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ARAVIND EYE CARE SYSTEM: PROVIDING TOTAL EYE CARE TO THE RURAL POPULATION

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In 2010, Aravind Eye Care System was the world's largest provider of eye care services. Each day, it handled an average of 6,000 outpatients, performed between 850 and 1,000 surgeries and conducted between four and five outreach camps that examined 1,500 patients and transported 300 patients for surgery. The growth of Aravind Eye Care System was phenomenal but the mission set by its founder — of eliminating needless blindness — was an enormous task. This task was now being expanded to provide total eye care, in response to the available evidence on the widespread prevalence in India's rural areas of moderate visual impairment and other eye-related problems. The outreach eye camps reached only seven per cent of the people in remote villages who had eye problems. As a result, the top management at the Aravind eye hospital faced the need to reach out to and cure a much larger percentage of the affected people in the rural areas.

FORMATION AND GROWTH

Dr. Govindappa Venkataswamy started Aravind Eye Care System (Aravind), in Madurai city in the south Indian state of Tamil Nadu, as an eye clinic and an 11-bed hospital in 1976, with the idea of creating a sustainable eye care system. A year later, 23 more beds were added in another building referred to internally as the Annexe. At the same time, to address the firm's mission to serve poor blind people, a low-cost facility with 100 beds was added exclusively for those who required free treatment, marking the beginning of the firm's contribution to restoring eyesight to the millions of people with poor vision.

Aravind Eye Care System included five hospitals, which, each year, collectively performed more than 275,000 surgeries and laser procedures. In addition to the hospitals in Tamil Nadu, Aravind Eye Care System helped the eye hospitals in Gujarat, Kolkata and Uttar Pradesh to develop management capabilities and then handed these hospitals over to the promoters (NGOs, societies, trusts and corporations). Aravind grew by increasing both its area of operation and the range of eye care services it offered. The eye care system included an eye bank, an ophthalmic equipment and supplies manufacturing plant; a medical research foundation; community outreach programs; community-based primary- and secondary-care eye

clinics; and education, training and consultancy services. The single Aravind eye hospital had evolved into the Aravind Eye Care System that treated a few hundred thousand patients every year. From April 2009 to March 2010, more than 2.5 million persons had received outpatient care and more than 300,000 had undergone eye surgeries at the five Aravind eye hospitals in Madurai, Theni, Tirunelveli, Coimbatore and Puducherry.

ARAVIND'S APPROACH

Aravind's approach was to provide quality eye care at prices that everyone could afford. A core principle of the Aravind Eye Care System was to provide services to the rich and poor alike and to continue to be financially self-supporting. It provided free eye care to two-thirds of its patients by using the revenue generated from the one-third of the patients who paid for the services. Aravind culture was such that the service personnel were disciplined, accountable and responsive to patients. Over the years, the respect and care shown to the patients irrespective of their ability to pay had helped to build Aravind's image and its community trust.

The Aravind approach sought to restore eyesight to the millions of people with poor vision, eliminate needless blindness and correct moderate visual impairment by providing high-quality, high-volume and compassionate eye care to all.

SERVICES OFFERED

The Aravind approach required generating volumes both to sustain and to grow the business. The growth was not only in numbers but also through expansion of the service mix, which had initially focused on cataract surgery but had widened to include multi-specialty eye care. Over time, Aravind had added to its service mix such specialities as treatment of retinal disorders, cornea disorders, glaucoma, pediatric ophthalmology, neuro-opthalmology, uvea disorders and low vision. The service was not limited to curable blindness. In the case of incurable blindness, Aravind provided rehabilitation services.

In addition to the services delivered by the hospitals, Aravind offered an extensive community outreach program, which included the comprehensive eye-screening camp. Each month, four to five eye-screening camps were organized in each district (administrative subdivision in a state). Different types of camps were available for different patient groups and different types of eye problems. For example, the pediatric eye camp addressed congenital eye problems and eye problems of children, whereas eye camps for school children tended to focus on detecting and treating refractive errors and squint eye. Workplace screening camps were held mostly to treat refractive errors for the benefit of employees of any kind of industry and those who worked in corporate offices. Diabetic retinopathy camps were for the diabetic community to diagnose and prevent the loss of vision due to diabetic retinopathy. Comprehensive eye screening camps examined people for cataracts, glaucoma, retina problems and other related ailments. Surgeries were not done at the eye campsites; instead, patients requiring surgery were taken to the hospital.

PRICING EYE CARE SERVICES

The patients who came to Aravind's "paying section" for eye care were charged at competitive rates. The charges were not more — and were often lower — than the costs for similar services available at other

comparable hospitals in the same location. As of 2010, the consultation fee for a patient was INR50[1] and was valid for three months. The starting rate for cataract surgery was between INR4,100 and 6,000. Phaco surgery (surgery for removing cataract through a small opening and therefore not involving stitches) was priced between INR6,500 and 40,000, depending on the type of lens implanted and the scale of comfort. Poor patients who came to the "free section" were not charged any consultation fee and were not charged for many of the surgical procedures that did not involve expensive supplies. For cataract surgery, for example, patients were required to pay INR750, essentially to cover the costs of the lens, the consumables and a one-month's supply of post-operative medications, which was given to patients at the time of discharge. For those who could not afford even this amount, all charges were waived by the doctor in charge at the out patients' department.

Patients who were advised they needed glasses had the option to buy from the spectacle shop located in the hospital. The prices of glasses and frames were usually less than the cost in an optical shop. The grinding of the glasses and their fitting were done in-house while the patients waited, thus saving the patients another trip to the hospital. The same arrangement applied to patients who were prescribed glasses in eye camps — they purchased the glasses, which were dispensed on the spot.

Aravind, in recognition that predominantly the very poor attended the eye camps, provided all the services for free, including transportation to the base hospital, surgery, food, post-operative medications, transportation back home and follow-up a month later at the camp site.

PROCESSES THAT REFLECT ARAVIND'S APPROACH

The Aravind approach was supported by its efficient service operations. Its productivity levels were high because of volumes, technology and people. High-quality service in large volumes resulted in a low-cost, sustainable operation. The large volumes helped to recover the costs of equipment faster, compared with the longer payback times experienced by many small, private practitioners. This approach also helped Aravind to buy the most current technology and high-quality equipment. Aravind's motivated and loyal paramedics were recruited on the basis of their ability and attitude and, once they were successfully recruited, they were provided with very good training. The paramedics performed many of the routine clinical tasks, which increased the productivity of the doctors.

Managing the process was very important to managing the costs of offering free service to two-thirds of the patients. Process innovations helped provide quality eye care at a very economical price. Surgeon productivity was six times greater than that of surgeons elsewhere. For example, at Aravind, an ophthalmologist performed between six and eight intraocular lens (IOL) surgeries per hour, whereas elsewhere only one or two surgeries were performed in the same amount of time.

Aravind had perfected several surgical techniques, which were refinements of procedures, rather than inventions. For example, instead of the usual surgery performed using either sutures or expensive equipment and instrumentation, Aravind had developed and perfected its own version of manual sutureless cataract surgery, which speeded up the surgical procedure. The productivity of the doctors was also increased as each surgeon worked on two operation tables alternately. A team of paramedics and junior doctors were tasked with washing the eye, injecting medicines and so on. The surgeons did their part and moved on to the next table.

[1] *US$1 = INR 45.60 on average between June 7 and October 31, 2010.*

The effective utilization of doctors was not limited to the surgery. Trained paramedical staff performed preliminary tests, refraction assessments, scans and other routine tasks, rather than having the doctors perform them. The patients were examined by resident doctors who recorded the diagnosis and made recommendations, and a medical officer then examined the patient and reviewed the diagnosis and recommendations. Tests that could be done by paramedical staff were done by them, and trained counselors helped the patients to make informed decisions and responded to their questions relating to costs and treatments. The doctors were therefore not required to spend time on routine tests or in providing information to patients, which could be done equally well by others, allowing the doctors to devote their time to medical advising. Aravind Eye Care System had 150 counselors on staff and six nurses for every doctor.

To guide outpatients, a patient information brochure was available, as was an outpatient coordinator who helped patients to negotiate through the hospital procedure smoothly and reduced their anxiety and their need to seek information from the hospital staff. Thus, having an outpatient coordinator contributed to both service efficiency and patient satisfaction. The staff alternated between working with the paying segment and the free segment every month or every other month to ensure responsive service was provided to all categories of patients.

Planning for expected patient loads ensured the availability of resources. Planning was done on a yearly basis, on a monthly basis and on a daily basis to schedule patients, deploy staff and equipment and to arrange for supplies and spares. Resource planning ensured that surgery was not postponed for want of supplies or surgeons.

Technology was also used to enhance performance. For example, communication technology helped to make information available to the right personnel, which reduced the throughput time. The response time to complaints was also sought to be reduced through use of technologies. Patient registration through the use of computers took approximately one minute for each patient. The computers were also used to generate the case sheets (individual patient's medical record). The equipment used for eye care was of high quality but the rooms were utilitarian.

Aurolab was established to produce quality products at affordable cost and was an integral part of Aravind Eye Care System. Aurolab was established in 1992 to produce IOLs to make quality cataract surgery affordable in developing countries. Aurolab was able to reduce production costs and thus was able to price the IOLs to less than 10 per cent of the price of imported lenses. Similarly, Aurolab started manufacturing sutures at one-fourth the price of imported sutures. These products were available worldwide to everyone and were not just limited to Aravind, keeping in line with Aravind's broader vision.

ORGANIZATION AND STAFFING

Aravind had seven base hospitals (five tertiary-level and two secondary-level base hospitals), five community eye clinics and 36 vision centres. Each community eye clinic had five staff members: one ophthalmologist, one refractionist (technician), one medical record staff, one senior paramedic and one counselor. Each vision centre employed one refractionist, one counselor and one person for optical services. In addition to these fixed centres, Aravind had a community outreach program comprising six camp managers, 26 camp organizers and eight administrative assistants. The staffing pattern was different for different types of camps (see Exhibit 1). Camp organizers had targets on the number of camps to be organized and number of beneficiaries (see Exhibit 2).

The strength of Aravind hospitals was its personnel. Doctors were an important resource, and retaining them was difficult because, once doctors gained experience and reputation, they typically accepted offers to receive higher salaries. The compensation was designed to retain key staff and was generally based on market rates. Paramedics were critical to the functioning of the Aravind system. The primary focus in the recruitment and selection of paramedics was on value-fit. The paramedics were young women who had passed their pre-degree program, and most had a rural background. Aravind recruited from the villages young women between the ages of 17 and 19, who had a certain amount of curiosity and a capacity for hard work. The organization preferred to hire young women from large families, farmers' families and those with the right attitude. The young women's parents were also interviewed to understand the family's commitment levels. The advantage was that those young women who were committed were more willing to stay on for a few years with the organization. Most of young recruits continued to work with Aravind even after they married because they were respected in the community. The recruitment and selection process identified candidates who empathized with the patients they served. They were trained for two years, receiving a stipend of INR1,000 in the first year and INR1,200 in the second year. They received subsidized food and were provided residential accommodation, which was compulsory. On confirmation, these women were paid INR4,900. On average, they worked for five years. The drop-out rates among the paramedics was 50 per cent in a four-year time period. Their training focused on skill development to meet job requirements. All training was done internally; therefore, the women did not receive a certificate that they could use for finding jobs elsewhere, which increased the retention of paramedics.

EYE CARE SERVICE – THE BIG PICTURE

In India, the availability of eye care service was limited, with only approximately one eye doctor for every 100,000 people, even fewer eye doctors in rural areas. Some districts did not have an eye doctor at all. The National Programme for Control of Blindness (NPCB) was launched in 1976 as a Government of India scheme with the goal of reducing the prevalence of blindness from 1.4 per cent to 0.3 per cent. The NPCB implemented a plan for providing a grant-in-aid for conducting free cataract operations to motivate many nongovernmental organizations (NGOs) to assist in this endeavor. Monetary assistance was revised from time to time. All the camps, which were conducted by either the Indian government or NGOs, aimed to diagnose eye problems at the community level and to then refer those who needed secondary or tertiary care services. Surgeries could not be performed in the community clinics or camps, only in the base hospital. As a result, Aravind conducted eye diagnostic camps, and any cataract patients were transported to the base hospital on the camp day itself.

According to a survey in 2001/02, the prevalence of blindness in India was estimated at 1.1 per cent. The target for the 10th five-year economic plan of Government of India was to reduce this prevalence to 0.8 per cent by 2007. A survey done in 2006/07 estimated the prevalence of blindness at 1 per cent.[2] Another study suggested the prevalence of moderate visual impairment was 8.09 per cent. Most of the moderate visual impairment identified in the study was assessed to have been caused by refractive error (45.8 per cent), and by cataracts (at 39.9 per cent). Moderate visual impairment was more likely to be present in higher age groups, in females, in lower socioeconomic groups and in the rural population. The study suggested that by 2020, 139 million Indians would likely have moderate visual impairment.[3] The number of blind people in

[2] *R. Jose, "Present Status of the National Programme for Control of Blindness in India," Community Eye Health Journal, 21, (65), March 2008, pp. s103-s104.*
[3] *R. Dandona et al., "Moderate Visual Impairment in India: The Andhra Pradesh Eye Disease Study," British Journal of Opthalmology, 86, (4), 2002, pp. 373–377.*

India was estimated at 18.7 million in 2000 and was projected to reach 24.1 million in 2010 and 31.6 million in 2020.[4]

Cataract surgeries had steadily increased in India, from 3.9 million in 2002/03 to 5.9 million in 2008/09. The cataract surgical rate per million people in Tamil Nadu was 7,633, compared with the national average of 4,425. Gujarat had the largest number of eye camps, and even small hospitals hosted eye camps. The cataract surgical rate per million people in Gujarat was 10,015.[5] In Tamil Nadu, Aravind was one of the largest providers of eye care services, having conducted 167,747 cataract surgeries in 2009/10, compared with 488,666 cataract surgeries performed in Tamil Nadu. The productivity in terms of number of surgeries was low for other hospitals compared with that of Aravind. The total Indian average was approximately 400 eye surgeries per doctor a year, whereas each Aravind doctor performed approximately 2,600 eye surgeries per year.

EYE CARE MARKET

The Indian population was prone to blindness as a result of cataracts and diabetes: 50 to 60 per cent of the blindness was because of cataracts, while 40 per cent was because of other reasons, including diabetes.

Understanding and acceptance of eye care treatment in India was poor. Many people did not know that most of the cases of blindness could be cured or corrected. Also, many patients were afraid of surgery, which led to the poor response to the efforts to remove the backlog of untreated cases of blindness.

Cost was other important reason for poor acceptance of eye care service among the rural population. As part of the community outreach program, some of the patients were referred to the base hospital for further medical intervention and surgery. Although these surgeries were free or were offered at a subsidized price, patients often did not make the trip to the base hospital as they could not afford the costs of transportation, lost wages, food and accommodation. Also, because these patients were new to the town, they had no guidance on locations, place to stay and local transport.

In a study conducted to understand the predictors of eye camp attendance in rural areas, researchers observed that gender and distance were significant predictors. Men were twice as likely as women to attend the camp, and persons living three kilometres or less from the eye camp were more likely to attend than those living farther away. Eye camp attendance was shown to not be significantly associated with age, literacy status, level of publicity, the presence of people with good postoperative outcomes within a village or economic status.[6]

Those people affected by low vision included both the poor and also those who could afford and were willing to pay for eye care services. According to a manager in Aravind,

> the preference for Aravind Eye Care system by patients who pay for the service is because of the upgraded comprehensive eye care that includes specialty service not available from private practitioners. The patient is offered a wide range of services at

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[4] R. Dandona and L. Danadona, "Review of Findings of the Andhra Pradesh Eye Disease Study: Policy Implications for Eye-care Services," Current Opthalmology, 49, (4), 2001, pp. 215–234.

[5] Aravind Srinivasan et al., "Cataract Surgery and Intraocular Lens Manufacturing in India," Current Opinion in Ophthalmology, 19, 2008, pp.60–65.

[6] A.E. Fletcher, Martine Donoghue, John Devavarman, R.D. Thulasiraj, Susana Scott, Mona Abdalla, C.A.K. Shanmugham and P. Balamurugan, "Low Uptake of Eye Services in Rural India," Archives of Ophthalmology, 117, October 1999, pp.1393-1399.

different price levels from which the patient can make a choice. The referrals from ophthalmologists and physicians also add to the demand. Strong word of mouth helps in getting a large number of patients who are willing to pay and this influence bring in close to 70 per cent of such patients. Quality, transparency of charges and service orientation create trust and increases the patients' willing to pay for the services.

SERVICE DELIVERY OPTIONS

Efficient service delivery was critical to eradicate needless blindness and treat other eye-related problems, particularly in the rural areas. Aravind developed comprehensive service delivery models in the areas of diabetic retinopathy, glaucoma and pediatric ophthalmology. It also used tele-opthalmology with remote consultations. Even with all these service delivery options, eye camps were still important in rural areas. The service options examined here include base hospitals, community centre clinics, vision centres, eye-screening camps and mobile units.

Base Hospitals

Aravind had five tertiary hospitals. Sixty per cent of the patients visiting these hospitals lived nearby. Each hospital had its own jurisdiction to organize outreach programs and expected walk-in patients from those areas (see Exhibit 3).

Each base hospital was also a teaching institute and was well equipped to provide both secondary and tertiary care services (Primary care services are limited to diagnosis and treatment of common eye problems. Secondary services include, in addition to primary services, cataract eye surgery. Tertiary services include, in addition to secondary services, specialty surgeries and laser treatment. It also is a training/ teaching institute and a Centre of Excellence.). A variety of pricing levels were available to suit the various economic groups. Specialty treatment and surgery were provided either free of cost or were subsidized, depending on the patients' ability to pay.

Aravind had two secondary-level base hospitals. These new branches were opened in two district headquarters, which were closer to Madurai and Coimbatore hospitals. One functioned at Dindigul and another at Tiruppur, where cataract surgeries were performed.

On average, 67 per cent of the cataract patients received services free of cost. Of these patients, 39 per cent were referred through the camps and 28 per cent were walk-in patients. Although walk-in patients were charged INR750 for the cost of the implanted intraocular lens, the number of walk-in patients for cataract operation had increased. Cataract surgery performed under the walk-in category where the patient had to pay a subsidized amount of INR750 increased from 48,552 in 2008-2009 to 53,779 in 2009-2010 and to 62,399 in 2010-11. The totally free cataract surgery increased from 67,406 in 2008-2009 to 73,057 in 2009-2010 and to 73,389 in 2010-2011.

For the smaller and newer Aravind hospitals, fewer patients were willing to pay. For example, in Theni, the ratio of patients who paid to patients who received free services was approximately 25:75.

Cataract surgeries were performed for free for the patients who were referred through the camps. Camp patients who required specialty care (three per cent of the total outpatients) paid a subsidized fee for services obtained at the base hospital

Community Centre Clinics

Aravind had one city centre clinic and five community centre clinics. These eye clinics were established to reach consumers in the outlying areas and served populations of between 100,000 and 200,000. They were established within 50 km of the base hospital for ease of management. The following considerations were taken into account when selecting a location:

- Good access to the community centre from nearby villages
- Absence of another eye hospital or doctor in that location
- Prior outreach work carried out to ensure people were familiar with Aravind and had a positive image of its services
- Availability of other health care facilities, including general physicians, medical shops and heath care NGOs

Each centre was staffed by an ophthalmologist and support staff. The consultation fee was INR30. The investment required was the same as for the vision centre, approximately INR800,000 to INR1,000,000, but the recurring expenses were increased because of the larger staff size. Forty per cent of the patients referred from the community centre for surgery paid for the services. The performance of Melur Community Centre is given in Exhibit 4.

Vision Centres

The vision centres were primary eye care centres established in locations with population of approximately 50,000 within a five kilometre radius and approximately 100,000 within a 10 kilometre radius. Aravind had established 36 such centres. The vision centres had the following objectives:

- To use trained staff and tele-ophthalmology to provide comprehensive and quality eye care at a location close to the target rural population
- To collaborate with the community to create awareness and educate on eye care
- To develop a sustainable fixed-location approach to eye care service delivery

The consultation charge at the vision centre was INR20. The vision centre was economically advantageous to the patient as it saved the costs of transportation, other expenses and lost wages. It was estimated that a visit to the hospital would cost, on average, INR350, while it cost only INR120 to visit a vision centre, a saving of INR230.

These centres were equipped with basic ophthalmic equipment, such as a slit lamp, a streak retinoscope, a direct ophthalmoscope, trial sets, a Schiotz tonometer, basic sterilizers, blood pressure apparatus, a 90-diopter lens, a computer with a digital camera (in the place of webcam) and Internet connectivity. Vision centres were staffed by a coordinator (who was also the counselor) and a technician, who was a trained ophthalmic assistant who could perform slit lamp examinations, assess refraction errors, treat minor ailments and perform other tasks. The centre was linked to the base hospital through wireless networks. Once the technician completed a patient's examination and tests, each patient then interacted with an ophthalmologist through the video conferencing facility. Tele-ophthalmology enabled a doctor from one location to interact, through video conferencing, with patients at another site. Data were shared through computers, allowing the ophthalmologist to diagnose the patient with the help of local technicians who used ophthalmic diagnostic equipments to transfer the images. Patients who required procedural intervention were required to travel to the hospital. Ninety per cent of the patients were treated at the centre itself, while approximately 10 per cent of cases were asked to visit the base hospital for surgery and

treatment. In addition to the counselor and technician, one field worker was recruited locally. Field workers created awareness within the community regarding the eye problems, contacted potential patients, referred patients to the centre and arranged the eye camps.

The Vision Centre was a branch of outreach activity. The outreach department was given the task of starting any new centre, which included analyzing the market potential and establishing the centre in coordination with respective internal departments and the local community. The outreach department had the responsibility to promote the service of vision centres. The investment required for a vision centre was INR800,000 to INR1,000,000. The recurring expenditure was usually recovered after the centre had been in operation for two years. The vision centres were viable, as indicated by the positive net income in four of the five vision centres operating under the Madurai Hospital (see Exhibit 5). The penetration of service by different vision centres is given in Exhibit 6.

Eye-Screening Camps

Through the eye-screening camps, medical teams from each of the Aravind's hospitals reached out to patients in rural areas. In 2009/10, Aravind organized 2,148 camps, screened 455,378 patients, carried out 76,056 surgeries and provided 77,618 pairs of eyeglasses. One of the aspects that influenced the number of eye-screening camps organized was the hospital capacity and its utilization. Each month, Aravind organized four to five eye-screening camps in a district.

The eye camps were useful for generating demand, mobilizing the community resources to assist service delivery and building Aravind's image in the community. In many cases, after two months of performing a free eye camp, the paying segment in that area increased. Comprehensive eye-screening camps also attracted paying patients to the hospital through enhanced awareness and trust. In 2009/10, 33 per cent of the 189,461 cataract surgeries were for patients who had paid for the surgery. Of the remaining 67 per cent of free cataract surgeries, 39 per cent had been referred through the eye-screening camps. There was zero cost to patients but Aravind was eligible for grant-in-aid under NPCB. In the case of all 285,967 surgeries in 2009/10 (including cataract surgeries), 47 per cent of the patients had paid for the surgery. Of the remaining 53 per cent of patients who received free surgeries, 27 per cent had been identified as requiring surgery in camps (see Exhibit 7).

The camps, usually held on Saturdays and Sundays, opened in the morning, with local volunteers assisting in the registration. Identity cards and case sheets were generated and the paramedical staff conducted tests, followed by an examination by the doctor. Glasses were provided in the campsite itself, and those who were prescribed glasses bought them on site. In cases where the right type of glasses was not available, they were delivered in a week's time.

At the screening camps, the outpatients were sometimes advised to have surgery at the hospital. As many were reluctant to visit the hospital on their own, they were taken to the hospital either by a hired bus or by public transport, accompanied by an Aravind staff member. Lunch was provided for those who were taken to the hospital for surgery. Aravind eye hospitals advised patients to attend follow-up visits at the eye camps after the surgery, and the follow-up camp dates were given to the patients before they left the hospital. Ninety per cent of the patients attended the follow-up camp, one month after the surgery in the same venue. There, a team from the hospital checked the patients' post-operative vision.

The teams from Aravind worked closely with local community leaders and service groups to organize the camps. Community participation created ownership of the program and ensured good response and

acceptance in the community besides contributing to cost reduction by providing support facilities. The eye camp partners included such organizations as the Lions, Rotary, religious organizations, education institutions, youth welfare associations, banks, industries, trusts, cooperative societies, panchayats (Gram Panchayats are local self-governments at the village) and also individuals. The sponsor's responsibilities included identifying the location, arranging building and water and other support facilities, coordinating the publicity, planning the transportation of patients and arranging hospitality for the medical team (see Exhibit 8). The responsibilities of the hospital included medical team transportation, diagnosis and treatment, inpatient food and transport, surgery and consumables, post-operative care and follow-up care.

The camps varied in size, from small camps catering to 300 outpatients and 60 inpatients, medium-sized camps serving 600 outpatients and 60 to 100 inpatients, and major camps, which could see 1,000 outpatients and 100 to 200 inpatients. The budget for small camps was INR8,160, which included the costs of publicity, patients' lunches, travel from camp to the hospital, the medical team's costs of boarding and lodging, and volunteers' refreshments. The cost for the medium-size camp was INR17,470 and for major camps was INR53,500. The cost and productivity of two small camps are indicated in Exhibit 9.

In the initial stages Aravind organized camps on its own but as the attendance increased, external funding was needed. Under the National Programme for Control of Blindness (NPCB) scheme, INR750 was made available by the government to the NGO sponsoring the IOL surgery.

The number of patients seen in a camp depended on the location and its potential, the sponsor and the efforts made by the sponsor. The number of patients screened for surgery was sometimes as low as 15 to 20 and sometimes as high as 250. When the camps were organized at locations far from the base hospital, then larger numbers of patients were required to make holding the camps viable. The camps organized by Theni base hospital averaged 35 to 40 patients identified as requiring surgery whereas the camps organized by Madurai base hospital averaged 85 patients identified as requiring surgery. The population in the area considered for a medium-size camp was approximately 50,000. Of this population, 20 per cent were typically in the high- or middle-income group, who generally did not prefer to attend an eye camp. Thus, the effective population was 40,000, and, of this number, approximately eight per cent, or 3,200 persons, needed glasses. Of this number, approximately 10 per cent, or 320 persons, already had glasses, leaving a population of approximately 2,880 who were potential patients.

The challenges faced in the outreach programs included the need to promote community participation and retention of community partners. Maintaining the quality of service in the eye-screening camps was also difficult but was important to sustain the outreach program. A study on the use of eye services in rural India indicated that only 6.8 per cent of the 749 adults with an eye problem attended eye camps in 48 villages. The study was conducted in the area of operation of Aravind hospitals. The principal barriers to attending the eye-screening camps were fear (principally of eye damage), cost (both direct and indirect), family responsibilities, old age (treatment in old age was considered not to be worthwhile), a belief in not interfering with "God's will" and an attitude of being able to cope (with low or no vision).[7]

Mobile Unit

The World Diabetes Foundation funded a mobile unit of Aravind hospitals with a grant of INR5 million, which included the costs for a vehicle, equipment and maintenance. Indian Space Research Organization provided a satellite based communications facility between the mobile unit and the base hospital The mobile unit, launched in 2003, was equipped to take a digital fundus image to help detect diabetic

[7] *Ibid.*

retinopathy. Software was developed to enable the transfer of the digital fundus images from the mobile unit to the base hospital. The report was available in 15 minutes, thus saving time and avoiding the patients' need to travel to the hospital. Only patients requiring surgical intervention needed to travel to the hospital. The mobile clinic had a capacity to serve 75 patients a day. The daily running cost for the van was INR4,000 to INR5,000.

Refraction Van

At the beginning of 2010, Aravind launched a pilot mobile refraction unit (MRU), which was attached to the Theni hospital. A van serviced by Theni hospital was equipped with a refraction unit and a spectacle-dispensing unit to enable Aravind to address uncorrected refractive errors in rural areas. A village was identified, and the camp was organized with the help of a sponsor. The roles of the sponsor and of Aravind eye hospital are shown in the Exhibit 10.

The MRU team comprised a camp coordinator, a senior and a junior refractionist, an optical sales staff, an optical edging staff, one field staff and a driver.

The village was identified on the basis of its suitability. Qualifying villages had a minimum of population of 1,000, were not served by eye care providers and lacked good access to public transportation. Such villages also needed to be easily accessible to four or five other villages for a combined target population of 5,000. The sponsor was responsible for arranging two rooms with power supply, a table, and few chairs and benches. Two days prior to the camp, approximately 2,000 handbills were distributed by field staff from the nearest vision centre. Sometimes, a loudspeaker was used to announce the date of the eye-screening camp at village festivals. Word-of-mouth by the village headman and officers were also an important method of promoting the MRU camp.

The MRU carried approximately 120 eyeglass frames and 350 pairs of plastic lenses. The frames were priced at INR100 and upward, and the single-lens vision eyeglass at INR150 and upward. Thirty per cent of spectacles were ready-made spectacles, 40 per cent were custom-made spectacles that were edged, fitted and delivered on the spot, and 30 per cent of the prescription lenses were processed and fitted at the hospital and delivered within one week to the vision centre nearest to the camp. Patients requiring primary examination or treatment were referred to the nearest vision centres, and those requiring advanced examination were referred to the base hospital at Theni. Between March and June 2010, 19 MRU camps were conducted in Theni district. The revenue and costs of an MRU are shown in Exhibit 11.

CREATING AWARENESS AND ACCEPTANCE

The community outreach program created awareness of the importance and need for eye care. It educated the population on the causes of blindness and the use of eye care services to restore most peoples' vision. The methods used in the outreach program included distribution of handbills (small notices) and posters; the posting of notices on publicity boards on street corners, shop hoardings and bus stops; loudspeaker announcements (considered the most effective); announcements on cable TV; and referrals through local doctors, teachers, other NGOs and village leaders.

The hospital had a team of camp organizers, each of whom was responsible for one or two districts. The camp organizer planned for a year, estimating the number of patients to be served on the basis of population figures and past incidence of blindness in the area. The camp organizers planned the eye camp and identified sponsors to support these camps.

A study was conducted to compare the effectiveness of alternative intervention strategies for increasing awareness and acceptance of cataract surgery. The intervention strategies included four health education approaches and two options for economic incentives. The four health education approaches were as follows:

1. House-to-house visits by patients who had successfully received cataract surgery. These former patients were recruited and trained to screen and motivate people with cataracts to have the surgery.
2. House-to-house visits by a basic eye health worker.
3. Screening camps at a central location in a village. Distribution of handbills to every household, informing villagers about the eye camps and announcing the upcoming camp dates.
4. Campaigns by field workers at weekly marketplaces using video display from the van, loudspeaker announcements and posters. People could volunteer to have their eyes examined at the location. Visits were made on market day in the weekly markets for four consecutive weeks.

The two options for economic incentives were as follows:

1. Partial incentive: Free surgery and free eyeglasses
2. Full incentive: In addition to free surgery and free eyeglasses, free transportation to the hospital and free meals during the hospital stay were offered.

Approximately eight months after intervention, the villages where the interventions were carried out were studied for cataract surgery awareness and surgical acceptance. Surgical awareness levels were found to be not significantly different except for the intervention that used eye-screening van sites. Surgical acceptance (identified as those operated on after the interventions) indicated that the most effective intervention was "having a villager with sight restored by cataract operation to promote/educate on cataract treatment and with offer of full economic incentive." When only partial incentive was offered along with the four options of educating on cataract surgery, acceptance rates were much lower.[8]

ISSUES FOR CONSIDERATION

Aravind experimented and innovated its service operations and tried various options for service delivery. The number of patients served by Aravind grew substantially but the percentage of rural population served remained very low.[9] In spite of enormous outreach work, when the camps were organized in the rural community, the uptake was not even 10 per cent of the population who needed eye care. The manager of the outreach program needed to examine how to bridge this enormous gap in service to the rural population and to present a solution to the top management of Aravind Eye Care System. From past experience, the manager realized that providing access to a service was alone insufficient both to meet the objective of making a substantial impact on reducing needless blindness among villagers and to mitigate moderate visual impairment. The major obstacles to using Aravind's eye care services included lack of priority for eye care among the rural population, poor acceptance of eye treatment and fear of surgery. Overcoming these obstacles required creating awareness regarding the importance of eye care, increasing the acceptance of eye care services among the rural population and providing improved access to eye care service.

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[8] G.E. Brilliant, James M. Lepownski, Beatriz Zurita and R.D. Thulasiraj, "Social Determinants of Cataract Surgery Utilization in South India," Archives of Ophthalmology, 109, April 1991, pp.584-589.

[9] A.E. Fletcher, Martine Donoghue, John Devavarman, R.D. Thulasiraj, Susana Scott, Mona Abdalla, C.A.K. Shanmugham and P. Balamurugan, "Low Uptake of Eye Services in Rural India," Archives of Ophthalmology, 117, October 1999, pp. 1393-1399.

Exhibit 1

STAFFING FOR ARAVIND'S EYE CAMPS

Items/ Type of staff		Size of Camp		
		Small	**Medium**	**Large**
Expected Number of Outpatients		200–300	300–500	500–800
Expected Number of Inpatients		40–60	60–100	100–150
Doctors (Senior and Junior)		1+1	1+2	2+2
PMOAs	**Preliminary Vision**	1	2	3
	Tension and Duct	1	2	3
	Refraction	2	3	4
Patient Counselor		1	1	1+1
Optician (Sales and Delivery)		1	1	2
Optical Technician (Edging and Finishing)		1	2	2
Camp organizer		1	1	1+1

Note: PMOA = paramedical ophthalmic assistant.
Source: Organization records.

Exhibit 2

ARAVIND'S ANNUAL EYE CAMP TARGETS FOR CENTRES WITH POPULATIONS OF 1 MILLION TO 2 MILLION

Type of Outreach	Camps/ Year	Outpatients	Outcome
Eye-Screening Camps (for adults 40 years of age and older)	45 camps	250–300 OP per camp	20–25% of OP were admitted for cataract surgery (ensuring the total camp target achieved the CSR of 1,000–2,000 in its service area). 15% of OP received eyeglasses and 5–10% of OP were diagnosed with specialty problems
Diabetic Retinopathy Screening Camp (for all diabetic people or all people 40 years of age and older)	2–3 camps	200–250 OP/camp	40–50% of OP were self-reported diabetics or had not been diagnosed for diabetes. 15–20% of diabetic people were diagnosed as having diabetic retinopathy
Workplace Screening Camps (for adults aged 30–50 years old)	10 camps	150–200 employees/ camp	35% of employees received eyeglasses to correct refractive errors
School Screening Camps (for children aged 6–15 years old)	10 schools	750–1000 children/ school	4–5 % of the children received eyeglasses
Pediatric Screening Camps (for children aged 0–5 years old)	2–3 camps	100 children/per camp	5% of the children were diagnosed with childhood blindness (excluding the diagnoses of refractive error)

Note: OP = outpatients; CSR = cataract surgery rate (i.e., the number of surgeries per 1 million population per year). In the small camps, the population in the identified area was 25,000. Of that number, 20 per cent of the population (5,000 people) earned middle and high incomes and typically did not attend the camps. Of the remaining population of 20,000, 8 per cent (1,600 people) typically had visual impairments and required glasses, and, of this number, 10 per cent (160) typically had already been served; therefore, out of a total population of 25,000, the potential number of patients was 1,440.
Source: Organization records.

Exhibit 3

ARAVIND'S INFRASTRUCTURE AND SURGERIES PERFORMED IN 2009/10

Base Hospital	Infrastructure		Population (in millions)	All Surgeries Performed 2009/10			
				Base Hospital (Paying - walk in)	Base Hospital (Non-Paying - walk in)	Outreach (Free)	Total
Madurai	Secondary Care Hospital	1	26.7	58,620	31,314	29,321	119,255
	City Centre	1					
	Community Clinics	2					
	Vision Centres	13					
Theni	Community Clinics	1	4.1	5,107	2,633	2,963	10,703
	Vision Centres	8					
Tirunelveli	Community Clinics	1	15.1	20,312	9,503	11,294	41,109
	Vision Centres	5					
Coimbatore	Secondary Care Hospital	1	27.1	33,175	22,376	18,583	74,134
	Vision Centres	5					
Puducherry	Vision Centres	5	21.6	18,011	8,835	13,920	40,766
Total			94.6	135,225	74,661	76,081	285,967

Source: Organization records.

Exhibit 4

MELUR COMMUNITY CENTRE PERFORMANCE, 2009 TO 2010

Items	April 2008 – March 2009	April 2009 – March 2010
Number of Staff	8	8
New Outpatients	12,160	12,447
Repeat visit Outpatients	6,315	6,305
Total Outpatients	18,475	18,752
Non-paying Inpatients	367	421
Paying Inpatients	253	310
Total Inpatients	620	731
Eyeglasses Prescribed	2,416	2,638
Eyeglasses Ordered	2,397	2,572

Source: Organization records.

Exhibit 5

ANNUAL NET INCOME OF FIVE VISION CENTRES OPERATING UNDER MADURAI HOSPITAL

Item	Alanganallur	Gandhigramam	Rameswaram	Sholavandan	Thirupuvanam
Income (in INR)	484,183	563,988	554,097	472,342	394,816
Expenditure (in INR)	463,963	548,653	562,741	463,595	394,624
Surplus (in INR)	20,220	15,335	(8,644)	8,747	192

Source: Organization records.

Exhibit 6

PENETRATION OF SERVICES BY ARAVIND'S VISION CENTRES IN 2009/10

2009/10	Madurai	Theni	Tirunelveli	Coimbatore	Puducherry	Total
Number of Vision Centres	8	8	5	5	5	31
OPs Seen (New)	31,353	29,311	22,286	15,768	12,645	111,363
Glasses Delivered	6,789	6,394	4,684	3,270	2,749	23,886
Total Surgeries	1,895	1,264	871	843	433	5,306
Target Population	400,000	400,000	250,000	250,000	250,000	1,550,000
Population (in millions)	0.40	0.40	0.25	0.25	0.25	1.55
Eye Care Need (20%)	80,000	80,000	50,000	50,000	50,000	310,000
CSR	4,738	3,160	3,484	3,372	1,732	3,423
OP Coverage	39%	37%	45%	32%	25%	36%

Note: Few new centres have been started since March 2010. OP = outpatients; CSR = cataract surgery rate (i.e., the number of surgeries per 1 million population per year);
Source: Organization records.

Exhibit 7

TYPE AND SOURCE OF ARAVIND PATIENTS UNDERGOING EYE SURGERIES IN 2009/10

Type and Source of Patients	Cataract Surgeries	All Surgeries
Paying hospital: (different level of pricing packages)	62,625	135,225
Free hospital: (subsidized price to meet the consumables)	53,779	74,661
Camp: total free of cost	73,057	76,081
Total	189,461	285,967

Source: Organization records.

Exhibit 8

ARAVIND HOSPITALS' GUIDE TO SPONSORSHIP OF AN EYE-SCREENING CAMP

Any individual or voluntary social service organisation – such as Lions, Rotary, religious groups, industries, trusts, banks, hospitals, rural service organisations, recreation clubs, farmers associations, panchayat presidents – interested in the community welfare may sponsor an eye camp.

Sponsors' Role
The sponsors should play the primary role in setting up the campsite, arranging facilities and publicising the camp. They are responsible for assembling patients and providing lodging and food for the medical team.

How to sponsor a camp?
A village with a population of at least thirty [thousand] to fifty thousand including the surrounding areas is selected for conducting an eye camp. A convenient venue (such as a large school building in the area) and a suitable date (which does not interfere with local festivals, marriages and other functions or with other camps) will be selected for conducting the camp.

The sponsors should:

- Plan for manpower and finance to conduct widespread publicity through all possible media.
- Delegate a separate team of members and volunteers to look after the publicity work.
- Arrange boarding and lodging for the medical team if the location is beyond 125km from the base hospital.
- Arrange transport for patients between the villages and the site of the camp, if the camp venue is not accessible to a radius of 5 to 10 km.

Source: Organization records.

Exhibit 9

COSTS AND PRODUCTIVITY OF ARAVIND'S EYE-SCREENING CAMPS

Place **July 26, 2009**	**Total Expenses** (in INR)	**Expected Outcome**		**Unit cost as per target** (in INR)		**Actual outcome**		**Actual cost to find** (in INR)	
		OP	**Admission**	**OP**	**Admission**	**OP**	**Admission**	**OP**	**Admission**
Kattur	14,490	600	150	24	97	701	198	21	73
Chekkanurani	8,685	300	50	29	174	142	21	61	414

Note: Total expenses do not include the cost of return transportation from the venue to the hospital. OP = outpatients.
Source: Organization records.

Exhibit 10

ROLES OF THE SPONSOR AND OF ARAVIND HOSPITALS IN ORGANIZING A MOBILE REFRACTION UNIT

Sponsor/Supporter	**Aravind Eye Hospitals**
Provides a place for performing eye examination	Provides a clinical team from the base hospital
Coordinates the power supply	Prints the handbills
Sponsors the camp and arranges for publicity	Door-to-door distribution of the handbills
Rallies local support	Transports the medical team
Mobilizes volunteers to help during the camp	Provides food and refreshments for the medical team
	Incurs all expenses related to the mobile refraction unit

Source: Organization records.

Exhibit 11

REVENUE AND COSTS FOR A MOBILE REFRACTION UNIT CAMP

Item	**Value (in INR)**
Total cost of the van	2,800,000
Lifetime of the equipment	5 years
Total possible expenses for the mobile refraction unit per camp	3,376
Current average sales of spectacles per camp	20
Average sales price per spectacles	260
Purchase cost of frames and lenses for the spectacles	100

Source: Organization records.