticular blindness senility and metabolic disorders accounted for more than 90% of the cases. Prevalence of cataract and corneal blindness was higher in rural areas probably due to the limited availability of medical facilities, while diseases of uvea, retina and optic nerve were seen more amongst the urban population.

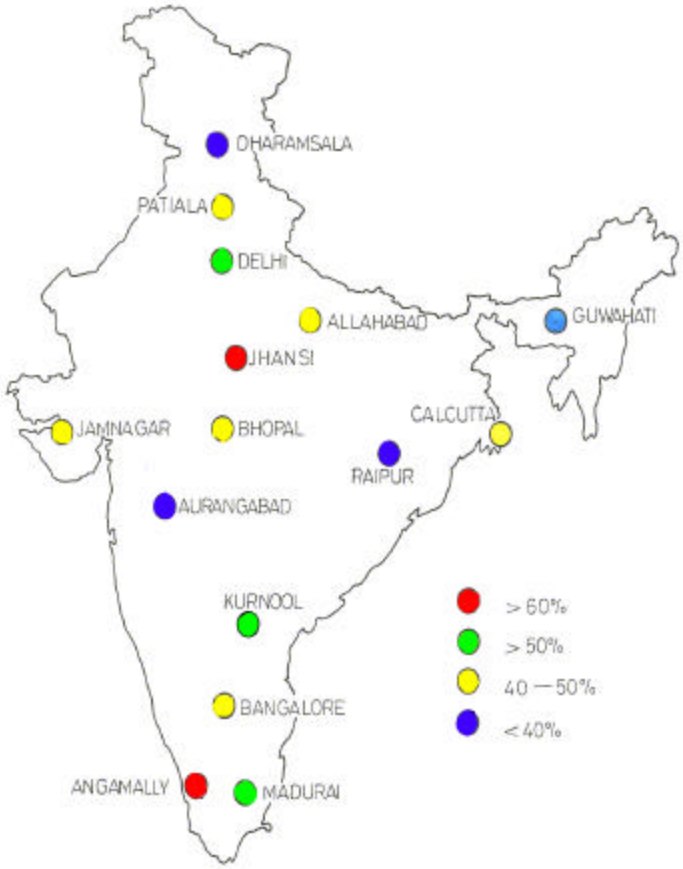




CATARACT STUDIES

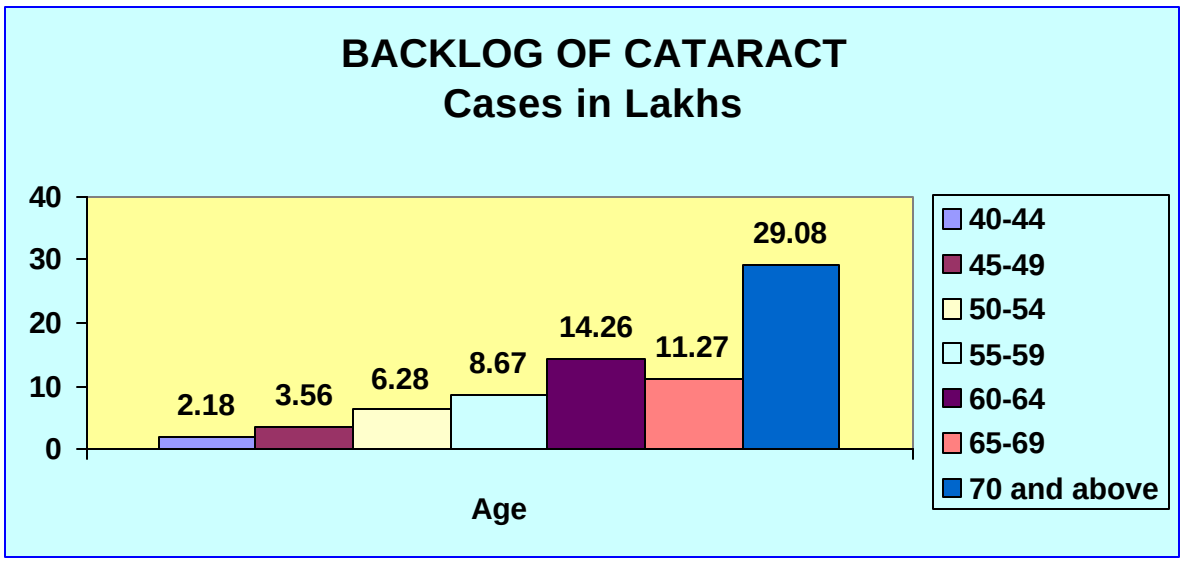
The blindness study conducted by ICMR identified cataract as the major cause of blindness in the country. To further define the distribution of cataract in the country ICMR initiated an epidemiological study in the year 1982. 19 centres were selected across the country for participation in the study. In all 88 villages were covered with a coverage of 4000 population per centre having 1000 eligible persons (> 40 yrs). Nearly 13,000 individuals were enrolled for the study and examined (response rate 88.5%).

For this study cataract was defined as presence of lenticular opacity detectable by distant direct ophthalmoscopy or oblique illumination.



A wide range of prevalence of cataract from 30.1-72.2% was found. Southern India showed much higher rates as compared to other centres. The direct relationship between age and the development of cataract was seen in all the centres. Out-door occupations like manual labourers, agricultural workers and farmers showed a higher prevalence of cataract as compared to other occupational groups (house wives, service, retired, unemployed, domestic workers, etc). 80% of the cases were due to senility and cortical cataract was seen more commonly than the nuclear cataract.

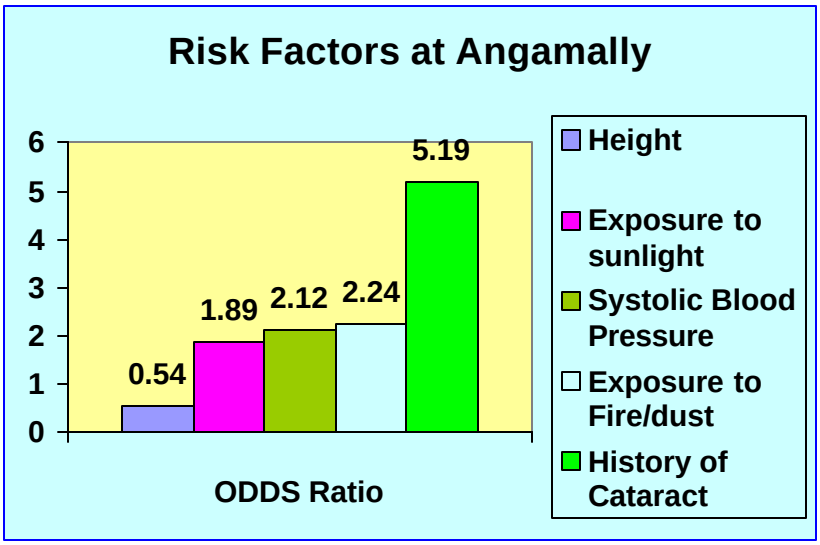
This study estimated that in the year 1981 there was a total of 7.53 million eyes having mature and hyper mature cataracts which constituted the entire backlog in our country. In addition on estimated 2.2 million people develop cataract every

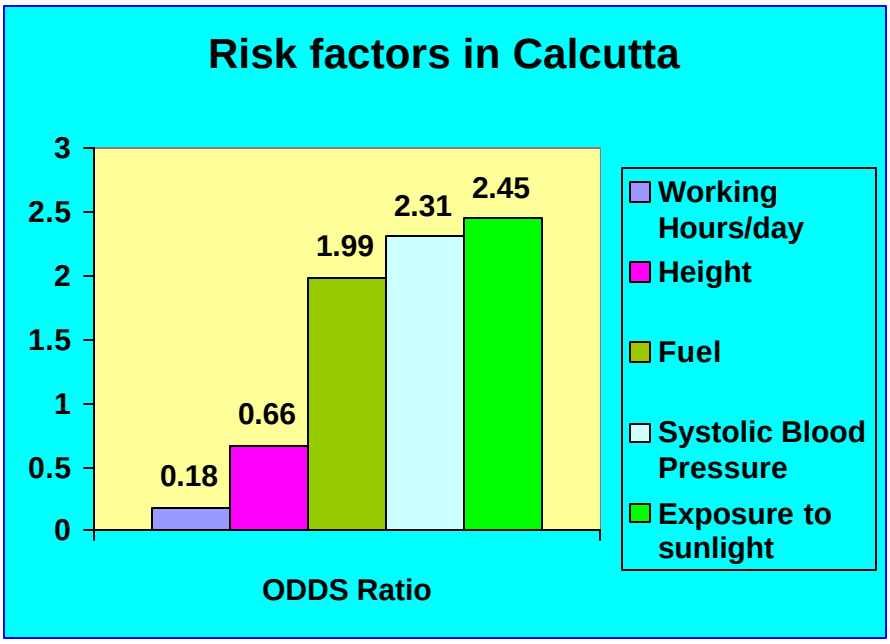


year. This implies that the number of cataract surgeries which are conducted every year needed to be increased considerably to be able to tackle the emergence new cases every year in addition to the existing backlog.

The first phase had established that there was an ever increasing backlog of cataract cases. The resources available in the country for conducting surgeries on these patients are limited and mainly concentrated in the urban areas. Therefore, it was hypothesised that if some etiological factors responsible for initiation and development of cataract could be identified the same could be modified to delay the onset of cataract by a few years. This would prove to be an enormous benefit for the health planners in tackling the problem of backlog of cataract cases. Accordingly the second phase of cataract study was conducted in 1986-89 in an effort to identify possible risk factors for senile cataract. For this purpose a community based case control approach was adopted wherein a fixed number of cases and an equal number of controls would be included. The earlier study had identified areas of low prevalence (less than 400/thousand), medium prevalence (400-600/thousand) and high prevalence (more than 600/thousand). Two villages in the high prevalence area were selected wherein a sample of 300 cases and equal number of controls were enrolled. Cases were selected from 40-60 years age group with lenticular opacities or surgical aphakia and were included in this study.

The univariate analysis identified a lot of probable factors The multivariate analysis was conducted to remove the confounding factors and to identify independent factors. The study identified a few risk factors like high systolic blood pressure, exposure to sun light, history of cataract in the family, exposure to fire or dust and usage of cheap cooking fuel such as cow dung and wood. The high systolic blood pressure referred only to the higher range of normotensive individuals with systolic blood pressure less than 160 mmHg. The protective factors included height and less number of working hours per day. Though the study identified some risk factors and protective factors it could not identify any factors which could be modified to delay the development of cataract.





ICMR supported an **Indo-US hospital based case control study** in an effort to identify some cataract risk factors. Distinctive features of this study were emphasis on specific types of cataract and the inclusion of blood biochemistry factors to identify systemic markers. A minimum of 200 cases were enrolled

in each of the four groups, pure subcapsular cataract, pure cortical cataract, pure nuclear cataract and mixed nuclear-cortical cataract. This study involved a study of the **associations** between types of cataract (nuclear, cortical, posterior subcapsular and mixed) and a number of physiological, environmental, behavioural and biochemical **variables**.

The study showed an association of some of the risk factors only with some of the identified types of cataracts. Multivariate polychotomous logistic regression analysis demonstrated increased risk of cataract with lower educational achievement(all types of cataract), decreased cloud cover at place of residence (all types), use of aspirin less than once a month (Posterior subcapsular and mixed), diets low in proteins (posterior subcapsular, nuclear and mixed) higher blood pressure (nuclear and mixed), lower body mass index (nuclear and mixed), use of cheaper cooking fuels (cortical, nuclear and mixed), and lower levels of antioxidant index based on red blood cell level of glutathione peroxidase and glucose 6 phosphate dehydrogenase and plasma level of ascorbic acid and vitamin E (posterior subcapsular and mixed). All the risks were significant only for the specific cataract types. This emphasises that there is a need to investigate the epidemiology of specific types of cataract.

OPERATIONAL RESEARCH ON MOBILE EYE CAMPS

ICMR cataract studies estimated a cataract backlog of 7.53 million cases with majority in the rural areas. The concept of eye camp represents a revolutionary approach which was promoted by pioneers in the late sixties to provide curative services to these patients at their door steps. Subsequently, a large number of governmental and NGOs started organising eye camps. A need was felt to critically evaluate the existing eye camp methodology & standardise the eye camp organisational techniques. ICMR therefore conducted a project on Operational Research of Mobile Eye Camps (MEC) during 1986-88. Social scientists and ophthalmologists were both involved in the study of these Eye Camps since a lot of the issues involved Health Education & Rehabilitation of blind persons.

A total of 15 Eye Camps were studied. The reasons for success of the camps was the obvious commitment of the organisers with the idea of doing "seva" which lent credibility to the organisers. The cooperation which comes forth in MECs organised by voluntary agencies or charitable trusts was lacking in Govt. agencies organising the MEC. The Doctors/staff behaviour and facilities available contributed highly towards patient's satisfaction leading to success of the camps.

From the technical point of view, the study revealed that most of the eye camps had followed the prescribed norms. But in some of the camps the deviations from prescribed guidelines of NPCB are conspicuous which can jeopardise the results of surgery.

The most observed lacuna highlighted by the Social Scientists was the low importance given to educational component of eye health care, particularly regarding preventive, promotive and rehabilitative aspects of the incurably blind. The fact that awareness and concern about eye health care would not only enhance the need for utilisation of services but also increase eye health consciousness to benefit the community was never felt by the organisers at any stage of the camp.

Ocular Infections

One of the earliest studies undertaken by the Council was on trachoma (in 1956) as one of the causes of blindness. Infection is one of the important causes of ocular morbidity especially in the economically weaker sections of the community and in the rural areas where eye care facilities are not readily available. This prompted the Council to initiate two projects in the field of ocular infections.

A Centre for Advanced Research on Ocular Infections was set up in Guru Nanak Eye Centre, Delhi. This Centre worked on developing alternative strategies for facilitating case detection and early diagnosis of ocular infections. One of the aspects studied was transportation of clinical specimens to a laboratory for facilitating identification of the causative organisms. Filter paper strips were found to be an affordable and viable alternative with exception of infections caused by organisms sensitive to drying like N. gonorrhea. A test for rapid identification of fungal infections was developed using SDA slides for culture. This provided positive identification with 48-72 hours as compared to 5-6 days for culture on SDA slant. This center also prepared a monograph on ocular fungal infections.

In another project, the Council aided in setting up Centre for Research on Chlamydial Infections, which is the only one of its kind in the whole South-East Asian Region. This Centre has conducted several studies on the sero-prevalence of chlamydial infections in different groups of people. A total of 5000 samples have been tested for chlamydial antibodies of which 28.6% were positive. Among the positive cases more than 75% had antibodies against *Chlamydia pneumoniae*. Of the 286 samples tested for chlamydial antigen, 30% showed a positive result.

The Centre has used the chlamydia antigen from egg culture to produce antibodies in rabbits, which was later fused with mouse myeloma cell line to form hybridoma cell lines producing monoclonal antibodies. Four such clones have been developed by the Centre. The antibodies produced have been conjugated with peroxidase for the antigen capture EIA test for use in diagnostic kits. The Centre has thus developed the expertise to produce monoclonal antibodies for indigenously manufacturing kits for diagnosis of active chlamydial infections.

This Centre is also engaged in training of various personnel in the techniques of diagnosis of chlamydial infections anywhere in the body including pulmonary, genital, ocular and other sites. This Centre is also functioning as a reference center for diagnosis of chlamydial infections in the South-East Asia region.

Glaucoma

Prevalence

Glaucoma is an important cause of permanent visual impairment and blindness all over the world. According to the estimates of International Agency for Prevention of Blindness (1980), glaucoma alone is responsible for 20% of blindness in the world. In developed countries such as USA and Great Britain, glaucoma accounts for nearly 8% of all cases of legal blindness. In African countries, blindness due to primary glaucoma varies from 8% (Malawi) to 20% (Nigeria and Ghana). In Asian countries the prevalence of glaucoma blindness varies from 0.5% to 36.3%, with lowest figure quoted from India. However, according to Blindness Survey of India carried out by National Program on Control of Blindness (1986-89), glaucoma as a cause of blindness accounts for 1.70% of the blind population.

The relative frequency of primary angle closure glaucoma and primary open angle glaucoma differs in various populations. For example, primary angle closure glaucoma is rare in blacks but it is seen more commonly in Japan, India, Burma, China, Indonesia and Eskimos. According to the estimates the comparative frequencies of primary angle closure glaucoma and primary open angle glaucoma vary from 1:4 to 1:6 among the Caucasians and Black races as compared to Orientals and Eskimos, where the ratio is reverse. The exact cause of this higher prevalence of primary angle closure glaucoma in Orientals and Eskimos is not fully established.

Very few studies have been conducted to find out the prevalence of various forms of glaucoma in Indian population.

Sood et al (1968) conducted a study on the prevalence of glaucoma in 496 individuals in the general population of Pondicherry in the age group above 35 years. A prevalence of 7.2% was detected. Other studies on the prevalence of glaucoma in India are hospital based studies. The prevalence rate in different studies varies from 7% to 31.3%. On critical evaluation, from epidemiological point of view, these studies are not comparable because they are unrepresentative. The cut off age, method of examination, method of measurement of intraocular pressure and definition of glaucoma are varied. In none of the studies the assessment of anterior chamber depth and gonioscopic examination has been carried out to identify the cases of angle closure glaucoma. The identification and segregation of primary angle closure glaucoma is important not only from the point of view of epidemiology of glaucoma, but from the therapeutic view also. The permanent visual impairment and loss of vision due to glaucoma can be prevented by early detection and appropriate medical, surgical and laser treatment as soon as the disease is detected.

The Council has initiated an epidemiological study which is a community based study being conducted at Angamally covering a sample of 20,000 persons above 35 years of age. The main objective is to determine the prevalence of various types of glaucoma in the population. Screening is being done at the village level by an ophthalmologist and an optometrist.

Management

Glaucoma is an asymptomatic disease in most instances and tends to spare the central visual acuity till the end. Illiteracy and ignorance about ocular disease abound in the community and visual loss with age is equated, by and large, with cataract progression, and hence patients do not seek medical attention early enough.

Glaucoma as an ocular disease is very exacting in nature in that it requires long term drug therapy, strict patient compliance, periodical monitoring of ocular parameters and a reliable follow up. Long term management with drugs is economically difficult and these are not freely available.

It is observed that medical management of glaucoma is less than ideal, given the poor cost benefit ratio and unreliable patient compliance and follow up. A primary surgical treatment at an early stage of the disease would perhaps be the ideal in the given circumstances. A success rate of 80%-90% is observed with primary surgery. In cases where a surgical procedure is not successful, topical drugs, antifibroblastic wound modulation and the glaucoma valve may be used to protect vision.

The Council has therefore initiated a national multicentric project to assess the short term and long term efficacy of management of glaucoma in Indian situation.

NEW AREAS IDENTIFIED FOR RESEARCH IN THE COMING YEARS

The ICMR has recently convened a core group of ophthalmologists who met and reviewed the current status of research in the country including the areas which have hitherto been overlooked and are now assuming importance due to the changing scenario of ocular diseases due to the shift in the socio-demographic profile of the country. The group identified some major areas for concentrated research. A coordinator has also been designated for each of the specific areas who would be identifying potential investigators and reviewing the project proposals. The areas and the coordinators are as follows :

Thrust Area	**Coordinator**
Cataract research with special emphasis on surgical outcome.	Dr. D.K. Mehta, Director, Guru Nanak Eye Centre, Maharaja Ranjit Singh Marg, New Delhi - 110002. Ph.3236931 Fax 3230033
Identifying risk factors for cataract and molecular research in cataract	Dr. D. Balasubramaniam, Director Research, L.V.Prasad Eye Institute, L.V. Prasad Marg, Banjara Hills, Hyderabad - 500 034. Ph. 040-3548098 Fax 040-3548271
Childhood blindness with special emphasis on early diagnosis and management modalities.	Dr. Tarun Sharma, Consultant, Vision Research Foundation, Shankara Netralaya, 18, College Road, Chennai - 60000 006. Email drts@sankaranethralaya.org Ph 044-8271616, 9435; 8261265,5402 Fax 0448254180
Diabetic retinopathy (DR) with special emphasis on population based epidemiological data, evaluating various models for early diagnosis, developing modules for training of doctors including general practitioners and ophthalmologists	Dr. P. Namperumalsamy, Director, Arvind Eye Hospital, P.G.Instt. of Ophthalmology, 1, Anna Nagar, Madurai - 625 020. E mail dr.nam@aravind.org Direct phone: 0452- 531709 Fax : 0452-530984

Age Related Macular Degeneration (ARMD) with special emphasis on epidemiological studies for risk factors, genetic factors, environmental and occupational factors and the rehabilitation needs of this group.	Dr. Amod Gupta, Prof. & Head, Deptt. Of Ophthalmology, P.G.Instt. of Medical Education & Res., Chandigarh - 160012. Ph. 0172-715663
Corneal diseases with special emphasis on corneal preservation and eye banking activities.	Dr. G.N. Rao, Director, L.V.Prasad Eye Institute, L.V. Prasad Marg, Banjara Hills, Hyderabad - 500 034. Email gnrao@lvpeye.stph.net Ph. 040-3548098 Fax 040-3548271
HIV and ocular manifestations	Dr. D.K. Mehta, Director, Guru Nanak Eye Centre, Maharaja Ranjit Singh Marg, New Delhi - 110002. Ph.3236931 Fax 3230033
Ocular Infections - Multicentric studies for evaluating the pattern and sensitivity of organisms across the country along with the environmental criteria.	Dr. H.N. Madhavan, Prof. Of Microbiology, Vision Research Foundation, Shankara Netralaya, 18, College Road, Chennai - 60000 006. Email drhnm@sankaranethralaya.org Ph 044-8271616, 9435; 8261265,5402 Fax 0448254180