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Aravind Eye Care System: Giving the Most Precious Gift

In 1976 when Padmashree Dr. G. Venkataswamy,¹ or Dr. V. as he was popularly known, retired from the Government Medical College, Madurai,² as head of the Department of Ophthalmology, he was determined to continue his work of providing quality eye care to the rich and poor alike--the work he had started at the Government Medical College, Madurai. His work involved organizing rural eye camps where vision was checked and corrective glasses were prescribed, cataract was diagnosed, and corrective and preventive measures for proper eye care were explained to patients. Dr. V. was seized with the passion of eradicating needless blindness, first from his home state Tamil Nadu, and then the country. He made this his life mission. It deeply pained him that an estimated 45 million people worldwide and 10 million in India had lost the precious gift of sight, most often quite needlessly. To carry out his mission, after his retirement, Dr. V formed a non-profit organization, which he named Govel Trust, investing all his life savings in it³. He was the Chairman of the trust and his two brothers, two sisters and their spouses became the trust members (Dr. V remained a bachelor throughout his life). The President of Madurai Main Rotary was taken as an ex officio member. In 1976, the Govel Trust set up a modest 11-bed hospital, named Aravind Eye Hospital (AEH), in the house of one of Dr. V.'s brothers at Madurai. In this hospital, five beds were for paying patients and six were reserved for free patients.

By 2003, the humble 11-bed hospital had grown to become the Aravind Eye Care System (AECS) comprising a chain of hospitals; a centre for manufacturing synthetic lenses, sutures, and specific eye pharmaceuticals; an institute for training; an institute for research; an international eye bank; a women and child care centre; a post-graduate institute of ophthalmology; and a centre for community outreach programmes (Exhibit 1). In a span of

¹ Awarded in 1972 by the Government of India. Padmashree is one of the top civilian honours conferred by the government every year for outstanding work in different fields.

² Madurai is a famous temple city and is the third largest city in Tamil Nadu.

³ The name was formed taking the first letter of Dr. V.'s father name, Govindaswamy, his own name Venkataswamy, and his mother's name Lakshmi.

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23 years, AEH in Madurai had become a 1500 bed hospital that performed nearly 95,000 eye surgeries every year. In addition, there were four more AEHs located in Tirunelveli, Coimbatore, Theni, and Pondicherry (Map 1). The five hospitals together performed a total of 190,000 surgeries every year, or about 45 per cent of all eye surgeries done in Tamil Nadu and five per cent in India. The persons at the helm of this system were Dr. V., his sister, Dr. G. Natchiar, and her husband, Dr. P. Namperumalsamy (Dr. Nam).

In March 2003, one of the case writers met Dr. V., Dr. Nam and Dr. Natchiar in Dr. V.'s office. It was 8.30 in the morning and Dr. V., then 85, was busy planning his day's schedule. Dr. V. began the interview by saying:

Despite all our efforts, so many people with problems with their vision have still no access to hospitals. Much of the blindness can be corrected through surgery. But they are afraid of operations. So we have to increase the awareness of the causes of blindness and the need for early treatment. Even in villages where we conduct eye camps, only seven per cent of people with eye problems turn up. We have to do more to create demand.

Most of this blindness is needless and curable. We have to eradicate all needless blindness...

Dr. Nam was equally enthusiastic about this vision:

At present we do about 3.6 million eye surgeries in India. If this can be increased to 5 million, needless blindness can be eradicated. We do about 2,600 surgeries per doctor per year in our Aravind Eye Hospitals. The all India average is about 400. It is possible for other hospitals to come up to our level of productivity. We are willing to help them to do so.

Dr. Nam further added:

We perform 95 per cent of our cataract surgeries with insertion of intraocular lenses (IOL).⁴ The all India average of IOL surgeries is only 60 per cent and in some states like Bihar, it is only 30 per cent. We have to raise this percentage through training of doctors.

Dr. Natchiar informed the case writer:

All our systems are oriented towards enabling the doctors to be at their productive best. We support them through well-trained paramedical staff. Community outreach programmes are central to our mission, since most of the blind are poor and are in rural areas.

History

Dr. V. was born in 1918 in a small village near Madurai. His father was a reasonably well-to-do farmer. Dr. V. studied in the local school and then went to Chennai to do medical studies.

⁴ See later.

He completed his M.B.B.S. in 1944 from Madras University and joined the Army Medical Corps in 1945, but was discharged in 1948 after he developed severe rheumatoid arthritis. Arthritis incapacitated him to such an extent that he could not hold even a pen. However, with sheer perseverance and will power, he not only started to write but was also able to wield the surgeon's scalpel.

He then joined Government Medical College, Madurai as an ophthalmic surgeon and rose to become the Head of the Department of Ophthalmology in 1956. In 1961, Dr. V. pioneered a state-level programme of outreach eye camps to address the problem of blindness in the state. People living in distant villages came to these eye camps to get their eyes tested, diagnosed, and treated. In 1965 Dr. V. visited the United States to attend a conference on the rehabilitation of the blind. It was at this conference in New York that he struck a life-long friendship with Sir John Wilson, the founder of the Royal Commonwealth Society for the Blind (now known as Sight Savers International), an organization that had been supporting eye camps in India. Dr. V. and Sir John Wilson met the then Prime Minister of India, Mrs. Indira Gandhi, to ask for support for setting up a national organization to control blindness. Dr. V. had also attended to the then Chief Minister of Tamil Nadu, Mr. M. Karunanidhi, who supported the government sponsored eye camps all over Tamil Nadu spearheaded by Dr. V. So even before he retired, Dr. V. was overseeing the growing network of eye camps in the state. He had also developed a network of friends and well wishers across India who empathized with his passion for providing good quality affordable eye care.

In 1976 when the Govel Trust was founded. Dr. V.'s sister Dr. G. Natchiar, and her husband Dr. Nam were also ophthalmologists at the Government Hospital, Madurai. So when Govel Trust decided to set up Aravind Eye Hospital (AEH) in Madurai, Dr. V. persuaded them to join the hospital. Over the years other family members (all doctors) joined to head different specialties. Many (including Dr. V., Dr. Nam, and Dr. Natchiar) received training in the United States and were highly competent surgeons.

Dr. V. was profoundly influenced by Mahatma Gandhi and Sri Aurobindo Ghosh, the sage philosopher who had founded the ashram in Pondicherry. He always felt a strong urge to do something for the society (rather than take from it). In an article in 2001 Dr. V. wrote:

Many people often ask me: What made me take up a task of such magnitude at the age of 58? I guess I drew my inspiration from the legacy of our great forefathers... Besides, there were inspirational leaders like Mahatma Gandhi and Sri Aurobindo whose philosophy and way of life influenced many. Naturally I felt impelled to give something back to this great land of ours.⁵

He named the hospital after Sri Aurobindo as a tribute to this great sage.

Initial Growth

In 1976 Dr. V. put in his personal savings to set up AEH, Madurai. However, for cataract surgeries of poor patients from eye camps AEH received partial government support.⁶ From

⁵ Aravind Eye Care System (2001), Promises to keep. Madurai: Aravind Eye Care System. (Page number?)

⁶ Partial in the sense that though the government paid an amount for each surgery performed on poor patients in the eye camps, this fell quite short of the total cost of the surgery.

the beginning, Dr. V. had insisted on following the policy of taking both paying and free patients. The paying patients were charged moderately, same as other comparable hospitals in the city. There were to be no “five star” customers to cross-subsidize poor patients. Dr. V. was certain that high productivity and large volumes were necessary for the hospital to become viable, and also to generate a surplus for providing funds for expansion.

As a result, the AEH, Madurai started generating a surplus from the very beginning, and within one year, it opened another 30 bed hospital. In 1978, an exclusive 70-bed hospital was built for free patients. The hospital presently used for paying patients was built in 1981 with 250 beds in a five floored building of 80,000 sq. ft. Dr. V. and his team initially focused only on cataract surgery, but other specialties such as retina, cornea, glaucoma, paediatric ophthalmology, neuro-ophthalmology, uvea, low vision, and orbit were gradually added. No compromises were ever made on equipments: they were of the best quality and many were imported. However, the waiting halls, examination rooms and doctor's chambers were Spartan and utilitarian.

In 1984, a new 350 bed hospital was opened to cater exclusively to free patients in Madurai. The top floor of this building housed the nurses' quarters. From the beginning, AEH had the policy of not conducting surgeries at eye camps as was the common practice at that time.⁷ The eye camps were for poor patients. Everyone who came to these camps was checked free, and those who needed surgery were brought to the main hospital. Patients did not have to pay for the surgery but they had to bear the cost of the intra ocular lens (IOL). The cost of IOLs was quite high. So in 1992, a new manufacturing facility, Aurolab, was set up to produce IOLs at an affordable cost. These lenses brought down the cost of IOL implant surgery to about ₹500 (which covered the cost of IOL, special sutures, and medications). AEH also took up intense counselling on IOL implant surgery and health education for both the walk-in free patients at the base hospital and those attending eye camps. Though these patients were required to pay ₹ 500 for IOL implant, in deserving cases, the doctor in charge at the Outpatients Department had the power to waive it. Later, in 1995, when the Government of India launched a cataract blindness control programme with World Bank funding and offered a subsidy for the camp patients, the camp patients were not charged this amount. In stages, the number of free beds increased to the present number of 1468 beds (1200 free and 268 paying) in the hospitals in Madurai.

By the end of 1990s, Govel Trust ventured into other towns of Tamil Nadu. An 874 bed hospital was set up in 1997 in Coimbatore, the second largest city in Tamil Nadu. In 1985, a 100 bed hospital was opened at Theni, the birth place of Dr. Nam, a small town 80 kilometres west of Madurai. Theni catered to additional eye camp patients. In 1988, another hospital with 400 beds was opened at Tirunelveli, a town 160 kilometres south of Madurai. Then to cater to the people of north Tamil Nadu, in 2003, a 750 bed hospital was set up in Pondicherry. Though Pondicherry was a Union Territory, it came within the geographical area of Tamil Nadu and it was also the town where Aurobindo Ashram was located. As of 2003, the five hospitals of AECS among them had a total of 3,649 beds, of which 2,850 were free and 799 were paying beds (Exhibit 2).

From Hospital to Eye Care System

Initial focus of the Govel Trust was on building hospitals and reaching out to the poor with quality surgery. However, Dr. V. soon realized that to reach the ultimate goal of eradicating

⁷ Surgical eye camps are not very common now and are officially discouraged by the government.

needless blindness through affordable and quality eye care AEHs, would have to undertake several other activities. Thus over the years, AEHs evolved to become Aravind Eye Care System (AECS). AECS went into manufacturing of lens, undertook research and training activities, got involved in community health, etc. In 2003 the main divisions of AECS 2003 were: Aurolab for manufacturing intraocular lenses; Lions Aravind Institute of Community Ophthalmology (LATCO), a training centre; Aravind Medical Research Foundation, a centre for ophthalmic research; Aravind Centre for Women, Children and Community Health, a research centre for women and children; and the eye bank, the Rotary Aravind International Eye Bank.

Blindness in India

Blindness could be classified into different categories (Exhibit 3). In India, about 12 million people were bilaterally blind and another 8 million were blind in one eye. About 36 million had low vision, needing regular monitoring.

State wise variation in blindness across country was considerable. For example in the age group of 50 years and above (this group accounted for 90 per cent of country's blindness which was about 16 per cent of the population), it varied from 4.3 per cent in Kerala to 13.7 per cent in Karnataka.

Cataract was the most common cause of blindness, accounting for 62.6 per cent, followed by uncorrected refractive errors (19.7 per cent). The other important causes for bilateral blindness were glaucoma (5.8 per cent) and posterior segment pathology (4.7 per cent).

Exhibit 4 gives a cross-section of the human eye, and a brief description of the common diseases and their treatment. Every year around 9000 ophthalmologists undertook an estimated 3.7 million cataract surgeries in India. In Tamil Nadu (population as per Census 2001: 62,110,839), 370,031 cataract surgeries were done in 2001-2002. Government hospitals did about 7.17 per cent of these; 10.16 per cent were done in eye camps, 7.86 per cent in private clinics, and the rest (74.82 per cent) by non-profit organizations like AEH.⁸ Other major private eye hospitals in Tamil Nadu and the number of surgeries done by them per year, as per the information given by Aravind Eye Care System, were:

| | |
|-------------------------------------|--------|
| Sankara Nethralaya, Chennai | 25,000 |
| Joseph Eye Hospital, Tiruchirapalli | 27,000 |
| Sankara Eye Society, Coimbatore | 30,000 |
| K.G. Eye Hospital, Coimbatore | 6,000 |

As on 2003, the all India average of IOL implantation surgery was 65.4 per cent of which Tamil Nadu with 91 per cent surgeries was at the top followed by Andhra Pradesh (79.7 per cent), Orissa (79.3 per cent), and Maharashtra (71.5 per cent).⁹

Eye camps were a popular way to reach out to rural population. Generally charitable trusts or individuals sponsored eye camps. Prior to the date of the camp, there would be a publicity campaign through pasting of posters, distribution of pamphlets and announcements from moving vehicles. The cost of surgery and treatment was supported by

⁸ Achievements under cataract blindness control project: 1994-2002, *Quarterly Newsletter of National Programme for Control of Blindness and Vision 2020: The Right to Sight Initiative*, 1 (2), July-September 2002.

⁹ *Ibid.*

the State and Central Governments and institutions such as the World Bank. Eye camp check-ups and subsequent treatment were free for patients.

Work Flow at AEH

Outpatient Departments

The workflow in the outpatient departments (OPD) of different units of AEHs, both paying and free, was essentially the same¹⁰. All OPDs began work at 7 a.m. Patients would gather much before the starting hour and wait in the designated waiting areas. Sharp at 7 a.m., the registration process would begin. The computerized registration took about one minute per patient. After registration, patients would move to the case counter located adjacent to the waiting hall. The case history of the patient would be taken by the staff and a computerized case sheet would be given to the patients. Then they would be escorted to the designated doctor. Three computers were kept for recording new cases and one for old cases. These computers could handle around 200 cases per hour. Trained paramedical staff did the preliminary checks of patients, and paramedics trained in refraction testing conducted the basic refraction tests. There were four to five examination stations where the resident doctors examined the patients. They would record their diagnoses and recommendations. After this, a permanent doctor of the hospital would examine the patient, check the diagnosis and the recommendations of the resident doctor, and confirm the diagnosis and treatment, or modify them, as needed. The whole process usually took about two hours but it could vary depending on the tests needed. The OPD in the paying units examined around 1000 patients a day, six days a week.

Patients who were advised glasses after the refraction tests had the option of going to one of the spectacle shops located in the hospital. These shops were run as a separate profit centre. These shops sold spectacles at a price lower than the market rate. Both free and paying hospitals had separate shops but the prices of similar spectacles were the same. Patients received the spectacles the same day because the grinding of the glasses and fitting were done in-house. The system of in-house spectacle shop at AEH thus saved patient's time. They would leave the hospital with glasses, in a time slot of three to four hours.

For those patients who needed surgery, there were two options. Subject to availability of rooms, they could decide to get admitted immediately or schedule a later date. Paying patients could also choose the mode of surgery, the type of lens to be fitted and the type of room. They had the option of deciding on the doctor who would carry out the surgery.¹¹ All these requests were fed into the computer, and patients would be handed out an admission/reservation slip.¹² AEH had a set of counsellors who explained the various options, surgical procedures, post-operative care needed, cost of different types of surgeries, cost of rooms, and generally helped patients to make their choice. Dr. Aravind Srinivasan, a senior doctor, who accompanied one of the case writers on a tour of the hospital said:

In many hospitals, many of these functions (especially refraction testing) are carried out by doctors. We seek to maximize the doctors' contribution by helping

¹⁰ The description below has been based on the observations of the case writers at the Madurai hospital.

¹¹ Free patients could not choose their doctors. We were told that actual exercising of this facility even by paying patients was not very common.

¹² For free patients, phaco surgery was not available. Of course, all except those contra-indicated were given IOLs, but free patients were given only rigid lenses.

them to devote their time mainly to medical advising. Tests that can be done by paramedical staff are assigned only to them. Our counsellors are highly trained to help patients to take informed decisions, so that doctors are not required to spend their time on such matters.

The flow of patients was smooth. They received clear directions and paramedical personnel were stationed at critical places for directing people, thus avoiding confusion and crowding. As a result the waiting halls were not crowded - quite unusual in a hospital of this size in India.

All surgeries were done in the morning. Afternoons were for attending OD. The doctors were rotated between free and paying hospitals, so that both categories of patients received similar quality of medical attention.

Surgical Wards

The workflow in the surgical wards in Madurai was equally smooth and efficient. At 6.45 a.m., one of the case writers was picked up by Dr. Aravind Srinivasan to observe the procedure for cataract surgery.

At 7 a.m., the doctor and the case writer were in their surgical gowns and masks. The names of patients undergoing surgery during the day had been put up in each theatre. This scheduling was done by using a software that incorporated patient's preferences including preference for a particular doctor. The nursing staff reported at 6.30 a.m., and the patients for the day were already in the ward adjacent to the operating theatres. The patients who were to be operated were administered local anaesthetic injections, and their eyes were washed and disinfected. At 7.15 a.m., when the case writer accompanied Dr. Srinivasan inside the operation theatre two patients were on two adjacent operating tables. Most hospitals avoid two operating tables in the operation theatre because of high risk of infection. However, AEH had been following this system from its inception and had not had any problems, perhaps because, generally eye patients were otherwise healthy and the chance of cross infection was considered to be very small.

The operation theatre had four operating tables, laid out side by side. Two doctors would operate, each on two adjacent tables. Dr. Aravind's first patient was already on the first table, with microscope focused, instruments ready and the nurses fully attentive. The case writer watched Dr. Srinivasan carry out a phaco procedure on the TV screen; the procedure was being transmitted through a camera attached to the microscope. The doctor kept giving a description of what he was doing for the benefit of the case writer. The entire procedure took about 12 minutes; the team consisted of one doctor and four nurses.

By the time the first operation was over, the second patient was ready to be operated on with the microscope focused on the eye. Dr. Srinivasan moved straight to the second table. Meanwhile the first patient had been bandaged by the nurses and moved out. The third patient walked in and was sitting on a bench in the theatre. As soon as the first patient moved out, the third patient was put on the first table and was readied for the operation.

The case writer observed that, as soon as the second surgery was over, the doctor moved back to the first table with virtually no loss of time. He was constantly moving between the

two tables with hardly any break. In the same way, another doctor operated on the third and the fourth tables. After the day's surgeries Dr. Srinivasan said:

I work like this the entire morning from 7 a.m. till 1 p.m. or 1.30 p.m., or even later, if there is a large number of patients to be attended to. Most doctors take a short time off for breakfast and a brief five to ten minutes break for tea. I usually do about 25 surgeries in a half-day session. Most do this number.

In the afternoon, the operating theatres were scrubbed and cleaned and instruments sterilized. The patients who had already been operated on were moved back to their wards.

The procedure in the hospitals at Theni and Coimbatore was similar. AEH, Coimbatore was a newer and a better well designed and integrated hospital. It had all the specialties and facilities needed for conducting the Dip NB (equivalent to MS) programme. It also conducted short-term specialized programmes for doctors from other developing countries. The basic workflow for outpatients and surgeries was the same as it was in Madurai. AEH Theni was smaller than other hospitals and did not do paediatric and retinal surgeries.

Exhibit 5 gives the details of number of surgeries done and outpatients attended to from 1997 to 2003 by all hospitals under the AECS. Even in a small hospital like Theni, the three doctors stationed there performed 6,000 surgeries every year. We were told that in most eye hospitals, a surgeon did about 300 surgeries per year, while in AEHs they did about 2,500 surgeries per year. Exhibit 6 gives details of out patients' visits and major surgeries done in each hospital of the AECS.

Dr. Aravind Srinivasan explained:

We work like this for six days a week. On most Sundays we go out to eye camps and spend at least half a day testing patients. Sometimes if one is lucky, one may get one Sunday off in a month.

He continued:

Besides surgery, we do outpatient work, and many do research as well. To us, this hospital is our life. We have dedicated our lives for this one mission.

The paying wards had regular beds but the free wards had "beds" in the form of mats placed on the floor. Two types of mats were used to distinguish eye camp patients from walk-in free patients. The use of mats enabled better utilization of floor space — about 30 patients could be accommodated in one room.

AEH, Madurai, had an excellent IT system that kept track of all patients. The system generated daily schedules taking into account the load on that day, patients' preference for any doctor, and pending work. This enabled the hospital administration to keep track of the workload in different units. Details of complications in terms of categories of patients and surgeons were maintained. Abstracts of medical records of patients were entered into the system, including their past clinical visits, and this enabled a history sheet to be generated for an old patient quickly.

The data on the complication rates of AECS' hospitals revealed that quality of surgery was given high priority. AECS management kept a very close track of the intra-operative as well

as post-operative complication rates. According to AECS doctors, the major complications were under control and the figures for complications were considered highly satisfactory. All the same, each case of complication was traced to the operating team that had performed it and the reasons identified. Corrective action, including training of whoever was found deficient, was undertaken. Exhibit 7 gives the complication rates of AEH, Madurai, in 2002. Exhibit 7a provides complication rates of AEH, Coimbatore, and that of the Royal College of Ophthalmologists, UK.

Eye Camps and Community Outreach Programmes

The AECS considered its community outreach programmes to be absolutely vital to its mission. The only way people in many rural areas could get access to eye care was through eye camps. These camps were organized by different agencies and conducted differently. AECS conducted about 1500 eye camps every year.

Each of the hospitals of AECS had its own set of camp organizers who planned their activities for each calendar year, and these were coordinated from Madurai. Generally each district had a camp organizer who would set a target for the year based on the population, estimated percentage of blind people, estimated turnout at the camps, and percentage needing surgeries. The camp organizers then had to find sponsors. However, finding sponsors was not a problem. They comprised local NGOs, Lions and Rotary Clubs, local industrialists and businessmen, and philanthropists. Sponsors took care of the expenses connected with the publicity such as pamphlets, banners, and announcements from moving vehicles using a public address system, and the organization of the camps (usually in some school or public place). The camps were held usually on Saturdays and Sundays and started early in the morning. Lunch arrangements were made for those who had to undergo surgery at the base hospital. These expenses were also borne by the sponsors. The sponsors provided free transportation to and from the hospital to the patients. The hospital, in turn, met the cost of surgery, stay, and food in the hospital. It also provided free post operative medication for 40 days.

Doctors (mostly post-graduate residents) and paramedical staff usually reached the camp site previous evening to supervise the arrangement and, depending on the distance, would camp for the night. In the morning, patients were first registered with the help of local volunteers, and then given a case sheet and an identity card. The identity cards helped in future follow-ups. The paramedical staff conducted the preliminary tests for refraction, and patients above 40 years of age were tested for intra-ocular pressure to screen for glaucoma. Senior doctors evaluated the test findings, carried out final examination, reviewed patient records, and then made the final diagnosis and prescribed treatment. An optician also accompanied the team, with a large stock of spectacles with commonly prescribed powers. Thus those who were advised glasses could purchase them on the spot and the glasses would be delivered to them within one hour. About 75 to 90 per cent opted to purchase spectacles at the camp site and over 85 per cent got them immediately. The rest got them the following week at the same campsite, or they were couriered to them at AECS' cost. This innovation of having a mobile optical shop at campsite was decided after a study of barriers to refractive correction. Mr. R.D. Thulasiraj, Executive Director, LAICO, (who was earlier the administrator of AEH, Madurai) explained:

We found that the cost associated in procuring a pair of glasses (which included a couple of visits to the shop, a second visit to the doctor for a final check up, etc.)

was higher than the actual cost of the pair of glasses. If the cost of time, travel, and other incidental expenses were put together, getting a pair of glasses became prohibitively expensive. As a result, we found out that many people who were checked at the camps did not bother to get their glasses and the cycle of needless blindness/poor sight continued.

We decided that if this cycle had to be circumvented, it was important to be able to provide glasses to eye camp patients soon after the refractive errors had been detected. An analysis of the data revealed that the most time-consuming part of readying the spectacles was preparing the glasses correctly as per prescription. Based on the large data AEH had of the probable refractive needs of patients, a forecast was made before each eye camp as to how many lenses in each power should be taken to the camp to meet the projected need. The fitting of the glass to the frame was done at the camp site and spectacles were provided there and then to patients. However, patients did have the choice of not buying the spectacles at the camp.

In the advertisement of the camp, patients coming for the check-up were usually advised to come prepared to go to the base hospital for surgery, if necessary. Thus most came with their bags and, often, with relatives who would accompany them. Persons needing and willing to undergo surgery were then counselled about the procedure, length of stay, and facilities at the base hospital. If they agreed to surgery, then they were taken to the base hospital after lunch. They would be operated upon either the next day or the day after depending on the workload. Their basic needs such as food during their stay were taken care of by AECS.

Generally people from the same or adjoining villages travelled together, were operated on the same day, and stayed together in the hospital. They thus formed a support group. This group of patients and relatives returned after about three days in a transport provided by the hospital. The hospital also met the cost of surgery including cost of IOLs, sutures, and post-operative medication for forty days, of which the government reimbursed to the extent of ₹ 500 per patient.¹³ The cost of the doctors' travel to and from the camp sites was mostly met by the hospital.

The cost of an eye camp to the sponsor varied depending on the nature of the camp. A "small" camp with 300 outpatients (leading to about 60 surgeries) generally cost ₹ 6,700 while a large camp with 1,000 outpatients and 200 surgeries could cost ₹ 42,500 to the sponsor.

The Theni hospital conducted eye camps in two districts in the adjoining state of Kerala and AEH Pondicherry was expected to reach out to some of the villages in the neighbouring state of Andhra Pradesh.

Exhibit 8 gives the number of camps organized by AECS from 1998 to 2002 and the numbers of patients treated from camps (apart from "walk-in" free patients at the hospitals).

¹³ Actually, this was reimbursed based not on the number of patients operated but who turned up at the follow-up camp. Since many did not turn up in these camps, the hospitals were denied reimbursement to that extent.

Other Community Outreach Programmes

Diabetic Retinopathy Management Project: This project was initiated in 2000 with the aim to create awareness about diabetic retinopathy in the rural communities. In 2002, 46 eye camps were organized in which 11,644 persons were examined. Of these, 3,443 were diabetic, who were screened for retinopathy, and of these 533 were found to have retinopathy. Some of them were advised surgery. Extensive campaigns were also conducted through leaflets, posters, and booklets on diabetes and its effect on the retina.

Community Based Rehabilitation Project: In 1996, Theni hospital, with the support of Sight Savers International, undertook to rehabilitate incurably blind persons by providing community based support. House-to-house identification of eye problems and screening camps were organized and patients with eye problems were treated. Rehabilitation consisted of teaching the incurably blind people skills in orientation, mobility, and activities of daily living. Some were economically rehabilitated through building of appropriate skills.

Eye Screening of School Children: In this project, teachers were trained to detect eye defects in children to take early corrective measures. They were also taught to measure visual acuity, identify signs of squint and vitamin deficiency. The children were then tested by ophthalmic assistants and later by ophthalmologists. In 2002, 68,528 children in 80 schools were screened and 3,075 were given glasses to correct refractive errors.

Use of IT Kiosks for Tele advice: This initiative was launched with the help of the Indian Institute of Technology (IIT), Chennai. Under the guidance of Dr. Ashok Jhunjunwala, a faculty member of the institute, a number of IT kiosks were being put up all over Tamil Nadu by a company called n-Logue. In one cluster of villages near Melur, about 40 km. from Madurai, the IT kiosks were provided with web cameras that enabled patients to screen the picture of their eyes and email them along with a voice description of the problem to doctors at AEH, Madurai. One doctor was nominated to take care of these emails. The doctor would make the diagnosis based on the description given by the patient and the picture sent, and then advises the patient. This was, however, not an on-line service.

Other Units and Activities of AECS

Aurolab

The cost of surgery was always a central concern at AECS. As noted earlier, AECS had decided on adopting the IOL implant surgery as the standard operative procedure for all cataract cases. However, the cost of IOL lenses which had to be imported was very high, about \$80-100, and this made the cost of surgery quite high. In 1991, AECS set up Aurolab as a separate non-profit trust to manufacture lenses. Its mission was to achieve "local production at an appropriate cost". Some of the members of the Aurolab Board were also members of the Govel Trust. The technology was obtained from IOL International, Florida, USA, with a one-time fee for technology transfer along with a buyback arrangement. This helped in maintaining quality. This venture was also supported by Seva Foundation, Sight Savers International, the Combat Blindness Foundation, USA, Canadian International Development Agency (CIDA) through Seva Service Society, and David Green, an Ashoka Fellow and Executive Director of Project Impact Inc. in California.

Out of the 220 employees of Aurolab, 10 per cent were either diploma or graduate engineers, pharmacists, and marketing personnel; and 90 per cent were women technicians. Girls from rural areas with 12 years of formal education were selected and given the same training that was given to ophthalmic assistants, for a period of six months. Then for the next 18 months, they were given specialized training in manufacturing of lenses.

Raw material for lenses was imported from US/UK. Soon Aurolab was selling the rigid IOL lenses for less than US \$5. By 2002, it was producing about one-sixth of the total number of low-end lenses produced in the world. However, it also produced the foldable and the superior category acrylic lenses. It was able to get the CE Mark (a mark of quality) and ISO 9002 certification. In 2003, by working single shift, Aurolab was producing around 600,000 lenses per year. Large NGOs such as CBM, Lions, and Rotary bought IOL lenses from Aurolab, and supplied them to various eye hospitals all over the world. This increased sales worldwide, and 33 per cent of the lenses produced by IOL were exported. Of the remaining 67 per cent, 20-25 per cent were consumed by AEH and the rest were sold in the open market in India. Since its inception, Aurolab had supplied more than 2 million lenses to NGOs in India and about 120 countries world over.

While the cost of lenses came down, the price of sutures remained high. This now became a need to be addressed. In 1998, Aurolab diversified into manufacturing of sutures used in IOL surgery. It set up the Sutures Division. The sutures are made from silk and nylon and come attached to a tiny stainless steel needle. The cost of sutures produced at Aurolab was one-fourth of the price of the imported ones.

The Managing Director of Aurolab, Dr. Balakrishnan, Ph.D., said with pride:

Aurolab was responsible in driving down the prices of IOL all around the world. Our lenses are of high quality, but priced low; that takes us nearer to our goal of eliminating needless blindness.

Then Aurolab decided to diversify further and started two new Divisions: Pharmaceutical Division and the Spectacle Lens Division.

The Pharmaceutical Division produced pharmaceuticals used in cataract surgery and other eye-related ailments at a reasonable cost. These pharmaceuticals were either not easily available or available at a high cost. In 2002, it formulated 25 drugs and was the sole Indian manufacturer for Econazole, Coltrimazole, and Prednisolone Sodium Phosphate eye drops.¹⁴ Aurolab pharmaceuticals and suture needles were covered under the Indian Drug Control Act and were WHO GMP certified. The international certification also made it possible to sell the formulations in the international market.

The Spectacle Lens Division set up in 1999 provided technical support services to AECS' in-house spectacle shops for the production of spectacles, quality control, and training of personnel. Ever since World Health Organization (WHO) had identified detection and correction of refractive errors through spectacle lenses as a major requirement for reducing avoidable blindness, the division focussed its attention on this aspect. A laboratory with plastic lens surfacing and computerized edging facility was established to research and refine the process. Lens edging facilities were established close to the optical shops for

¹⁴ Aravind Eye Care System (2001) *Activities Report*. Madurai: AECS.

quicker delivery. Technology for applying hard coating to both sides of the lens to make it scratch resistant and for providing colour tints to lenses to satisfy the needs of low vision patients had also been acquired.

Lions Aravind Institute of Community Ophthalmology (LAICO)

In the early 1990s, AECS started collaborating with Lions Club International Foundation, a voluntary organization for community service. In 1992, with the support of Lions Club International Sight First Programme and Seva Sight Programme, AECS established Lions Aravind Institute of Community Ophthalmology (LAICO). The objective of LAICO was to improve the planning, efficiency, and effectiveness of eye hospitals with a special focus on developing countries. It contributed to eye care through teaching, training, research, and consultancy. It offered long term courses in hospital management as well as short duration skill development courses in the area of community outreach, social marketing and instruments maintenance. These courses were offered at very reasonable fees. The list of courses, duration, and fees charged in March 2003 are given in Exhibit 9. Till 2003, LAICO had already worked with 149 eye hospitals in India, Africa, and South East Asia. It was Asia's first international facility for training blindness prevention workers in India and other parts of the world.

LAICO also provided capacity building services to other hospitals. Its staff would first visit the hospitals requesting support, assess and identify their problems, bottlenecks, and constraints. Then it would invite some personnel from these hospitals for training at LAICO. Training consisted of visiting the hospitals under AECS and the outreach camps to study the workflow. At the end of the training, the participants would have to present a full action plan, implement it, and the progress would be assessed after six to nine months.

Till 2003, LAICO had made interventions in UP, West Bengal, Orissa, Delhi, and a few other states in India. Its international intervention included Malawi, Kenya, Zimbabwe and Zambia. In some countries, in addition to training doctors, nurses from AECS were sent for a month to impart rigorous training to the nursing staff there. Dramatic improvements were recorded in functioning wherever LAICO had intervened. Mr. M. P. Saravanan, a faculty member of LAICO, narrated the following intervention experience in Chitrakoot:

In Chitrakoot, they were doing 20,000 to 25,000 surgeries a year. Ninety per cent of this was done in a three-month period. Of the surgeries, 70 to 80 per cent were non-IOL surgeries. Only in slack periods would they take up IOL. After our intervention, they were able to do 25,000 to 30,000 surgeries a year; all IOL. Our aim in such interventions was to enhance not only their capabilities but also their skills.

The performance of hospitals before and after intervention is presented in Exhibit 10. Data are for 40 hospitals two years after intervention.

LAICO, in collaboration with the International Agency for Prevention of Blindness (IAPB), had committed itself to goal of the global initiative of the "Vision 2020: The Right to Sight". Mr. Thulasiraj was the regional chairman of the IAPB, Southeast Asia Region, and was thus involved in the policy making for eradicating blindness at the national and international levels.

Aravind Medical Research Foundation (AMRF)

AMRF coordinated all the research undertaken by different units of AECS. Several clinical studies, population based studies, and social and health systems researches were conducted using the data readily available in the hospitals and the community outreach programmes. Many of these research projects were supported by different agencies and some by AEH itself. Research covered a variety of fields like clinical trials to evaluate alternate surgical techniques and drug therapies, impact of vitamin supplements on morbidity and mortality of infants and children, beneficiary assessment, impact assessment of cataract intervention, barriers experienced by patients in accessing eye care sources, and infrastructure utilization in eye care. Dr. V.R. Muthukkaruppan, who was earlier Professor of Immunology at the Madurai Kamaraj University, and the former Vice Chancellor of Bharathidasan University, Tiruchirapalli, had been appointed to provide leadership to the research efforts of AMRF.

Exhibit 11 gives details of ongoing and completed research projects.

Aravind Centre for Women, Children, and Community Health (ACWCCH)

The centre was started in 1984 with the aim of reducing nutrition-related blindness in children through preventive health care. It worked with government's public health programmes of immunization, education programmes on nutrition, and training programmes to create awareness. It conducted regular village health programmes and training programmes for village health care workers.

Rotary Aravind International Eye Bank (RAIEB)

RAIEB was established in 1998 and was one of the four eye banks in the country affiliated to the International Federation of Eye Banks. Till 2003, the bank had processed 4,383 eyes and AECS had conducted 2,181 transplants.

Aravind Post-Graduate Institute of Ophthalmology

As part of its efforts to train ophthalmologists, in 1982 AECS introduced post graduate residency programme at its Madurai unit, and with this, the name of the hospital was changed to Aravind Eye Hospital and Post-Graduate Institute of Ophthalmology (AEH&PGIO). As of 2003 AEH&PGIO had admitted around 30 resident doctors. Admission was strictly on merit. No capitation fee was ever collected even when the going rate in 2003 was about ₹ 1.5 to 2 million at other private teaching hospitals. It was affiliated to Dr. MGR Medical University, Chennai, and offered Diploma in Ophthalmology (DO), and MS in Ophthalmology (MS). In 2001, eight candidates had earned their DO and four graduated with MS. In 2002, six graduated in DO and four in MS In affiliation with the National Board of Examination, New Delhi, the AECS also offered the Diplomate of the National Board. Nine students qualified in 2001, and 13 in 2002. In affiliation with the Royal College of Ophthalmologists, London, membership of the Royal College of Ophthalmologists (MRCOph) and FRCS were offered. Four candidates passed Part 1 of the MRCOph in 2002¹⁵ and four candidates received their FRCS. It also took fellows for super specialization in fields of retina-vitreous, cornea, paediatric ophthalmology, glaucoma, anterior chamber,

¹⁵ In 2002, out of 11 candidates who appeared from India, five were from AECS. . Out of the 7 candidates who cleared that year, four were from AECS.

and uvea. In addition, it conducted various short-term courses for practising ophthalmologists.

Recruitment and Training

AEH laid great stress on the kind of people it recruited. Dr. Natchiar, who was in charge of training of paramedical staff, told the case writers:

We have a ratio of about 1: 6 between doctors and nurses. Then we have also about 40 counsellors. We have about 900 girls between our four hospitals and Aurolab. We generally recruit girls from rural background. We do not prefer urban girls. We take girls in the age range of 17 to 19; very rarely more than 19. We look for girls with right attitude from large families, preferably farmers' families. Knowledge and skills are important, but they come second. We never advertise. Once a year, we put up a notice for recruitment in our hospitals and word of mouth carries the news. We receive around 400-500 applications and we take about 60 - 100 girls per year. Selection for all the hospitals is done at Madurai and Tirunelveli. I along with Dr. Usha (a younger ophthalmologist and a member of the family who was being groomed to head the recruitment and training of nurses) and the head nurse are involved in all selections. Parents are always called for the interview.

We look for the right kind of person. We do not give any consideration to any letters of recommendation.

After recruitment, we give them two years' training. The training is considered to be excellent and is recognized in the U.S.A., and the Government of India is considering adopting our training syllabus for nurses' training. During the training period, we rotate them among different units of our different hospitals.

In the first four months, they were given training in basic sciences and human anatomy and physiology. The trainers and Dr. Usha, who headed the training of nurses, would select ophthalmic assistants from this group. They would be further trained to work in the outpatient department, operation theatre, counselling, etc. Though the criteria for making such decisions were not clearly articulated, they were well understood by the team. In the next eight months, they received special training for the department they were chosen for. Following this, another six months were spent in apprenticeship under a trainer nurse working in the same department. There was one-on-one training at each step. During the last six months, they worked on their own with some guidance from senior nurses and doctors. The medium of instruction was essentially Tamil (the language spoken in the state); they were also taught some basic medical terminology in English and were given training in basic conversational English.

The nurses' training was designed after the training programme of ophthalmic assistants that Dr. V. had coordinated in 1973 for the rehabilitation work funded by the USAID. The training programme did not lead to a degree. However, there were efforts underway in February 2003 to formalize the programme and the training modules were being upgraded with the help of qualified volunteers from the USA.

Dr. Natchiar added:

At the end of two years, we take parents' consent before absorbing the girls permanently. In our experience, 99 per cent of the trainees stay on with us. Those who we consider to be unsuitable, mainly because of their attitude, are not given job offers.

During the three years of their service as permanent employees, ophthalmic assistants were also imparted training in cooking, housekeeping, tailoring, etc. This helped them to be prepared for becoming good housewives in the future. The cost for these programmes was borne by AECS. Voluntary *bhajan* (devotional songs) and yoga sessions were organized in the evening. The nurses were encouraged to be always kind to patients and approach them with gratitude for providing them an opportunity to serve. The nurses were asked to save a part of their salary, so that they had a sizable sum for their marriage.

According to Dr. Natchiar:

More than salaries, it is the recognition that they get in society. They get a lot of respect. Not only do they get very good training and experience, they also have opportunity to go abroad, even if it is for short periods. All these are seen as positive factors.

The nurses too corroborated Dr. Natchiar's views. One of the senior nurses said:

I work harder than the government hospital nurses and I get paid a little less or the same as them, but I get much more respect in society. When I travel in the bus, someone generally recognizes that I work in Aravind Eye Hospital and would offer me a seat, or be nice to me. I really feel happy about it.

Both Dr. Usha and Dr. V. stressed that ophthalmic assistants were at the core of AECS' success. Their contribution to the smooth functioning of the hospitals of AECS was immense. The senior assistants appreciated the atmosphere of peace and efficient functioning of the hospitals and set an example for the junior staff.

All AECS hospitals abounded in photographs of Aurobindo and Mother, and staff members were expected to imbibe the values of service. When the new unit was opened in Pondicherry, two old time "founder" sweepers from Madurai were sent to inculcate right attitudes and values in the new sweepers. One of the doctors very succinctly described the ethos of AEH:

We have a unique culture based on service. All the doctors speak softly to patients and nurses. No one shouts. If a doctor behaves in an unacceptable manner, word goes around the hospital in no time, and the doctor is in trouble. We believe mutual respect to be our core value.

Doctors were crucial at AEH. Most were inducted as residents. About 30 MBBS doctors were taken in the three-year residency programme which led to a masters' degree in surgery (MS). During the residency period they received a stipend. The residents were given training in all branches of ophthalmic surgery. At the end of the training, many were offered jobs as permanent medical officers in different AEHs, and most accepted the offer.

AEH also offered a Fellowship Programme for doing super specialization after an MS degree in areas like, retina-vitreous, cornea, paediatric ophthalmology, glaucoma, uvea, and orbit. Duration of the programme was 18 months and it did not lead to any degree. During the duration of the programme, the Fellows received a stipend. There were 15 fellows pursuing different specializations in 2003.

The case writers interviewed some of the Fellows. They felt that in their MS course in other colleges they did not get adequate exposure to surgery. They also felt that AECS gave them wider choice in specialization. To quote one Fellow:

We did not get adequate surgical exposure in MS. This is usually the case with many colleges, especially in north India. Here I have been exposed to not only different kinds of IOL surgeries but even in plastic surgery. In Delhi, where I had studied, we did not have so many different cases. The college did not even have a phaco machine. We used to do about one or two cases of surgery a month whereas here we do around 30 a day!

A large number of Fellows were from other parts of India and so they went back to their home states after completion of training. Those who joined AEHs were largely locals.

Unlike many large hospitals AEH employed only full time doctors and did not allow any doctors to do private practice. Dr. V. clearly stated:

We do not think part time or external doctors can develop institutional loyalties. They also may not develop the skills we need.

On an average, AECS doctors (at Madurai) spent 60 per cent of their time in clinical work, 20 per cent teaching, and 20 per cent in research. But this varied considerably among doctors. Though doctors were not allowed to miss surgical work, they could take time off from OPD to pursue research. They could apply for research grant from AECS which in turn would channel the fund through Aravind Medical Research Foundation or get from outside funding agencies. They were also encouraged to teach at LAICO.

AECS ensured professional growth of all the doctors. They regularly organized for a called Journal Rounds which all medical officers and Fellows were required to attend. At this forum, a doctor or a Fellow would pick up an article of interest from a journal and present it to others. In the Grand Rounds, doctors from different AEHs would have a tele-discussion on a particular topic.

One of the medical officers explained the advantages of being at AEH:

I see the following plus points here. I am at my home place. We get a very good exposure to the latest surgical techniques. We also get opportunities to practice tele-medicine with eminent people.¹⁶ If you want to be abreast of latest techniques in ophthalmology, this is the best place. We get opportunities to do research, attend international conferences and present papers. We can attend one or even more than one conference each year.

¹⁷ More specifically, primary open angle glaucoma. There are other types of glaucoma, the incidence of which is rare.

I am in charge of the newly set up Vision Rehabilitation Centre. My long term mission is to develop this centre using new techniques such as magnifying devices. By developing skills for the visually handicapped, I'll be able to improve the quality of their life. I plan to set up similar rehabilitation centres in other hospitals too.

Asked whether he found time for research in the midst of all these activities, he said:

Time is not a problem. Those interested can find time.

But this view was not shared by all. To some, this heavy work load was not conducive for research:

It is all right to say you have a lot of opportunities to do research. But after a long day of 12 or 13 hours, how many can find the energy to do research? Every day is a full day here.

Another doctor had this to say:

We do commit ourselves totally to the cause of eradication of avoidable blindness. That means we have to do a certain number of surgeries every day. But subject to this, we have quite a lot of flexibility.

There was good understanding between medical officers and ophthalmic assistants. This bonhomie developed as a result of frequent visits to eye camps where they worked closely as a team.

Quality was strictly monitored at AECS. Morbidity meetings were organized every week in a non-threatening manner. Complication rates of individual surgeons as well as that of the hospital were calculated every month. Dr. V. and others gave a lot of stress on the quality of eye care. According to Dr. Nam:

Our destination is "good sight". We provide our doctors with the best that is available in the world. We train them through exchange programmes with prestigious medical schools all around the world. We have set up very rewarding collaborative research programmes with several universities.

One of the case writers met a resident who had come from Harvard Medical School. He told the case writer:

I've had more clinical experience here than any of my classmates at Harvard. In Harvard, I would only read about rare eye diseases; here I get to see them.

However, AECS did face the problem of retention of doctors. According to Mr. Thulasiraj, Executive Director of LAICO:

Doctor turnover is a problem. The retention is only for about three to four years. Every year we lose 20 to 25 doctors. India produces about 800 ophthalmologists a year. Can we get from that pool? We also have the fellow pool of about 25 or so.

However, both Dr. Nam and Mr. Thulasiraj were confident that this was not a serious issue because, though earlier, doctors at AECS were paid less than the market rate, it was not so any more. Their salaries were now at par with those from other hospitals. The only difference was, at other places, with private practice, they could make more money.

However, Mr. Thulasiraj added:

What we can offer is a good work environment, a good name, and a status based on our high integrity. We also offer good salaries and opportunities for personal growth. With this we should be able to retain enough doctors.

Financials

Though majority of the patients were treated free, AECS had always been financially self-supporting. Right from the inception, it did not take any government grants or donations (except for the support given by the government towards eye camp patients), and till today it had not applied for any other government grants for service delivery. Exhibit 12 gives the income and expenditure from 1997-98 till 2001-2, Exhibit 13 gives the income and expenditure statement of 2001-2.

Mr. G. Srinivasan, brother of Dr. V. and the Founder-Secretary of the Govel Trust looked after the entire finance and accounts of AECS. In the initial years, Govel Trust had borrowed some funds from the State Bank of India by pledging the properties of the trustees. The hospital or the trust did not try to raise any funds through donation. AEH Madurai was self-supporting right from the beginning and was able to meet all its recurring expenditure. After five years, it accumulated adequate surplus for its own development and also for the establishment of new hospitals in Theni, Tirunelveli, Coimbatore, and Pondicherry. The rates charged by AECS for surgery and hospital stay were quite moderate. Exhibit 14 gives the details of the rates charged at AEH Madurai. Other AEHs too met all their operational costs through patient revenues and generated surplus to contribute to the development of subsequent hospitals. Though donations were accepted and welcome, the hospital consciously chose to remain financially viable essentially through patient revenues for its core activities of patient care, community work and training. Mr. G. Srinivasan stated, "Tight financial control, on time accounting, coupled with appropriate pricing and transparency are the reasons for this financial success."

Both Dr.V. and Dr. Nam stressed that not only was AECS self-sufficient in terms of operational income and expenditure, but it also took care of capital expenditure for all expansion and new units. Dr. V. told the case writers:

You management people will tell me, why don't you go to the bank, take loans and grow faster? Cost of debt is low. But we, as a policy, will not go to the bank for loans, since it will compromise our freedom.

At AECS, they believed in gradual growth. Expansion would take place only after enough funds had been accumulated. Dr. V. saw no conflict between his objective of speedy eradication of blindness and the policy of gradual growth. He felt:

It is important to preserve our financial self-sufficiency. Also there is a limit to the rate at which we can grow effectively without compromising on the basic values of the organization.

Organization Structure

Exhibit 15 gives the organization structure. AECS worked under the Govel Trust of which Dr. V. was the chairman, Dr. Nam the director, and Dr. Natchiar the joint director. All AEHs reported to Dr. Nam. The heads of different units or clinics in AEHs who were generally senior medical officers reported directly to Dr. Nam. Post-graduate and Fellow students were under the respective clinic heads. However, nursing and other paramedical staffs were under the joint director. Heads of other units like LAICO too reported to Dr. Nam.

There were weekly meetings of all the heads of the hospitals, in which all operational and strategic matters were discussed. Dr. Nam would either visit other AEHs or talk to the heads on telephone.

AECS functioned in an open and transparent manner. Information was freely shared with everyone. The top management believed in "leading by doing". Once one of the case writers found Dr. V. and Dr. Aravind Srinivasan picking up pieces of paper from the floor and handing them over to the first sweeper they met. They did not shout or get upset with the sweeper but by their action demonstrated the value of cleanliness and humility.

There was a conscious attempt to imbibe the workplace with spiritual ethos. AEH Madurai had a meditation room where some of the personal belongings of Sri Aurobindo had been kept. Dr. V. visited this room every day. And though no one was compelled to go to the meditation room; many staff members and patients went there on their own accord. In Dr. V's words, "There is an atmosphere of spirituality in the hospital."

AEH in Madurai also had a small crèche for the very young children of the staff. Same care was given to all children irrespective of their parent's position in the organization, including doctors.

As on February 2003, the staff strength of AEH Madurai was 762. For about 113 doctors, there were 307 nurses, 38 counsellors, and 304 other staff. The pattern of staffing in other units was broadly similar. Exhibit 16 gives the break-up of staff strength for different units of AECS.

Future Directions

Though happy and satisfied with his achievements so far, Dr. V. felt he had a long way to go. His vision was no longer focused just on the functioning of AECS, but on the larger issue of how to make a lasting impact on the problem of blindness. Dr. V. said:

I am now seriously wondering how to develop sustainable systems. Only by strengthening the existing hospitals this can be achieved. I feel doctors in India are heavily underutilized. They are engaged in activities unrelated to their work. We have to find a way to improve the functioning of hospitals so as to increase the productivity of doctors.

Moreover, despite all our efforts, only about seven per cent of the target population come to camps. We have to increase this percentage too.

We also have to upgrade the skills of doctors to enable them to perform IOL surgeries. This will make a huge difference in the recuperation time and subsequent ability to earn one's living. Post-operative care has to be improved; counselling needs to be improved. It is in these areas that we hope to make a difference.

Mr. Thulasiraj added:

I can see many management issues coming up. There is going to be a need to restructure ourselves. There is considerable geographical spread as well as functional diversity. How should we restructure?

We are still too centralized in our decisions. Too many decisions are taken here in Madurai. We also have to broaden our leadership. Too much energy is coming from Madurai. How do we stimulate similar efforts from other units?

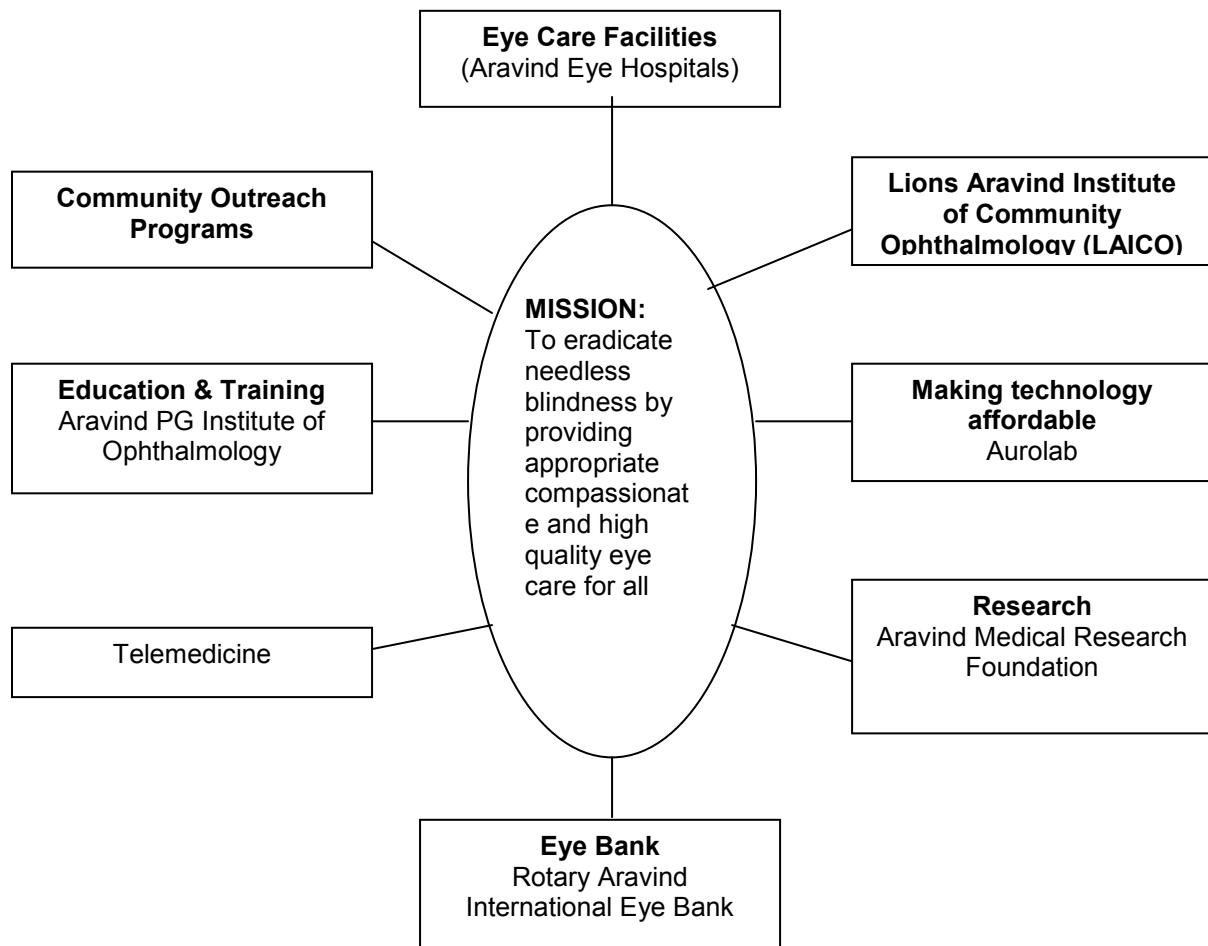
A lot of our strength comes from what I call "unconscious competence" Our strength is really not our technical skills or equipment. This can be easily replicated. Values are our unique strength. Values are the real reason for efficiency. We must find ways of sustaining and strengthening our values and culture. Integrating the culture of all our units is very important.

Integrity is a hallmark of this place. We never give commissions to other doctors, chemists, or other hospitals for special tests. We tell other diagnostic facilities what they should charge a poor patient sent from AECS for a particular test (e.g. MRI or CT scan) and they oblige. We have been able to have our way. We should be able to keep this integrity intact.

Dr. Aravind Srinivasan said:

One of our key strategic future steps is to develop dual specialties among our doctors. We would like to retain and get the best out of our doctors. One way may be to provide more meaning to their work. We are trying to help doctors develop at least one other specialty. We can then involve them in the running of the AECS. We also need to find resources to fund our research projects and build more linkages with eye care institutions all over the world.

Exhibit 1: Aravind Eye Care System



Source: Aravind Eye Care System.

Exhibit 2: Aravind Eye Care System: Number of Beds in Different Hospitals

(As on 2003)

| Unit | Free | No. of beds Paying | Total | Operation Theatres/Tables |
|-------------|------|--------------------|-------|---------------------------|
| Madurai | 1100 | 315 | 1415 | 13/45* |
| Tirunelveli | 300 | 130 | 430 | 3/9 |
| Theni | 150 | 30 | 180 | 1/3 |
| Coimbatore | 700 | 174 | 874 | 8/25 |
| Pondicherry | 600 | 150 | 750 | 8/25 |
| Total | 2850 | 799 | 3649 | 33/107 |

* Consisting of 25 tables in free hospitals and 20 in paying hospitals.

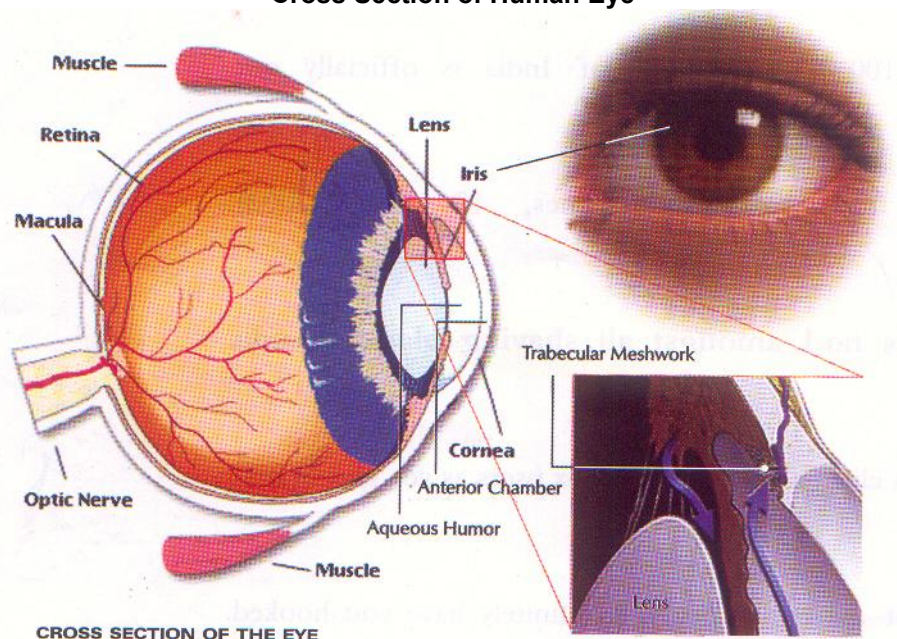
Source: Aravind Eye Care System.**Exhibit 3: Categories of Blindness**

| Category | Definition | Prevalence in the 50 years and older age group | |
|----------------------|---|--|------------|
| | | India | Tamil Nadu |
| Bilateral blindness | Both eyes < 6/60 – NPL | 8.5 | 6.0 |
| Social blindness | Both eyes <3/60 – NPL | 5.3 | 4.0 |
| Economic blindness | One eye < 6/60 – 3/60; Fellow eye < 6/00 – NPL | 3.2 | 2.1 |
| Unilateral blindness | One eye < 6/60; Fellow eye > = 6/18 | 5.1 | 6.8 |
| Low vision | One eye < 6/18 – 6/60; Fellow eye < 6/18 – NPL | 23.8 | 28.5 |

Source: National survey on blindness – 2001-2002, summary, *Quarterly Newsletter of National Programme for Control of Blindness & Vision 2020: The Right to Sight Initiative*, 1(2), July-September 2002.

Exhibit 4: The Human Eye and Its Diseases

Cross Section of Human Eye



Taken from *Jetwings*, March 2003- p 132.

Common Eye Diseases

Cataract is a medical condition in which the lens of the eye becomes progressively opaque and the vision gets blurred. The degeneration takes place over five to ten years. Earlier, the surgical procedure was to remove the lens after it had become fully opaque (when it reached maturity) and in its place the patient was prescribed to wear spectacles commonly known as aphakic glasses which had thick, positive power lenses. The new technique was to insert a tiny artificial intra-ocular lens (IOL) inside the eye in place of the natural lens. In IOL surgeries, patients did not require long hospitalization, the post-operative recovery was faster, and sight was restored in a shorter time (in a week to ten days). Further improvement was the availability of IOL lens that could be “folded” and inserted into the eye through a small opening. Once placed inside it “opened out”. These lenses required very small incision and hence recovery period was also short. With multi-focal lenses it became possible to take care of both distant and near vision. However, till as late as 2003 about 40 per cent of cataract surgeries in India followed the traditional procedure using aphakic lenses.

Another major breakthrough in ophthalmic surgery came with the introduction of phaco emulsification technique, wherein the opaque natural eye lens was first pulverized using ultrasonic beams and then extracted by suction. IOL was then inserted as usual. This technique enabled a patient to return home two to three hours after the surgery.

IOL insertion required advanced training of surgeons in microsurgery. In trained hands, the time taken to conduct the actual surgery, IOL and non IOL were same: about 12-15 minutes. Phaco surgery required both highly trained doctors and special and expensive equipment. Minimum cost of a good equipment to do phaco surgery was ₹ 600, 000.

Glaucoma was the second common cause of blindness.¹⁷ Glaucoma is caused when the level of aqueous humor, the fluid in the anterior chamber of the eye, increases as a result of a blockage of the exit passage, which leads to pressure build up in the eye. In severe cases it can damage the

¹⁷ More specifically, primary open angle glaucoma. There are other types of glaucoma, the incidence of which is rare.

retina and the optic nerve. Unlike cataract, glaucoma is a silent killer of vision. The patient would get no symptoms or warnings. Diabetics are prone to glaucoma. While cataract is usually age related, glaucoma could attack a person at any age. Because of its insidious nature, the preventive measure is regular eye check up.

Pathology of the posterior segment included the cornea and retina. These involved highly skilled surgeries. Retinal surgeries could be done using lasers. Corneal surgeries involved quite a variety of surgeries, including eye transplants.

Uncorrected refractive errors were usually corrected by spectacles and later on by contact lenses, but recently LASIK surgeries involving laser incisions to alter the shape of the eye ball were becoming common. With small powers, LASIK surgeries could eliminate the need for spectacles/ contact lenses; with higher powers, it could substantially reduce the power.

Exhibit 5: Surgeries Done and OP Visits, 1997-2003

| Year | Paying | | Free including Camp | | Total | |
|------|-----------|---------|---------------------|---------|-----------|---------|
| | OP visits | Surgery | OP visits | Surgery | OP visits | Surgery |
| 1997 | 401,518 | 42,808 | 574,350 | 80,287 | 975,868 | 123,095 |
| 1998 | 465,496 | 49,275 | 697,649 | 108,552 | 1,163,145 | 157,827 |
| 1999 | 530,253 | 55,460 | 752,819 | 127,708 | 1,283,072 | 183,168 |
| 2000 | 567,105 | 58,267 | 763,888 | 134,498 | 1,330,993 | 192,765 |
| 2001 | 603,800 | 63,265 | 725,210 | 127,893 | 1,329,070 | 191,158 |
| 2002 | 650,047 | 68,055 | 749,324 | 128,384 | 1,399,371 | 196,425 |
| 2003 | 758,991 | 78,487 | 688,584 | 123,579 | 1,447,575 | 202,066 |

Source: Aravind Eye Care System.

Note: The above figures are for all the hospitals of the AECS.

Exhibit 6: Patient Statistics for Different Units of the AECS, 2003

| | Madurai | Tirunelveli | Theni | Coimbatore | Pondicherry | Total |
|--|------------|-------------|-----------|------------|-------------|--------------|
| Outpatient Visits | | | | | | |
| Paying | 288,709 | 147,900 | 45,043 | 211,672 | 65,667 | 758,991 |
| Free (Direct & Camp) | 273,926 | 116,979 | 38,579 | 217,518 | 41,582 | 688,584 |
| Of the above: | | | | | | |
| Hospital OP visits | 415,995 | 198,849 | 63,937 | 293,317 | 86,883 | 1,058,981 |
| Eye camp OP visits | 146,640 | 66,030 | 19,685 | 135,873 | 20,366 | 388,594 |
| Total | 562,635 | 264,879 | 83,622 | 429,190 | 107,249 | 1,447,575 |
| # eye camps | 379 | 268 | 63 | 386 | 62 | 1,158 |
| Surgery | | | | | | |
| Paying | 37,377 | 14,097 | 2,224 | 19,024 | 5,765 | 78,487 |
| Free (Direct & Camp) | 60,273 | 18,403 | 5,711 | 32,658 | 6,534 | 123,579 |
| Total | 97,650 | 32,500 | 7,935 | 51,682 | 12,299 | 202,066 |
| <i>Some major types of surgeries</i> | | | | | | |
| ECCE without IOL | 1,075 | 267 | 62 | 836 | 185 | 2,425 |
| ECCE with IOL | 28,358 | 4,607 | 6,448 | 8,276 | 978 | 48,667 |
| ECCE IOL with phaco | 11,760 | 16,133 | 377 | 7,117 | 2,340 | 37,727 |
| Small incision cataract surgery with IOL | 29,696 | 2,693 | 0 | 23,478 | 5,463 | 61,330 |
| Laser photocoagulation | 6,885 | 3,503 | 160 | 3,652 | 1,005 | 15,205 |

Source: Aravind Eye Care System.

Exhibit 7: Free Section Complication Details, AEH, Madurai, 2003

| Name | Intra-operative | | Post-operative | | Total | |
|----------------------------------|-----------------|------|----------------|------|-------|------|
| | # | % | # | % | # | % |
| A/C Shallow | 1 | 0.00 | 17 | 0.02 | 18 | 0.02 |
| Blood Clot | 0 | 0.00 | 53 | 0.08 | 53 | 0.08 |
| Cornea Oedema | 0 | 0.00 | 152 | 0.23 | 152 | 0.23 |
| Cortex | 0 | 0.00 | 2 | 0.00 | 2 | 0.00 |
| Endophthalmitis | 0 | 0.00 | 59 | 0.09 | 59 | 0.09 |
| Hyphema | 0 | 0.00 | 38 | 0.05 | 38 | 0.05 |
| Hypopyon | 0 | 0.00 | 63 | 0.09 | 63 | 0.09 |
| Iridodialysis | 0 | 0.00 | 1 | 0.00 | 1 | 0.00 |
| Iris Prolapse | 0 | 0.00 | 2 | 0.00 | 2 | 0.00 |
| Posterior Capsular Rent with IOL | 670 | 1.02 | 1 | 0.00 | 671 | 1.02 |
| Posterior Capsular Rent (No IOL) | 87 | 0.13 | 0 | 0.00 | 87 | 0.13 |
| Striate Keratopathy | 0 | 0.00 | 70 | 0.10 | 70 | 0.10 |
| Vitreous disturbance | 695 | 1.06 | 0 | 0.00 | 695 | 1.06 |
| Zonular Dialysis | 86 | 0.13 | 0 | 0.00 | 86 | 0.13 |

Total surgeries done: 65,180

Source: Aravind Eye Care System.**Exhibit 7a: Medical Complications at AEH, Coimbatore and the Royal College of Ophthalmologists, U.K.**

| Adverse Events During Surgery | | | Adverse Events Within 48 hours of Surgery | | |
|---|------------------------------|-----------------------------|---|------------------------------|-----------------------------|
| Event | Aravind, Coimbatore N=22,912 | UK National Survey N=18,472 | Event | Aravind, Coimbatore N=22,912 | UK national Survey N=17,257 |
| Capsule rupture and vitreous loss | 2.0% | 4.4% | Corneal Oedema | 8.0% | 9.0% |
| Incomplete Cortical Clean up | 0.75% | 1.00% | Uveitis more than expected | 5.0% | 5.6% |
| Iris Trauma | 0.3% | 0.7% | Peri-ocular bruising and edema more than expected | 1.0% | 1.4% |
| Persistent Iris prolapse | 0.01% | 0.07% | Weak leak/ Rupture | 0.67% | 1.2% |
| Anterior Chamber Collapse | 0.3% | 0.5% | Hyphaema | 0.9% | 1.1% |
| Loss of nuclear fragment into vitreous | 0.2% | 0.3% | Retained lens material | 0.87% | 1.1% |
| Wounds | 0.30% | 0.25% | Vitreous to section | 0.1% | 0.3% |
| Choroidal Haemorrhage | ----- | 0.07% | Endophthamitis | 0.05% | 0.03% |
| Loss of intra Ocular lens into vitreous | 0.01% | 0.16% | Hypopyon | 0.04% | 0.02% |
| | | | Other* | 0.7% | 1.5% |

Source: The Aravind eye care system: delivering the most precious gift in C.K. Prahalad (2004), *The Fortune at the Bottom of the Pyramid*. N.J.: Wharton Publishing.

Exhibit 8: Eye Camps Organized and Patients Treated, 1997-2003

| Year | No. of Camps Organized | Patients Seen | Surgeries of "Camp" Patients |
|-------------------------|-------------------------------|----------------------|-------------------------------------|
| 1997 | 1041 | 287,571 | 40,389 |
| 1998 | 1346 | 373,997 | 65,926 |
| 1999 | 1488 | 413,580 | 87,084 |
| 2000 | 1548 | 426,350 | 93,519 |
| 2001 | 1480 | 422,373 | 88,585 |
| 2002 | 1549 | 461,762 | 92,372 |
| 2003(incl. Pondicherry) | 1158 | 388,594 | 81,357 |

Source: Aravind Eye Care System.

Exhibit 9: Training Courses Offered at LAICO and Course Fees

| Courses | Duration | Course Fee for participants from India/Nepal* (₹) | Course Fee for overseas participants (\$) |
|---|-----------------|---|--|
| Management Training for Heads of Eye Hospitals | One week | 10,000 | 330 |
| Management Training for Eye Care Programme Managers | Two weeks | 15,000 | 500 |
| Management Training & Systems Development for Hospital Administrators/Managers | One month | 15,000 | 500 |
| Certificate Course for Clinical & Supervisory Skills Development in Ophthalmic Paramedical Personnel | Three months | 25,000 | 850 |
| Community Outreach Course | Four weeks | 7,500 | 250 |
| Instruments Maintenance Technicians Course | Six weeks | 10,000 | 325 |
| Instruments Maintenance Ophthalmologist Course | Five days | 2,000 | 70 |

* Fee does not include lodging and boarding

Source: Aravind Eye Care System.

Exhibit 10: Result of Aravind's Intervention in Other Hospitals

| # Surgeries Done | | | |
|------------------------------|------------|----------------|--------------|
| | IOL | Non IOL | Total |
| 1 year prior to intervention | 18558 | 33948 | 52506 |
| 1 year after intervention | 40055 | 36940 | 76995 |
| 2 years after intervention | 51291 | 40154 | 91445 |

| # Hospitals Performing Surgeries | | |
|---|-----------------------------------|-----------------------------------|
| | 1 year before intervention | 2 years after intervention |
| < 1000 surgeries | 21 | 9 |
| 1000 – 2999 surgeries | 16 | 20 |
| 3000 – 4999 surgeries | 3 | 8 |
| > = 5000 surgeries | 0 | 3 |

| Cost Recovery Percentage (Income/Expenditure) # Hospitals | | |
|--|-----------------------------------|-----------------------------------|
| | 1 year before intervention | 2 years after intervention |
| < 60% | 10 | 4 |
| 60 – 79% | 4 | 6 |
| 80 – 99% | 6 | 5 |
| > = 100% | 5 | 10 |

Source: S. Saravanan (2003), Organizational capacity building: a model developed by aravind eye care system," *Illumination*, 3(1) January-March, .20-21.

Exhibit 11: Major Research Projects

Major Projects Completed

- 1984 Study of Eales' disease
- 1986 Operations research for effective delivery of cataract services
- 1986 Rapid survey techniques for blindness and cataract assessment
- 1987 Effect of small doses of vitamin A in children under five years of age
- 1989 Safety and efficacy of vanadium stainless steel (VSS) sutures in cataract surgery
- 1989 Study on salt pan Keratitis
- 1992 Madurai IOL study
- 1993 Childhood cataract in south India
- 1994 Aravind comprehensive eye survey
- 1994 Series of drug trial with Ofloxacin on patients with suppurative Keratitis
- 1998 Vitamin A supplementation in newborns (VASIN) study.

Major Ongoing Projects

- 1995 Molecular genetics of congenital cataracts in man and mouse
- 1997 Newly recognized presumed Trematode induced ocular inflammation in children
- 1998
 - 1. Role of antioxidants in prevention of cataract
 - 2. Vitamin A supplementation in newborns (VASIN) study
- 1999 Value of culture and serology in ophthalmic complication of leptospirosis
- 2000
 - 1. Diabetic retinopathy (action research project)
 - 2. Molecular genetics for hereditary glaucoma
 - 3. Paediatrics parasitic eye diseases
 - 4. Trial study of lensectomy vs. lens aspiration and primary capsulotomy in children
 - 5. Culture of rubella virus from proven cases of congenital rubella syndrome
 - 6. Molecular and genetic basis of congenital contract
 - 7. Trials on paediatric glaucoma
 - 8. Certain drug trials in corneal ulcers and conjunctivitis
- 2001
 - 1. Molecular genetics of juvenile onset primary angle glaucoma
 - 2. Genetics and structural analysis of myocillin protein involved in juvenile onset primary angle glaucoma
 - 3. Aetiology and pathology mechanism of leptospirosis uveitis
 - 4. Improving child health through health education project
- 2002
 - 1. Corneal epithelial stem cells for clinical and toxicological applications
 - 2. Prevention of traumatic corneal ulcer: A multicenter intervention project in South East Asia

Source: *Promises to Keep...*, Annual Report (2001) Madurai: Aravind Eye Care System, .40-42.

Exhibit 12: Income and Expenditure, 1997-98 to 2002-03

| | | | (₹ million) |
|-------------|--------|-------------|-------------|
| | Income | Expenditure | Surplus |
| 1997-98 | 180.3 | 81.7 | 98.6 |
| 1998-99 | 239.5 | 123.2 | 116.3 |
| 1999-2000 | 276.3 | 143.2 | 133.1 |
| 2000-2001 | 340.4 | 156.6 | 183.8 |
| 2001-2002 | 388.0 | 177.5 | 210.5 |
| 2002 - 2003 | 423.7 | 204.7 | 219.0 |

Exhibit 13: Income Statement, 2002-2003

| | (₹ million) |
|------------------------------|-------------|
| Medical service | 16.21 |
| Operation charges | 254.32 |
| Treatment charges | 22.84 |
| Consulting fees | 23.73 |
| X Ray & Laboratory charges | 4.32 |
| Tuition fees and course fees | 4.79 |
| Grants in aid | 37.80 |
| Donations | 3.74 |
| Interest received | 45.92 |
| Dividends received | 2.50 |
| Miscellaneous income | 1.93 |
| Total 418.10 | |

Expenditure

| | |
|-----------------------------------|--------|
| Staff Salary | 41.22 |
| IOL cost | 39.74 |
| Medicines | 15.97 |
| Electricity | 15.40 |
| Hospital linen | 1.02 |
| Camp expenses | 6.57 |
| Interest expenses | 0.15 |
| Library books | 0.29 |
| Water supply | 1.31 |
| Depreciation | 46.00 |
| Miscellaneous expenditures | 37.04 |
| Excess of income over expenditure | 213.39 |
| Total 418.10 | |

Source: Aravind Eye Care System.

Exhibit 14: Rate Card of AEH, Madurai (₹)

| Cataract with IOL | Surgery | Two days' room rent | Medicines | Total Cost |
|--------------------------|----------------|----------------------------|------------------|-------------------|
| Suite AC | 5500 | 2000 | 700 | 8700 |
| Deluxe AC | 4500 | 1200 | 700 | 6600 |
| A Special | 4500 | 600 | 700 | 6600 |
| A | 4000 | 300 | 700 | 5300 |
| B | 3250 | 200 | 700 | 4400 |
| C | 2750 | 60 | 700 | 3800 |

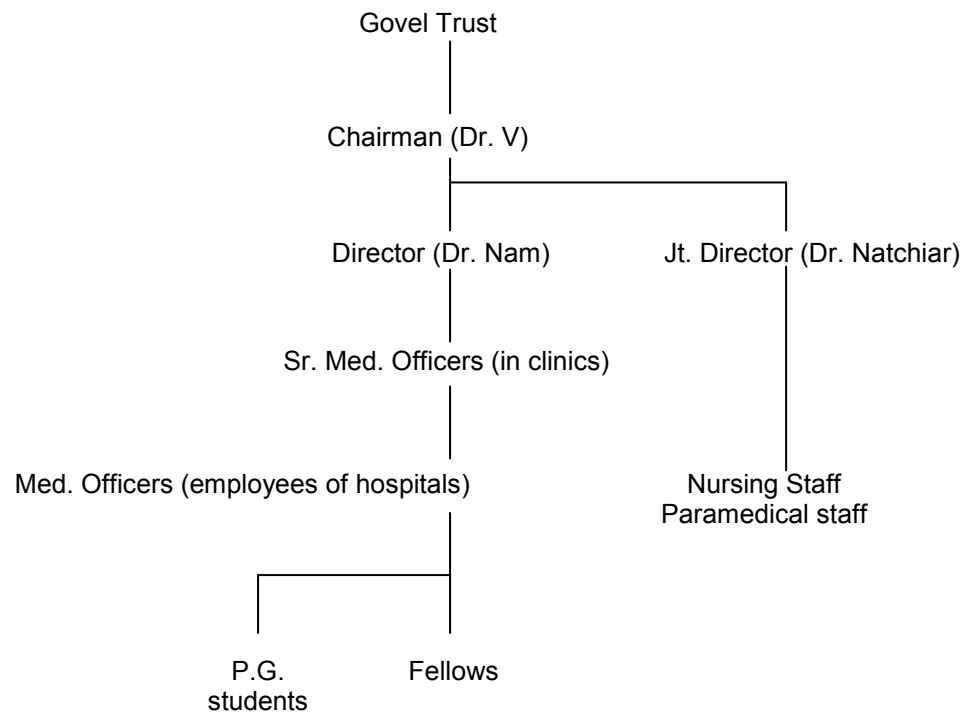
| Phaco with IOL | Surgery | Two days' room rent | Medicines | Total Cost |
|-----------------------|----------------|----------------------------|------------------|-------------------|
| Suite AC | 6500 | 1500 | 700 | 8900 |
| Deluxe AC | 6000 | 800 | 700 | 7700 |
| A Special | 6000 | 400 | 700 | 7300 |
| A | 5500 | 240 | 700 | 6700 |
| B | 5000 | 160 | 700 | 6100 |
| C | 4750 | 60 | 700 | 5700 |

| Phaco with Foldable IOL | Surgery | Two days' room rent | Medicines | Total Cost |
|--------------------------------|----------------|----------------------------|------------------|-------------------|
| Suite AC | 9500 | 1500 | 700 | 11900 |
| Deluxe AC | 8500 | 800 | 700 | 10200 |
| A Special | 8500 | 400 | 700 | 9800 |
| A | 8500 | 240 | 700 | 9700 |
| B | 8500 | 160 | 700 | 9600 |
| C | 8500 | 60 | 700 | 9500 |

| Phaco with Acrylic 3 Piece IOL | Surgery | Two days' room rent | Medicines | Total Cost |
|---------------------------------------|----------------|----------------------------|------------------|-------------------|
| Suite AC | 12500 | 1500 | 700 | 14900 |
| Deluxe AC | 11500 | 800 | 700 | 13200 |
| A Special | 11500 | 400 | 700 | 12800 |
| A | 11500 | 240 | 700 | 12700 |
| B | 11500 | 160 | 700 | 12600 |
| C | 11500 | 60 | 700 | 12500 |

| Cataract without IOL | Surgery | Two days' room rent | Medicines | Total Cost |
|-----------------------------|----------------|----------------------------|------------------|-------------------|
| Suite AC | 3500 | 1500 | 700 | 5900 |
| Deluxe AC | 2000 | 800 | 700 | 3700 |
| A Special | 2000 | 400 | 700 | 3300 |
| A | 1500 | 240 | 700 | 2700 |
| B | 1250 | 160 | 700 | 2300 |
| C | 1100 | 60 | 700 | 2100 |

Source: Aravind Eye Care System.

Exhibit 15: Aravind Hospital: Organization Structure (Medical)

Note: The above is the structure of the Madurai Hospital. The structure of other hospitals was similar. Compiled by the case writers after discussions with the executives of the Aravind Eye Care System.

Exhibit 16: Break-up of Staff Strength in Different Units of AEHs (2003)

| Category | Madurai | Theni | Tirunelveli | Coimbatore | Pondicherry |
|------------------|---------|-------|-------------|------------|-------------|
| Medical Officers | 38 | 2 | 10 | 22 | 13 |
| Fellows & PGs | 62 | 3 | 16 | 23 | 3 |
| Paramedics | 259 | 21 | 100 | 148 | 56 |
| Counsellors | 34 | 2 | 16 | 17 | 7 |
| Others | 310 | 18 | 59 | 72 | 58 |
| Total | 703 | 46 | 201 | 282 | 137 |

Source: Data supplied by Aravind Eye Care System.