



The Aravind Eye Hospital, Madurai, India: In Service for Sight

I (the casewriter) arrived early at 7.00 a.m. at the outpatient department of the Aravind Eye Hospital at Madurai, India. My sponsor, Thulasi (R.D. Thulasiraj, hospital administrator) was expecting me at 8.00 o'clock, but I came early to observe the patient flow. More than 100 people formed two lines. Two young women, assisted by a third, were briskly registering the patients at the reception counter. They asked a few key questions: "Which village do you come from?" "Where do you live?" "What's your age?" and a few more, but it all took less than two minutes per patient. The women seemed very comfortable with the computer and its data-entry procedures.

Their supervisor, a somewhat elderly man with grey hair, was hunched over, gently nudging and helping them along with the registration process. He looked up and spotted me. I was the only man in that crowd who wore western-style trousers and shoes. The rest wore the traditional South Indian garment ("dhoti" or "veshti"), and many were barefooted they could not afford "slippers". The old man hobbled from the registration desk and made his way towards me. The 50-foot distance must have taken him 10 minutes to make because he paused every now and then to answer a question here or help a patient there. I took a step forward, introduced myself, and asked to be guided to Thulasi's office. "Yes, we were expecting you" he said with an impish smile and walked me to the right wing of the hospital where all the administrative offices were. He ushered me into his office and pointed me to the couch across from his desk. It was only when I noticed his crippled fingers that I realized this grand old man was Dr. Venkataswamy himself, the 74-years-old ophthalmic surgeon who had founded the Aravind Eye Hospital and built it from 20 beds in 1976 to one of the biggest hospitals of its kind in the world in 1992, with 1,400 beds.

Dr. V. spoke slowly and with a childlike sense of curiosity and excitement:

Tell me, can cataract surgery be marketed like hamburgers? Don't you call it social marketing or something? See, in America, McDonald's and Dunkin' Donuts and Pizza Hut have all mastered the art of mass marketing. We have to do something like that to clear the backlog of 20 million blind eyes in India. We

Professor V. Kasturi Rangan prepared this case as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administration situation.

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perform only one million cataract surgeries a year. At this rate we cannot catch up. Modern communications through satellites is reaching every nook and corner of the globe. Even an old man like me from a small village in India knows of Michael Jackson and Magic Johnson. [At this point Dr. V. knew that he had surprised me. He suppressed a smile and proceeded.]

Why can't we bring eyesight to the masses of poor people in India, Asia, Africa and all over the world? I would like to do that in my lifetime. How do you think we should do it?

"I'm not sure," I responded, completely swept away and exhausted by the grand vision of this giant human being. But I don't think he wanted an answer that did not match his immense enthusiasm. Like my eight year old son, all he wanted was a way to further his goal, not a real debate on whether the goal was feasible.

The Blindness Problem

As of 1992, there were 30 million blind people in the world - 6 million in Africa, 20 million in Asia, 2 million in Latin America, and the rest in Europe, the former Soviet Union, Oceania, and North America¹. The prevalence of blindness in most industrialized countries of Europe and North America varied between 0.15% to 0.25%, compared with blindness rates of nearly 1.5% for the developing countries in Africa, Asia, and Latin America. While age-related macular degeneration, diabetic retinopathy, and glaucoma were the dominant causes in developed countries, cataract was the major cause of blindness in the developing countries, accounting for nearly 75% of all cases in Asia. Of the several types of cataracts, more than 80% were age-related, generally occurring in people over 45 years (and increasing dramatically in the over-65 age group).

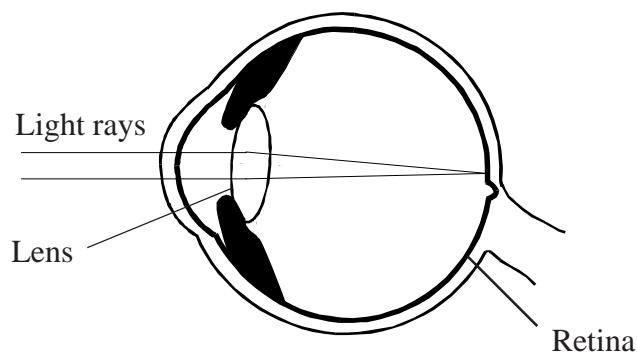
Cataract

As illustrated in **Figure A**, the natural lens of the eye, which is normally clear, helps to focus light on the retina. The lens becomes clouded in a cataract eye and light is not easily transmitted to the retina. The clouding process takes three to ten years to reach maturity and surgical removal of the clouded lens is the only proven treatment. Ophthalmic surgeons in some developing countries usually preferred to remove cataracts only when they were mature (i.e., when they significantly diminished sight.)

1. A distance of 20 feet (or 6 meters) is used as a standard in measuring the eye's ability to recognize certain sizes/profiles/shapes of objects. A less-than-normal eye would only be able to recognize these profiles at this distance, which a normal eye could distinguish at a further distance (e.g. 40 feet or 12 meters). Such a vision, 20/40 or 6/12, would then have to be corrected with glasses. According to the World Health Organization, sight worse than 20/400 or 3/60 (even after correction with glasses) is considered blind.

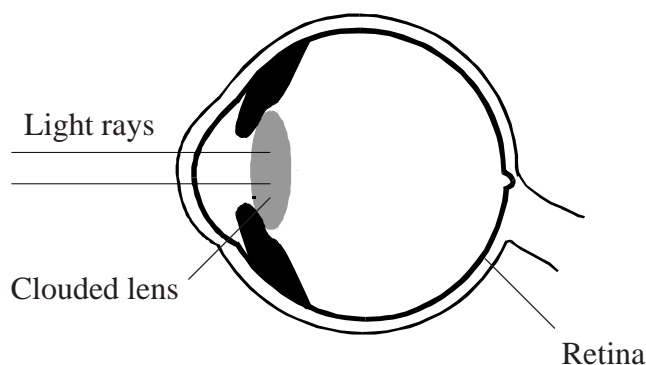
Cross Section of a normal eye

Figure A



The lens focuses light on the retina

Cross Section of a cataract eye



As a cataract forms, the lens becomes opaque and light cannot easily be transmitted to the retina.

Cataract removal was considered a fairly routine operation, usually performed under local anaesthesia, with a higher than 95% chance of improved vision. Two principal surgical techniques were used: intracapsular surgery without intraocular lens (ICCE), and extracapsular surgery with intraocular lens (ECCE). ICCE remained the most widely used procedure in the developing countries. The surgery, almost always performed without an operating microscope, used fairly simple instruments and could be completed in under 20 minutes. Some three to five weeks after surgery, after the eyeball returned to its original shape, the patient was fitted with aphakic spectacles (rather thick lenses that improved vision to an acceptable level). In contrast, the ECCE technique was always performed under an operating microscope. This surgery often required close to 30 minutes, because the surgeon left the posterior capsule intact when removing the natural lens, and then inserted a tiny transparent plastic intraocular lens (IOL) in the posterior chamber. Patients often therefore did not require corrective spectacles to restore vision. Moreover, the quality of the restored sight was near-natural and free of distortion or magnification. Unlike ICCE patients, ECCE patients usually experienced significant improvement in sight within days of the operation. ICCE patients, on the other hand, usually experienced gradual improvement over a three-to five-week period.

India

India's population of 850 million in 1991 was the second-highest in the world, after China. Although there were nearly 20 million blind eyes in India, with another two million being added annually, only 12 million people were classified as blind because the rest had better than 20/200 or 6/60 vision in one eye. Cataract was the main cause in 75% to 80% of the cases. The annual per-capita income of an Indian citizen was Rs.6, 800 (\$275), with over 70% below the Rs.2,500 (\$100) poverty line; the incidence of cataract blindness, however, was fairly uniformly distributed across the various socioeconomic groups. Although India's 8,000 ophthalmologists² (eye doctors) performed nearly 1.2 million cataract operations a year, the medical infrastructure to clear the backlog of cataract cases was woefully inadequate in making maximal use of existing resources. The United States, for instance, had twice as many ophthalmologists for a population of only about 250 million. India had about 42,200 eye hospital beds,³ and the medical resources and infrastructure were two-third skewed to the urban areas where less than one-third of the nation's population lived. The government, through its Ministry of Health and Family Welfare, took an active role in blindness prevention programs. Its 425 district hospitals (about one for every two million people) offered free eye care and cataract surgery to people who could not afford private treatment. About 30% of all cataract surgeries in India were performed in the government sector (both central and state), free of cost to the patients. Another 40% were performed in the private sector for a fee, and the remaining 30% were performed free of cost by volunteer groups and NGOs (nongovernment organizations). The government currently allocated about Rs.60 million (\$2 million) annually for blindness prevention programs. A recent report to the World Bank estimated that nearly \$200 million (Rs.6,000 million) would be required immediately to build the infrastructure for training personnel, purchasing equipment, and building facilities to overcome the country's blindness problem.

Dr. V. and the Aravind Eye Hospital

The eldest son of a well-to-do farmer, Dr. Govindappa Venkataswamy was born in 1918 in a small village near Madurai in South India. After his education in local schools and colleges, Dr. V. graduated with a bachelor's degree in medicine from Madras University in 1944. During his university years, and immediately thereafter, he was deeply influenced by Mahatma (meaning "great man") Gandhi, who united the country in a nonviolent movement to seek independence from British rule. Dr.V. reasoned that the best way to serve his country in the struggle for freedom would be in the capacity he was best trained for - as a doctor. So he joined the Indian Army Medical Corps in 1945, but was discharged in 1948 because of severe rheumatoid arthritis. Dr.V. recalled,

I developed severe rheumatoid arthritis and almost all the joints were severely swollen and painful. I was bedridden in a Madras hospital for over a year. The arthritis crippled me badly and for years I could not walk long distances, which I was accustomed to doing as a village boy. In the acute stage, for several months I could not stand on my feet and I was confined to

2. Ophthalmologists are trained eye doctors with medical degrees. They examined patients and prescribed treatment; if the treatment involved corrective glasses, the patients could get them from an optician. Unlike in the United States there were very few optometrists (professionals who measured eye sight and prescribed glasses) in the Indian medical system.

3. These were located in government hospitals, medical college hospitals, mobile hospitals, eye hospitals, and private nursing homes.

bed for over a year. I still remember the day I was able to stand on my feet. A relative of mine had come to see me in the hospital ward and I struggled hard to keep my feet on the ground and stand close to the bed without holding it. When I did, it felt as though I was on top of the Himalayas. Then, for several years, I used to struggle to walk a few yards or squat down on the floor. Even now in villages we normally squat on the floor when we eat, and I find it difficult. I could not hold a pen with my fingers to write in the acute stage of arthritis. We normally eat food with our fingers. I found it difficult to handle the food with my swollen fingers. Later I trained slowly to hold the surgeon's scalpel and cut the eye for cataract operations. After some years, I could stand for a whole day and perform 50 operations or more at a stretch. Then I learned to use the operating microscope and do good, high-quality cataract and other eye surgeries.

By the time of his retirement in 1976, Dr.V. had risen to head the Department of Ophthalmology at the Government Madurai Medical College and also to head Eye Surgery at the Government Erskine Hospital, Madurai. After retirement, in order to fulfill a long-cherished dream- the creation of a private, nonprofit eye hospital that would provide quality eye care- Dr.V. founded the Aravind Eye Hospital, named after an Indian philosopher and saint, Sri Aurobindo. Dr.V. noted:

What I learnt from Mahatma Gandhi and Swami [saint] Aurobindo was that all of us through dedication in our professional lives can serve humanity and God. Achieving a sense of spirituality or higher consciousness is a slow, gradual process. It is wrong to think that unless you are a mendicant or a martyr you can't be a spiritual person. When I go to the meditation room at the hospital every morning, I ask God that I be a better tool, a receptacle for the divine force. We can all serve humanity in our normal professional lives by being more generous and less selfish in what we do. You don't have to be a "religious" person to serve God. You serve God by serving humanity.

History

The 20-bed Aravind Eye Hospital opened in 1976 and performed all types of eye surgery; its goal was to offer quality eye care at reasonable cost. The first three surgeons were Dr. V.; his sister, Dr. G. Natchiar; and her husband, Dr. P. Namperumalswamy (Dr. Nam). A 30-bed annex was opened in 1977 to accommodate patients convalescing after surgery. It was not until 1978 that a 70-bed free hospital was opened to provide the poor with free eye care. It had a four-table operating theater with rooms for scrubbing, changing and sterilization of instruments. A main hospital (for paying patients), commenced in 1977 and completed in 1981, had 250 beds with 80,000 square feet of space in five floors, four major operating theaters (two tables per theater), and a minor one for septic care. There were specialty clinics in the areas of retina and vitreous disease, cornea, glaucoma and squint corrections, diabetic retinopathy, and pediatric ophthalmology; the heads of all but one of these clinics were family members of Dr. V., and all had received training in the United States. The Main Hospital was well-equipped with modern, often imported, equipment to provide the best possible eye care for its patients. (In 1992, there were about 240 people on the hospital's staff, including about 30 doctors, 120 nurses, 60 administrative personnel, and 30 housekeeping and maintenance workers.)

In 1984 a new 350-bed free hospital was opened. A “bed” here was equivalent to a 6’ x 3’ mattress spread out on the floor. This five-story hospital had nearly 36, 000 square feet of space and its top story accommodated the nurses’ quarters for the entire Aravind group of hospitals. The hospital had two major operating theaters and a minor theater for septic cases. On the ground floor were facilities for treating outpatients; in-patients were housed in large wards on the upper floors. The Free Hospital was largely staffed with medical personnel from the Main Hospital. Doctors and nurses were posted in rotation so that they served both facilities, thereby ensuring that nonpaying and paying patients all received the same quality of eye care.

Nearly half the patients in the Free Hospital were sourced from eye camps. Every Saturday and Sunday, teams of doctors and support staff with diagnostic equipment fanned out to several rural sites to screen the local populations. Eye camps were sponsored events, where a local business man or a social service organization mobilized resources to inform the local public within about a 25-to 50-mile radius of the forthcoming screening camp. Camps were usually held in towns that served as the commercial hub for a number of neighboring villages. Local schools, colleges, or marriage halls often served as campsites. Patients from surrounding villages who traveled by bus to the central (downtown) bus stand, were transported to the campsite by the sponsors. Several patients from the local area came directly to the campsite. The Aravind team screened patients at the camp, and those selected for surgery were transported the same afternoon by bus to the Free Hospital at Madurai. They were returned three days later, after surgery and recuperation, back to the campsite where their family members picked them up. Patients who came from nearby villages were taken to the central bus stand and provided return tickets to their appropriate destinations. A clinical team from Aravind went back to the campsite after three months for a follow-up evaluation of the discharged patients. Patients were informed of the dates for the follow-up camps well in advance- in many cases, at the time of the initial discharge after surgery. Aravind provided the services of its clinical staff and free treatment for the patients selected for surgery; the camp sponsors bore all other administrative, logistical, and food costs associated with the camp. (**Exhibit 1** shows the location of the various Aravind hospitals; **Exhibits 2** and **3** show the inpatients ward at the Aravind Main Hospital, Free Hospital, and some typical eye camp activities.)

As the Aravind Eye Hospital grew from a 20-bed to a 600-bed hospital, many members of Dr. V.’s family joined in support of his ideals. His brother, G. Srinivasan, a civil engineering contractor, constructed all the hospital buildings at cost and later became the hospital’s finance manger. A nephew, R.D. Thulasiraj (Thulasi), gave up a management job in private sector to join as the hospital’s administrator. Thulasi, at Dr. V.’s insistence, trained at the University of Michigan in public health management before assuming administrative duties at Aravind. Thirteen ophthalmologists on the hospital’s staff were related to Dr. V. In order to provide continuous training to its ophthalmic personnel, Aravind had research and training collaborations with St. Vincent’s Hospitals in New York City and the University of Illionis’ Eye and Ear Infirmary in Chicago; both institutions also regularly sent their own ophthalmologists for residency training to Aravind. Aravind was also actively involved in training ophthalmic personnel in charge of administering blindness prevention projects in other parts of Asia and Africa. Explaining the unfailing support of this family members, Dr.V. recalled.

We have always been a joint family through thick and thin. I was 32 when my father died. I was the eldest in the family, and in a family system like ours, I was responsible for educating my two younger brothers and two younger sisters, for organizing and fixing their marriages-that is the usual

custom we have –for finding suitable partners for them. I was the head of the family and looked after all of them. But that was not a problem. I was not married, because of my arthritis trouble. Now it has become a boon. My brother takes care of me, and I stay with him all the time. His children are as much attached to me as they are to him.

Dr. Natchiar, Dr.V.'s sister and now the hospital's senior medical officer, elaborated:

When Brother retired from government services, he seemed awfully impatient to serve society in a big way. He asked me and my husband [Dr.Nam] if we would give up our government jobs to join him. Usually in India, when one leaves government service to enter private practice, incomes go up threefold. In this case, we were told that our salaries would be about Rs.24, 000 a year (approximately \$1, 500 in 1980). And worse still, Brother always believed in pushing the mind and body to its highest effort levels. So we would have to work twice as hard for half the salary. My husband and I talked it over and said yes. We did not have the heart to say no. But what we lost in earning was made up by the tremendous professional support that Brother gave us. We were encouraged to attend conferences, publish papers, buy books, and do anything to advance our professional standing in the field. It is only in the last five years that our senior surgeon's salaries are reasonably consistent with their reputation in the field.

On his insistence that the hospital staff be totally committed and dedicated to the mission of the Aravind Hospital, Dr.V. expressed his philosophy:

We have a lot of very capable and intelligent people, all very well trained in theoretical knowledge. But knowledge by itself is not going to save the world. Look at Christ; you cannot call him a scholar, he was a spiritual man. What we need is dedication and devotion to the practice. When doctors join us for residencies, we gradually condition them physically for long hours of concentrated work. Most believe they need work only for a few hours and that, too, for four days a week. In government hospitals, rarely do surgeons work for more than 30 hours a week: we normally expect our doctors to go 60 hours. Moreover, in the government hospitals there is a lot of bureaucracy and corruption. Patients feel obliged to tip the support staff to get even routine things done. Worse still, poor villagers feel totally intimidated. We want to make all sorts of people feel at ease, and this can only come if the clinical staff and their support staff view the entire exercise as a spiritual experience.

Aravind Eye Hospital: 1992

By 1988, in addition to the 600 beds at Madurai, a 400-bed hospital at Tirunelveli, a bustling rural town 75 miles south of Madurai, and a 100-bed hospital at Theni, a small town 50 miles west of Madurai, were also started (see **Exhibit 1**). There were plans afoot to set up a 400-bed (Rs.10 million) hospital at Coimbatore, a city 125 miles north of Madurai. Coimbatore, like Madurai, was the hub of its districts and was bigger than Madurai in population and commerce. Dr. Ravindran, a family member who currently headed the Tirunelveli Hospital was slated to run the Coimbatore Hospital. Succession plans for the Tirunelveli Hospital would then have to

be worked out. Managing the Theni Hospital, which was located in Dr. Nam's home town, was not a big problem: first, because the facility was small, and second, because of the informal supervision it received whenever Dr. Nam visited his home town. In fact, Dr. Nam had been instrumental in setting up this facility to serve his community. In Madurai, by adding a block of 50,000 square feet to the Main Hospital and some reorganization in the Free Hospital, another 300 beds were added in 1991-250 of which were in the Free Hospital.

By 1992, the Aravind group of hospitals had screened 3.65 million patients and performed some 335,000 cataract operations-nearly 70% of them free of cost for the poorest of India's blind populations. (See **Exhibit 4** for a performance summary since the hospital's inception in 1976. **Exhibit 5** for details of its 1991 performance and **Exhibit 6** for Aravind's performance in the first six months of 1992.) All this was achieved with very little outside aid or donations. According to Dr. V.:

When we first started in 1976, we went around asking for donations, but we didn't have the credibility. A few friends promised to help us, but even they preferred to avoid monetary assistance. It was simple: we had to get started. So I mortgaged my house and raised enough money to start. Then one thing led to another and suddenly we were able to plan the ground floor of the Main Hospital. From the revenue generated from operations there, we built the next floor, and so on until we had a nice five-story facility. And then with the money generated there, we built the Free Hospital. Almost 90% of our annual budget is self-generated. The other 10% comes from sources around the world, such as the Royal Commonwealth Society for the Blind [U.K.] and the SEVA Foundation [USA]. We expend all our surplus on modernizing and updating our equipment and facilities. We have enough credibility now to raise a lot of money, but we don't plan to. We have always accepted the generosity of the local business community, but by and large, our spiritual approach has sustained us.

(See **Exhibit 7** for a 1991-1992 statement of income and expenses, and **Exhibit 8** for a historical summary.)

Having grown from strength to strength, Aravind in 1991 made a move to set up a facility for manufacturing intraocular lenses (IOLs).

IOL factory IOLs, which were an integral part of ECCE surgery, cost about \$30 (Rs.800) apiece to import from the United States. At a cost of Rs.8 million, in 1991, Aravind had therefore set up a modern IOL manufacturing facility. Called the Auro Lab, it could produce up to 60,000 IOLs a year. Currently, Auro Lab productions yield about 50% defect-free lenses, quality rated on par with imported lens. Mr. Balakrishnan, a family member with extensive engineering experience and doctoral education in the United States, had returned to manage Auro Lab. Dr. V. reasoned that within a year or two when the factory yield improved, it would be possible to bring down the manufacturing costs from approximately Rs.200 per lens to approximately Rs.100.

People come for cataract surgery very late in life, because the quality of regained vision after intra-cap surgery is so-so, but not excellent. With extra-cap surgery and IOL implants, the situation is dramatically different. People would opt for surgery earlier, because they can go back to their pro-

fessions and be productive right away. My aim is to offer 100% IOL surgeries for all our patients, paying and free. That is the better-quality solution, and we should provide it to all our patients.

Thulasi, Aravind's hospital's administrator, explained the challenges ahead:

Yes, our expansion projects are all very exciting but we cannot take our eye off the ball. We have to concentrate on the things that made us good in the first place. For instance, my biggest concern is the occupancy rate in the free hospital. On Monday, Tuesday, and Wednesday we are choked and overflowing with patients. Our systems have all got to work at peak efficiency to get by. But on Thursday and Friday, we suddenly have a slack. We need some continuity to keep our staff motivated and systems tuned.

Dr. Ravindran, head of the Tirunelveli hospital, concurred:

We have some fundamental management problems to sort out. While our cash flows and margins look all right at Tirunelveli, I am unable to repay the cost-of-capital. Thank God, Madurai buys all the equipment on our behalf. We started the Tirunelveli hospital with a lot of hope and experience. Even the physical design was an improvement over our Madurai facility. We have integrated the paying and free hospitals for economics of scale. The wards and patients examination rooms in the free section are far more spacious than at Madurai. Moreover, in order to better utilize operating room capacity, we have a central surgical facility which the free and paying sections of the hospital jointly utilize. Yet, after four years, we are not yet financially self-sufficient at Tirunelveli.

Thulasi mentioned another issue:

When we expand so fast, we have to keep in mind that we need to attract quality people. Fortunately our salary scales are now reasonable in comparison with the private sector, but we are still not there. For example, an ophthalmologist at Aravind would today, on an average, make Rs.80,000 annually. Not bad, compared to government sector salaries of about Rs.60,000. Of course, in private practice, some ophthalmologists can make Rs.300,000. But not everyone has the up-front capital to get top-notch equipment to facilitate such practice. Our nurses are paid Rs.12,000 a year on average, which is not bad at all given that our staff is recruited and trained from scratch by us. They don't come from nursing school; we provide the training for them. It is like getting a prestigious degree and job training all in one.

A Visit to the Aravind Eye Hospital

The Main Hospital

Located one block from the Free Hospital, the Main Hospital functioned very much independently. Complicated cases from the Free Hospital were brought in when necessary for diagnosis and treatment, but by and large all patients at this hospital paid for the hospital's services. Patients came to this hospital from all over Madurai district (i.e., towns and villages

surrounding the city). The cost of a normal cataract surgery (ICCE), inclusive of three to four days' post-operative recovery, was about Rs.500 to Rs.1, 000. If the patient required an IOL implant (ECCE), the total cost of the surgery was Rs.1, 500 to 2,500. The hospital provided A, B and C class rooms, each with somewhat different levels of privacy and facilities and appropriately different price levels.

The morning was usually very heavy, and by early afternoon, most people divided into two groups for a sequential series of evaluations. First, ophthalmic assistants recorded each person's vision. The patients then moved to the next room for a preliminary eye examination by an eye doctor. There were several eye doctors on duty, and ophthalmic assistants noted the preliminary diagnosis on the patient's medical record. Ophthalmic assistants then tested patients for ocular tension and tear duct function, followed by refraction tests. The final examination was always conducted by a senior medical officer. Not all patients passed through every step; for example, those referred to specialty clinics (such as retina and vitreous diseases) would directly move to the specialty section of the hospital on the first floor. Similarly, patients diagnosed as needing only corrective lenses would move to the optometry room for measurement and prescription of glasses. Those diagnosed as requiring cataract surgery would be advised in-patients admission, usually within three days. Most such patients followed up on the advice.

On the day of the surgery, the patient was usually awakened early, and after a light breakfast, was readied for surgery. On a visit to the operation theater, I noticed about 20 patients seated in the hallway, all appropriately prepared by the medical staff to enter into surgery, and another 20 in the adjacent room in the process of being readied by the nursing staff. The procedure involved cleaning and sterilizing the eye and injecting a local anaesthetic. The operating theater had two active operating tables and a third bed for the patients to be prepared prior to surgery.

I (the case writer) watched several operations performed by Dr. Natchiar. She and her assistants took no more than 15 minutes for each ECCE cataract surgery. She generously offered me the east port of the operating microscope to observe the surgical procedure. She operated from the north port, directly behind the patient's head. A resident in training from the University of Illinois occupied the west port. I had never seen a cataract surgery before, but was amazed at the dexterity of her fingers she made the incision and gently removed the clouded lens, leaving the posterior chamber in place. Then she inserted the IOL [intraocular lens], and carefully sutured the incision. Even while she was operating, she explained to me in a methodical step-step fashion the seven critical things she had to do to ensure a successful operation and recovery. When she was done, she simply moved on the adjacent operating table, where the next patient and a second supporting team were all ready to go. Meanwhile the previous surgical team helped the patient off the operating table to walk to the recovery room and prepared the next patient, who was already waiting in the third bed for the next surgery. Dr. Natchiar had started that day at about 7:30 a.m., and when I left at about 10:30 a.m., was still going strong in a smooth, steady, uninterrupted fashion. The whole team carried on about their task in a well-paced, routine way. There was none of the drama I had expected to encounter in an operating theater.

In contrast, Dr.Nam was performing a retina detachment repair in the adjoining operating theater. Without looking up from his task, Dr.Nam told me that he was in the midst of a particularly difficult procedure and it would probably be another hour before he could comfortably converse. His surgical team bent over the operating table in deep concentration, reflecting the nonroutine nature of their task.

The Free Hospital

The outpatient facilities at the Free Hospital were not as organized as the Main Hospital's. There was a temporary shelter at the Free Hospital's entrance where patients waited to register. Those who came for a return visit were directed to a different line from those who came for the first time. The patient flow inside also seemed somewhat crowded. The sequence, however, remained the same: registration; vision recording; preliminary examination; testing of tension and tear duct function; refraction test; and final examination.

The people in the hallways and waiting rooms appeared significantly poorer than those I had seen at the Main Hospital. A handful of administrative assistants in blue uniforms moved around in the crowd, helping patients and guiding them along in the sequential flow. As I walked up to the operating theaters on the next floor, patients from the previous day's "eye camp" were awaiting their turn to be prepared for surgery. Some older patients, clearly tired, had spread themselves out on the floor and against the walls. There was a lot more commotion here than at the Main Hospital.

Almost all the surgeries at the Free Hospital were of the intracapsular (ICCE) type. An extracapsular (ECCE) procedure with IOL was preformed only when medical reasons dictated against an intracapsular surgery.

The operating theaters also appeared more crowded and cramped. The uniforms of the supporting staff were green, whereas they were blue at the Main Hospital, and only one of the other operating tables was equipped with an operating microscope. The patient preparation for surgery and flow was similar to that at the Main Hospital. Two surgeons operated in the same theater, and each had two operating tables and one staging bed to organize the workflow. Historically, at Aravind, a team of five surgeons and 15 nurses could operate on about 150 cases in about five hours.

Dr. Narendran, who was in the midst of a cataract operation, invited me to the operating table. The critical steps in surgery here were essentially the same as I had seen in the Main Hospital except that intact clouded lens, along with its supporting membrane capsule, was removed here with a cryogenic device and the incision was sutured. An IOL was not inserted. These patients would be fitted with aphakic glasses three days later. Dr. Narendran had the following conversation with his patient:

Doctor: Old man, what do you do for a living?

Patient: I don't do anything. I just sit at home.

Doctor: Does your wife provide you with food?

Patient: No, my wife died long ago. My daughter-in-law takes care of me.

Doctor: Does she take good care of you?

Patient: No, but does the best she can. Once a day she gives me "kanji" [boiled rice and salt]. That, with some water, takes care of my needs.

Doctor: What will you do after you regain your eyesight?

Patient: I will go back to tending a herd of sheep. I used to know the owner [rancher]. He used to pay me a small fee.

Doctor: What will you do with that money?

Patient: Oh. I can then buy some meat once in a while. And I can also take my grand daughter to the temple fair next year.

Unlike the Main Hospital patients in the Free Hospital did not have “beds” in which to recuperate and recover, but rather were taken to big rooms on the upper floors and each was provided with a 6' x 3' bamboo/coir mat, which was spread out on the floor as a bed, and a small sized pillow. There were several such rooms, each accommodating 20 to 30 patients. Each rooms had self-contained bathrooms facilities. People from the same or nearby villagers were usually accommodated in the same room. They moved together as a cohort, both before and after surgery. The postoperative recovery period was usually three days, when the bandage was removed, patients eyes checked and, if all was well, aphakic glasses fitted. Patients were advised to come back in three months for follow-up evaluation.

At the Free Hospital, detailed records were kept of all postoperative complications (see **Exhibit 9**). Some complications, such as iritis, were considered minor and easily treatable, while others required extra care and additional hospital stay. Such complications were directly traced to the operating team, even to the level of the individual surgeon. Senior medical officers reviewed the data with the individuals concerned and offered coaching and advice to rectify operating techniques, if necessary.

At the records room in the Free Hospital, I pulled out six patient records at random to get a sense of the improvement in sight after surgery. A summary is provided below.

	Preoperative Sight Recording	Post-operative Sight Recording
Patient 1	No vision. Can register hand movements	6/12
Patient 2	No vision. Can register hand movements	6/12
Patient 3	No vision. Cannot register hand movements Can perceive light	6/36
Patient 4	No vision. Can register hand movements	6/6
Patient 5	No vision. Can register hand movements	6/18
Patient 6	3/60	6/12

The Eye Camp

I visited a typical eye camp, at Dindigul, a semi-urban town about 100 miles east of Madurai. These screening camps were almost always conducted with the help of local community support, with either a local business enterprise or a social service organization taking the lead role in organizing them.

The local sponsors provide information regarding the eye camp to all the neighboring communities (about a 25-mile radius). Public announcements in marketplaces, newspaper advertisements, information pamphlets, and other publicity material were prepared and distributed one to three weeks in advance of the camp. The camp was usually promoted under the sponsor's name, with the Aravind service playing only a supporting role. The sponsor not only paid all the publicity costs but also the direct costs

associated with organizing the camp-patient transportation, food, and aphakic glasses. In addition, the sponsors also paid for the costs of transporting, feeding, and bringing back the patients selected for surgery. This portion was estimated at Rs.200 per patient. Aravind bore the costs of surgery and medicines.

The camp at Dindigul was sponsored by a local textile mill owner. There were three other Aravind-associated camps in other parts of the Tamil-Nadu state that day. One was sponsored by a religious charity (Sathya Sai Baba Devotee's Association), one by a popular movie actor fan club (Rajni Kanth Appreciation Club), and the third by the Lion's Club. According to Dr. V.:

The concept of eye camp is not new. As the head of the government hospital, I used to go out with a team of doctors and support staff several times a year to screen patients in their own villages. Many of my colleagues in other parts of India also use this idea as part of their outreach programs. We were somewhat fortunate in the sense that we invested in the infrastructure, such as the vans and the equipment and committed doctors to support the demand we got from philanthropic individuals and organizations.

In the formative years of Aravind, patients attending the screening camps were examined and those needing surgery were appropriately advised. Even though surgery was free, the patients had to come to Aravind at their own expense. The response rate was less than 15%. Concerned by the low turnout, a research team from Aravind conducted in-depth home interviews with a randomly selected group of 65 patients for whom surgery was recommended but who didn't respond for over six months. The study revealed the following constraints.

• Still have vision, however diminished	26%
• Cannot afford food and transportation	25
• Cannot leave family	13
• Fear of surgery	11
• No one to accompany	10
• Family opposition	5
• Others	10

As a consequence, Aravind requested and the camp sponsors readily agreed to bear the costs of food, transportation and, in many cases, the cost of aphakic glasses to be worn by the patient after surgery. In order to reduce the fear of surgery, as well as to encourage a support group, patients were transported to Madurai as a group by buses. Patients were asked to bring a small travel bag in case it was necessary to go to Madurai. The sequence of screening steps matched those at the base hospitals:

1. Registration
2. Vision recording
3. Preliminary examination
4. Testing of tension and tear duct function
5. Refraction
6. Final examination by a senior medical officer
7. Optical shop (for those that needed it)

In addition, those selected for surgery had to undergo tests for blood pressure and urine sugar and if qualified, their surgery papers were prepared on the campsite. In addition, Aravind camp organizers, as well as local community elders, explained and reassured the patient regarding the

importance of the surgery and the other logistics involved. Bus trips were so organized that individuals from the same or nearby villages were always clustered in the same bus trip, which reduced the need for anyone to accompany the patients. They were all returned together after three or four days. This established a support group during their recovery phase. A team from Aravind returned for follow-up after three months.

The Dindigul camp was very well run. Soundararaja Mills (the sponsors) had organized bus shuttles from the central town bus stand to transport passengers to the campsite. About 1,000 people came from the villages within a 25-mile radius of the town. The mill owner had sought the cooperation of a local college, of which he was a trustee and a significant donor, for providing the physical facilities. At the campsite, the college principal was actively supervising the arrangements. He brought me a chart of the historical performance of the Soundararaja camp for the last five years. Many volunteer students were helping the Aravind staff organize the patient flow. The mill owner's son, also its finance manager, walked around the camp constantly inquiring about the arrangements. There was a sense of festivity in the air, as record "nadaswaram"⁴ music was being played over the public address system. A packed lunch was provided for those selected for surgery, and refreshments and a sit-in lunch for all the doctors and support staff participating in the camp. One of the school teachers who had organized the marketing of the camp explained:

My students simply worked flat out in the last one week. Soundararaja Mills provided us transportation to cover over 1,000 driving miles. Our "propaganda" was affected through handbills, wall posters and traveling megaphone announcements. Last Thursday night, they were mounting publicity posters on every public bus. We could not do it earlier because buses in this town are all scrubbed and cleaned every Wednesday night.

The camp had commenced on a Sunday morning at 8:00 a.m. and when I left at about 2:00 p.m. about 800 people had been screened and nearly 150 selected for surgery. The first group of patients were ready to leave for Madurai. Dr. Nam and his team were working away at a steady pace. He explained to me that nearly two-third of the work was done, but the turnout was a little lower than expected, because just two months prior to this camp, another organization had conducted an eye camp in the same area. (**Exhibit 10** provides a history of Aravind's "eye camp" performance. **Exhibit 11** provides further detail by type of sponsor for the 1991 eye camps.)

In the past, Aravind had also conducted several surgical camps. That is, patients identified as needing surgery would be provided the requisite treatment on-site. Recently, however, there was a conscious effort to move away from surgery camps because of the higher cost as well as lower quality of service they provided. For example, the makeshift operating theaters were not air-conditioned, cleanliness and hygiene were often not up to hospital standards, patient amenities were inferior, and post-operative complications were difficult to monitor.

The Aravind organization included a 10-person team of camp organizers. These individuals reported to Meenakshisunadaram (Sundar), the camp manager. Camp organizers were responsible for working closely with the camp sponsors, helping and guiding them with directions for mounting publicity, organizing the logistics, and arranging physical facilities for the eye camp. In addition to working closely with the sponsors who needed help, camp organizers also guided new sponsors who approached Aravind for their expertise and help in bringing eye-care to certain targeted communities.

4. Nadaswaram, a wind instrument much like a clarinet, was often played at auspicious occasions such as weddings in South India.

Camp organizers were aligned by district as shown in the territory map (**Exhibit 12**) and traveled extensively within their assigned territories. They all met at Aravind's headquarters at Madurai, once a week under the chairmanship of Dr.V. At one such meeting which I attended, Dr. V. went around the table from person to person asking for territory plans and every once in a while urged a camp organizer, "Why was the camp yield so poor in your territory? We could get only 14 surgery cases from a catchment population of nearly 100,000! Something is not right. Brother, find out what is going on! Work with the sponsor to improve propaganda." (See **Exhibit 13** for districtwide camp particulars.)

According to Sundar, the camp manager:

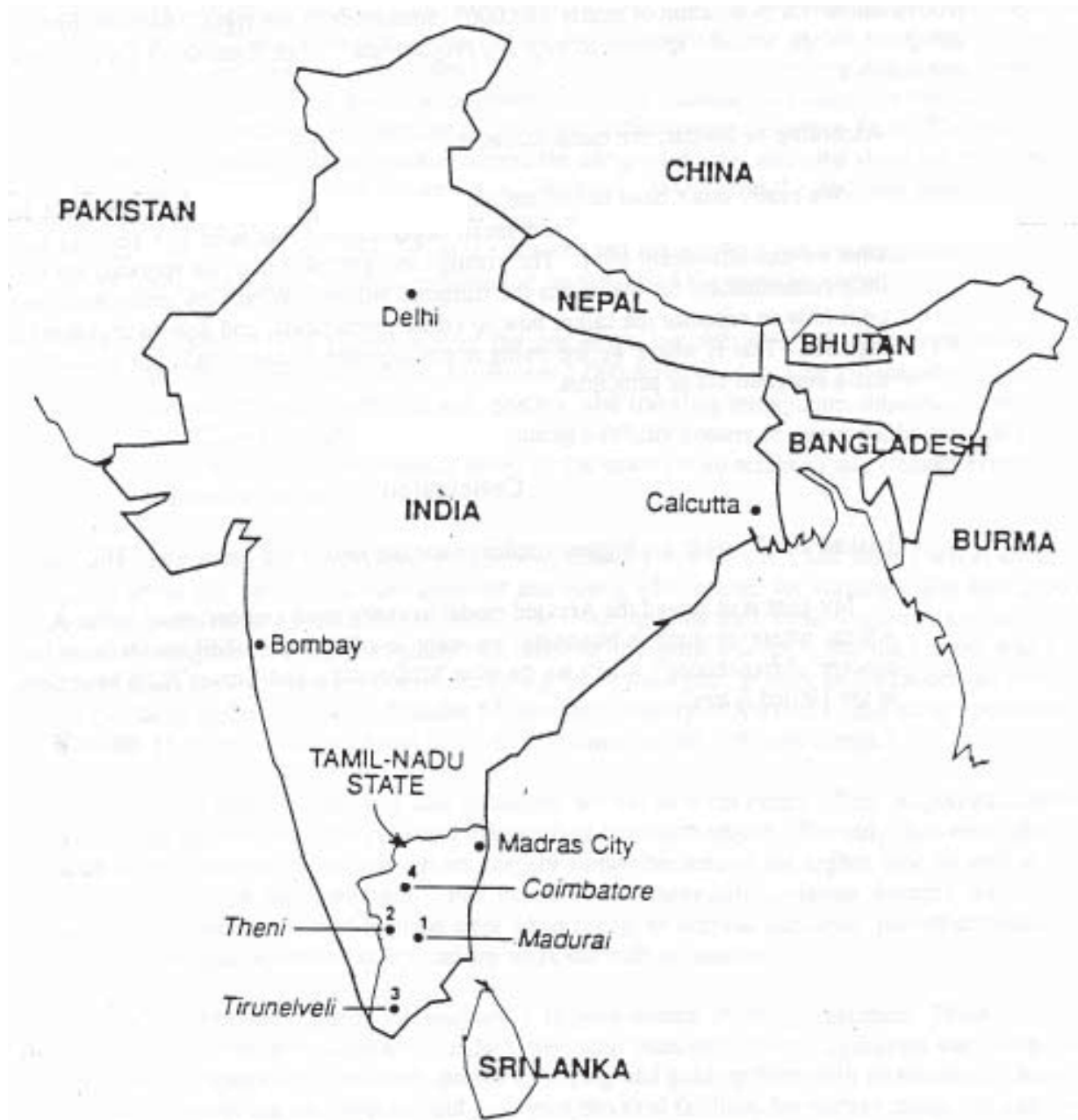
We really don't have to sell the idea of an eye camp to anyone. There are far more individuals, businesses, and social organizations that need our services than what we can effectively offer. The prestige and goodwill that our sponsors earn, in their communities, far outweighs the financial burden. What they really need help on is how to organize the camp, how to create propaganda, and how to organize the logistics. That is where we are trying to put together a consistent set of procedures and a common set of principles.

Conclusion

I asked Dr.V. what his biggest for the next three years was. His reply:

My goal is to spread the Aravind model to every nook and corner of India, Asia, Africa; wherever there is blindness, we want to offer hope. Tell me, what is this concept of franchising? Can't we do what Mc Donald's and Burger King have done in the United States?

Exhibit 1 Aravind Eye Hospital Locations



The four Aravind locations are shown in italics



A private room in the Main Hospital



In-patient ward at the Free Hospital

Exhibit 3 Eye Camp Activities



- From top, clockwise:
- a) Patients arriving by bus to the campsite
 - b) Patients registering at the campsite
 - c) Testing and preparing patients selected for surgery



Exhibit 1 Historical Patient Statistics (Consolidated)

Year	Paying		Free and Camp		Total	
	Outpatient Visits	Surgery	Outpatient Visits	Surgery	Outpatient Visits	Surgery
1976	NA	248	---	---	---	248
1977	15,381	980	2,366	---	17,747	980
1978	15,781	1,320	18,251	1,045	34,032	2,365
1979	19,687	1,612	47,351	2,430	67,038	4,042
1980	31,334	2,511	65,344	5,427	96,678	7,938
1981	39,470	3,139	75,727	8,172	115,197	11,311
1982	46,435	4,216	79,367	8,747	125,802	12,963
1983	56,540	4,889	101,469	11,220	158,009	16,109
1984	69,419	5,796	103,177	11,954	172,596	17,750
1985	89,441	7,194	153,037	17,586	242,478	24,780
1986	111,546	8,202	1,64,977	19,623	276,523	27,825
1987	121,828	9,971	180,181	21,562	302,009	31,533
1988	182,274	12,702	232,838	23,635	415,112	36,337
1989	203,907	15,103	290,859	25,867	494,766	40,970
1990	227,243	17,896	338,407	31,162	565,650	49,058
1991	241,643	19,511	327,692	31,979	569,335	51,490
1992	257,688	24,577	341,378	36,438	599,066	61,015
1993	293,149	27,979	364,558	41,380	657,707	69,359
1994	317,306	32,083	399,948	49,632	717,254	81,715
1995	327,768	36,138	414,817	59,535	742,585	95,673
1996	347,775	38,663	463,214	69,149	810,989	107,812
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	1,329,010	191,158
2002	650,047	68,055	749,324	1,28,384	1,399,371	1,96,439
Total	62,33,834	6,11,860	8,428,198	1,183,865	14,662,032	1,795,725

Source : Aravind Eye Hospital.

Exhibit 2 Patient Statistics: 2002

	Madurai	Tirunelveli	Theni	Coimbatore	Total
Outpatient Visits					
Paying	276,548	132,272	40,149	201,078	650,047
Free(Direct & Camp)	328,651	138,425	41,685	240,563	749,324
Surgery					
Paying	34,510	12,107	1,863	19,575	68,055
Free (Direct & Camp)	66,363	19,719	5,273	37,029	128,384
Hospital OP visits	409,755	182,356	60,035	285,463	937,609
Eye camp OP visits	195,444	88,341	21,799	156,178	461,762
Total OP visits	605,199	270,697	81,834	441,641	1,399,371
Screening Camps	591	364	132	463	1,550
Surgery Details					
Extra Capsular Cataract Extraction (ECCE) & other lens removal procedures without IOL					
	1,257	1,862	99	1,259	4,447
ECCE with IOL implantation	40,962	4,383	6,084	9,651	61,080
ECCE IOL implantation with phaco	9,900	3,569	262	7,626	21,357
Small Incision Cataract Surgery	27,503	14,984	0	24,797	67,284
Trabeculectomy & combined procedures					
	1,437	690	38	952	3,117
Retinal Detachment	625	64	0	315	1,004
Vitreous surgery	503	32	1	584	1,120
Membranectomy	39	4	0	21	64
Squint correction	524	89	0	218	831
Keratoplasty	306	39	0	164	509
Pterygium	226	162	12	412	812
Ocular injuries	317	90	26	403	836
Orbitotomy	55	1	0	3	59
Ptosis	138	6	0	70	214
Lid & Socket reconstruction	951	138	23	166	1,278
Lacrimal surgeries	2,030	884	97	990	4,001
Other orbit and Oculoplasty surgeries	376	40	8	11	435
Others	2,088	548	131	2,784	5,551
Laser procedures					
Laser photocoagulation	6,652	1,995	209	3,423	12,279
Nd. yag iridectomy	1,544	971	45	732	3,292
Nd. yag capsulectomy	2,333	1,269	101	1,563	5,266
Argon Laser Trabeculopasty	0	6	0	12	18
LASIK refractive surgery	1,107	0	0	448	1,555
Total	1,00,873	31,826	7,136	56,604	196,439

Source : Aravind Eye Hospital

Exhibit 3 Income and Expenditures for 2001-2002 (Rupees)

Income	Total
Medical Service Charges	15,354,454.64
Operation Charges	227,293,300.41
Treatment Charges	20,453,507.00
X-Ray Charges	406,641.34
Laboratory Charges	3,579,099.00
Consulting Fees	21,101,009.00
Tuition Fee & Course Fee	3,580,973.24
Sale of Books	440,144.00
Grants in Aid	33,587,260.15
Donation Received	2,366,177.00
Interest Received	49,373,877.10
Dividend Received	3,124,703.17
Miscellaneous Income	7,298,240.17
Total	387,959,386.22
Expenditure	Total
Medicine & Cotton	17,025,968.61
Hospital Linen	728,270.65
Staff Salary	38,649,889.85
Employer's Contribution to PF	4,203,055.00
Electricity Charges	13,099,989.36
IOL Cost	35,079,639.25
Cleaning & Sanitation	2,790,230.43
Travelling Expenses	2,167,357.84
Vehicle Repairs & Maint.	1,572,286.46
Inst & Equip. Maint	8,525,109.81
Gargil fund contn.	
General Repairs & Maint.	1,479,410.65
Building Repairs & Maint.	1,768,404.91
Camp Expenses	6,677,580.69
Electrical Items & Bulbs	906,655.73
Printing & Stationery	3,291,971.05
Postage, Telegram & Telephone	1,909,266.43
Building Rent	145,200.00
Subscription	517,811.00
Bank Charges	2,685.65
Interest Expenses	143,144.00
Library Books	686,896.78
Hospitality Expenses	222,368.00
Research & Special Study	470,761.50
Water supply charges	1,129,596.00
Taxes & legal fees	117,200.00
X-ray & Photography	260,481.79
Audit Fees	55,290.00
Farm/garden Expenses	136,496.35
Miscellaneous	1,670,250.73
Loss on sale of securities	32,500.00
Depreciation	32,062,437.63
Excess of Income Over Exp.	210,431,180.07
Total	387,959,386.22

Exhibit 4 Historical Financial Summary (Rupees)

Year	Income	Expenditure	Percentage of Expenditure Over Income
1979-1980	933,306.62	131,641.80	14.10
1980-1981	979,991.18	242,968.70	24.80
1981-1982	2,936,440.45	1,385,642.50	47.20
1982-1983	3,546,240.27	2,142,939.20	60.36
1983-1984	4,334,257.49	2,688,550.23	62.03
1984-1985	5,971,711.49	3,526,423.49	59.05
1985-1986	6,614,342.74	5,018,583.94	75.87
1986-1987	9,325,540.79	5,349,419.00	57.36
1987-1988	12,694,531.22	9,268,150.96	73.00
1988-1989	17,840,116.84	10,987,700.44	61.58
1989-1990	21,054,621.30	12,669,999.79	60.18
1990-1991	29,320,202.61	15,837,644.93	54.02
1991-1992	35,328,733.04	17,009,369.94	51.59
1992-1993	47,376,243.00	20,470,429.26	56.79
1993-1994	61,986,397.42	23,475,402.14	62.13
1994-1995	79,084,645.00	32,043,338.00	59.48
1995-1996	107,439,286.93	47,666,487.78	44.37
1996-1997	126,844,774.31	55,492,228.92	43.75
1997-1998	180,354,182.48	81,690,871.95	45.29
1998-1999	239,502,498.88	123,183,740.44	51.43
1999-2000	276,282,729.95	143,178,376.03	51.82
2000-2001	340,411,969.33	156,623,177.61	46.00
2001-2002	387,959,386.22	177,528,206.15	45.76

Exhibit 10 Free section complication details for the patients operated in 2002

Name	Intra-Operative		Post-Operative		Total	
	Nos.	%	Nos.	%	Nos.	%
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
Pupillary Capsular Rent with IOL	670	1.02	1	0.00	671	1.02
Posterior Capture Rent (No IOL)	87	0.13	0	0.00	671	1.02
S.K. (straight keratitis)	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

Exhibit 7 Eye Camp Performance

Year	Screening Camps	Surgical Camps	Outpatients Seen	Surgeries
1978	118	—	18,251	1,045
1979	215	—	47,351	2,430
1980	198	10	65,344	5,427
1981	140	13	75,727	8,172
1982	205	9	79,367	8,747
1983	204	9	101,469	10,975
1984	247	21	103,177	11,796
1985	496	18	96,346	11,904
1986	529	13	98,222	12,481
1987	520	12	110,001	13,593
1988	543	9	117,964	14,145
1989	818	2	164,497	16,334
1990	884	3	203,805	20,852
1991	707	3	191,000	20,818
1992	734	3	195,977	21,607
1993	797	6	204,102	24,291
1994	876	6	217,011	28,464
1995	861	15	215,161	32,677
1996	914	13	240,000	36,346
1997	1035	6	287,571	40,389
1998	1340	6	373,997	65,926
1999	1484	4	413,580	87,084
2000	1544	4	426,350	93,519
2001	1476	4	422,373	88,585
2002	1547	3	461,762	10,089
Total	18,432	192	4,930,405	687,696

Exhibit 8 Sponsors of the Eye Camps Conducted in 2002

Name or organization	No. of Camps	Total Out-patients	Surgery		
			Cat+IOL	Others	Total
Lions Clubs	400	145,707	28,834	1,057	29,891
Rotary Clubs	102	39,141	8,961	333	9,294
Vivekananda Kendra	59	12,769	2,509	83	2,592
Sri Satya Sai Samithi	8	2,634	615	13	628
Religious organisations	91	35,361	7,444	219	7,663
Junior Chamber	7	3237	590	23	613
Banks	43	11227	1,431	55	1,486
Mills and Factories	23	12,077	2,789	86	2,875
DBCS	170	25,299	6,852	227	7,081
Educational Insts.	80	17,306	2,665	83	2,748
Hospitals	69	17,573	2,912	101	3,013
Trusts	47	20,681	4,645	140	4,785
Youth and Fans Assn.	35	8,227	1,447	55	1,502
Other Vol.Orgns.	199	53,146	7,773	339	8,112
Others	216	57,377	9,731	358	10,089
TOTAL	1,549	461,762	89,200	3,172	92,372

Exhibit 9 Overall Performance of the Hospitals

	Total Camps	Out-patients	Operations
Madurai	591	605199	100873
Tirunelveli	364	270697	31826
Coimbatore	463	441641	56604
Theni	132	81834	7136
Total	1,550	13,99,371	1,96,439

Aravind Eye Hospitals – Districtwise Camp Performance in 2002

No.	District Name	Camps	O.P	Cat + IOL	Others	Total Surgery
1.	Coimbatore	205	48303	9283	473	19039
2.	Cuddaloore	11	8417	2452	92	4996
3.	Dharmapuri	12	10457	3130	84	6344
4.	Dindigul	107	26570	5668	178	11514
5.	Erode	55	21358	5418	280	11116
6.	Kanchipuram	1	2942	948	10	1905
7.	Kanyakumari	29	4217	328	10	666
8.	Karur	9	3621	772	15	1559
9.	Madurai	98	20082	3654	117	7425
10.	Nagapattinam	15	7702	1351	61	2763
11.	Namakkal	18	13546	4104	83	8291
12.	Nilgiris	7	1356	105	6	216
13.	Perambalur	3	1366	329	8	666
14.	Pondicherry	1	742	118	3	239
15.	Pudukkottai	58	12993	2625	86	5336
16.	Ramanathapuram	65	8657	1806	83	3695
17.	Salem	24	21005	6464	164	13092
18.	Sivagangai	34	7703	1120	43	2283
19.	Tanjore	37	18360	4481	133	9095
20.	Theni	114	14819	2654	12	5320
21.	Thiruvanamalai	1	2303	579	14	1172
22.	Thiruvarur	15	6038	1021	30	2072
23.	Tirunelveli	134	29945	6728	272	13728
24.	Tiruchy	12	4156	728	21	1585
25.	Tuticorin	101	18297	3519	139	7177
26.	Vellore	2	1990	410	13	833
27.	Villupuram	3	2708	884	20	1788
28.	Virudhunagar	73	14388	3060	151	6271
	TN-Total	1244	334041	73793	2601	150187
	Kerala	302	124265	14603	522	29728
	Karnataka	3	3456	49	49	902
	Grand Total	1549	461762	88445	3172	180817