Indian Institute of Management
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Narayana Nethralaya:
A Precious Gift to a Premature Child

In the year 2010, it was estimated that there were 27 million live births in India, of which about one to two per cent babies were born prematurely (premature birth is defined as the mother having a pregnancy period of less than 37 weeks). About eight per cent were born weighing less than two kg and it is estimated that 47 per cent of such babies developed a problem called Retinopathy of Prematurity (ROP), essentially non development of blood vessels within the retina which damage the retina, leading eventually to retinal detachment (For more details of this condition, see Exhibit 1). This condition typically manifests three to four weeks after birth. If not treated on time, this could lead to serious problems with vision and even permanent life long blindness, usually in another six weeks. It was estimated that, of those developing ROP, 10 to 20 percent of babies would lose their sight permanently if untreated. Most of these incidences of blindness, however, were preventable if diagnosed and treated on time before retinal detachment took place. A large number of premature births happened amongst the lower socio-economic group, especially those in the rural areas, due to malnutrition, anemia, and lack of awareness and access to facilities. Further, awareness about the condition was extremely limited even among doctors. In almost all such rural locations, there were no systematic screening processes in place and there was a shortage of ophthalmic surgeons who could treat the condition. All these factors made the detection and treatment rather uncommon. When babies became blind, it was attributed to their being born 'blind from birth', while the tragic fact was that their blindness was preventable in most cases, had they been detected and treated on time.

It was this problem that the ROP unit of Narayana Nethralaya, an eye hospital located in Bangalore, sought to address, under the leadership of Dr Anand Vinekar.

NARAYANA NETHRALAYA

Narayana Nethralaya (NN) was founded as a private clinic in 1983 by Dr Bhujang Shetty. By 2010, it had grown to become a 300 bed hospital, located in two facilities in Bangalore: one in Rajajinagar and the other in the Health City at Hosur Road. In 2010, it dealt with 172,183 out patients (OPs) and conducted 15,493 surgeries while 3,440 patients were treated free (for details on the number and types of surgeries conducted in 2010, see Exhibit 2). A substantial number of these surgeries (10,973) were for cataract, as was the case in most eye hospitals. These were conducted as microsurgeries, with Intra Ocular Lens (IOL) implantation, and the patients were generally operated on and discharged the same day. Narayana Nethralaya had treated more than one million patients since its inception.

Prepared by Professors Rekha Jain and S Manikutty, Indian Institute of Management, Ahmedabad. The authors are grateful to Dr Bhujang Shetty, Dr Rohit Shetty and Dr Anand Vinekar, and the ROP team of Narayana Netralaya for their cooperation that made this case possible.

The uniqueness of this hospital lay in its commitment to research and encouragement to doctors to enter into niche areas that might not be large in terms of the likely number of patients, but had significant impact due to their being at the cutting edge of research. They were, of course, important to the patients themselves, whose sight could be saved. Examples of such niche areas were pediatric ophthalmology and strabismus service (refraction errors and cataracts in very young children), retinoblastoma (a form of eye cancer), and ROP.

Regarding the philosophy behind funding this hospital and its specialties, Dr Bhujang Shetty, the founder and the head of the hospital, told the case writers:

> I founded this hospital in a small way as a clinic 27 years back. I also took the conventional route for quite some time but from the very beginning, I was clear that this was not going to be a pure commercial venture. I constantly encouraged innovation and getting into niche areas hitherto neglected. Now we have many units dealing in such niche areas.

Dr Rohit Shetty, the Vice Chairman and second-in-charge in the hospital said:

> Our philosophy has been to focus on special eye diseases that may be small in number but have significant impact. We have about 10 per cent of our doctors who are engaged in such niche areas.
>
> We also encourage our doctors to get trained in niche areas. At any point in time, about eight out of our total of 50 doctors would be on such training. We have an excellent wet lab where doctors may get the experience of conducting surgeries in conditions very similar to working on live eyes.
>
> We also encourage doctors to attend rejuvenating conferences that enable them to keep in touch with the latest developments.
>
> We also engage in training doctors from other hospitals and countries. We have been regularly training doctors both from developing and developed countries, as for example, from Vietnam, Indonesia, Papua New Guinea, Australia, and Germany. We have a full fledged research wing which has two divisions—one funded by ourselves and the other is externally funded. In our in-house research, we have two doctors and a team of lab assistants/staff working full time.
>
> In all, out of a rupee earned, about 80 paise would go to these innovative activities. We have observed one cardinal principle: no child will go out untreated because of the parent's inability to pay.
>
> We are not target-driven. There are no targets for any doctor. But patient satisfaction is absolutely important.

Narayana Nethralaya, however, had been financially self-supporting since its inception and had no loans or debts.

Dr Anand Vinekar and the ROP Unit

Dr Anand Vinekar, who headed the ROP activity (formally, the Head of Pediatric Vitreo-Retina) had his postgraduate degree from the Post Graduate Institution of Medical

Education and Research, Chandigarh. He also worked on a fellowship in pediatric vitreo-retinal diseases with Dr Michael Trese, Royal Oak, Michigan, USA. He had dedicated himself to the problem of pediatric blindness, especially to ROP. In an interview with the case writers, he said:

> I always wanted to work in this area. I joined this hospital only because they readily agreed to let me develop this specialty as a distinct unit and supported me.

Dr Vinekar set up the unit, visited various hospitals to educate them on the nature of ROP, and developed the needed network.

The Pilot Project

The pilot project was launched in 2008 in Karnataka in Bangalore Municipality jurisdiction, and the districts of Bangalore Rural, Mandya, and Mysore. The first task was to establish a network to reach premature babies. In 2010, in Karnataka, most of births (84%) were taking place in hospitals rather than homes, and the babies could be sent quickly to neonatal intensive care units (NICUs) for care, if they were premature. Premature babies required a lot of special attention and good NICUs would have ventilators, incubators, and other special facilities. Depending on the facilities available, NICUs were classified into three levels. Level 1 were those with no specialized facilities (and therefore were not really intensive units at all), and Level III were fully-equipped. Level II facilities were in the middle. For premature babies, Level 1 would not offer any protection, and the babies needed to be sent to Level II or Level III facilities.

At the start of the project, Dr Vinekar and his team tied up with some of these hospitals to visit the babies and conduct the eye examinations to ascertain the development of the eye and its blood vessels. Dr Vinekar became a member of National Neonatology Federation (NNF), Karnataka Branch, and this association gave him access to some neonatal clinics easily. Through this association, some hospitals agreed to give him access. No payment was made to or by the hospital for this service. Despite not seeking any financial support from hospitals, his initiative still had to face many difficulties. First, this intervention had to be viewed in the context that from the hospital's point of view, this was not necessarily a priority issue, since most of the premature babies were fighting for life and had a variety of problems threatening their little lives. Secondly, many of the doctors themselves were not aware or inadequately aware of this condition and had to be educated regarding ROP. Lastly, the parents also had to be educated, since most of them would refuse to believe that their babies had a sight problem and a surgical procedure, (albeit a relatively painless and quick laser technique) was needed, especially since the early stages of ROP would not produce any visible symptoms for the parents or doctors to appreciate the difference the surgery had made.

In this context, in 2008 NN devised a novel project, namely, Karnataka Internet Assisted Diagnosis of ROP (KIDROP). This project applied tele-ophthalmology techniques to diagnose ROP using a high-end portable pediatric wide field digital imaging camera. The retinas of babies in selected areas of Karnataka state would be examined, and the project would eventually be extended to the whole state. Over the past one year, the project had screened over 6,500 babies (new and follow-up) and offered free consultation and treatment to the babies who could not afford the treatment in the outreach centres. Peripheral ophthalmologists and pediatricians were also being simultaneously trained to manage ROP in the centres that the project team visited.

The first step in the diagnosis was to take a high quality image that would reveal the progression of the blood vessels in the retina (see images of the stages of disease in Exhibit 3 a, b, & c). This needed a special camera, which was bought in January 2008. The available cameras were bulky and not portable, and this would put a serious limitation to the project, since premature babies were generally too fragile to be moved to any new location. Hence a portable camera, named Retcam Shuttle was procured at a cost of rupees five million from Clarity MSI, California, USA. This needed to be supplemented by a portable laser machine necessary for conducting the treatment procedure if required.

In order to cover the surrounding geographic areas, Dr Vinekar and his team devised a plan to move from hospital to hospital in a grueling schedule that on some days involved covering more than 300 kms and visiting three to four hospitals. The poor condition of some of these roads made it worse. The schedule in 2010 was:

Monday: Mandya, Mysore, Chamrajnagar (320 kms)
Tuesday: In main hospital
Wednesday: Adi Chunchinagiri (AIMS), Hosur (220 kms), Bangalore Rural
Thursday: Kolar (150 kms), Bangalore Rural
Friday: Tumkur, Pavagada (140 kms), Bangalore Urban
Saturday: Bangalore Urban (70 kms)

At first, the entire examination, diagnosis and surgery were done by the full team, including Dr Vinekar. Since there was a scarcity of ophthalmic surgeons who could diagnose and treat the patients, the KIDROP project trained technicians to take these images to process and store them. Further, with a growing database of such images, technicians were trained to triage the screened infants. This training had taken over 18 months and had used more than 70,000 stored images. Although there could be concerns regarding replacing a doctor with a trained technician for this aspect of the job, the accuracy with which technicians could predict the different stages of ROP was extremely high. This could be partly due to the large amounts of images that were used for training, and partly due to the intensity of the training itself. The technicians were also a motivated lot, who wished to learn this application very well. Gradually, Dr Vinekar created a team of technicians who could be trained to dilate the pupils, and take the pictures and subsequently, they were trained to develop the skills of interpreting the retinal images.

An innovative step was taken when the images could not only be read on a remotely situated PC via a secure network using the internet and a dedicated server, but could also be viewed on an iPhone without the need of the PC or internet for the doctor. From a specially designed server, with the needed software to view and report, and a workflow of image transfer; the images could be remotely viewed either on a PC or an iPhone by ROP experts who could give live diagnosis of infants screened in the rural areas. Exhibit 4 gives the workflow of the entire process.

Diagnosis and reporting tools on the iPhone such as generation of work lists, providing a history of visits of particular patients, and detailed patient information helped to manage the entire project data. Representative screen images for these three aspects are provided in Exhibit 5. The iPhone was also used to store retinal images as thumbnails which could be expanded for better resolution (Exhibit 6). These could be seen live by the doctor even from remote locations to give an immediate opinion or the doctor could see them later on, to get the patient's history. Since, with the training, the screening and monitoring could be done by

the technicians, the doctor's presence during screening became unnecessary. The technicians could move around independently and only on days where laser surgery was scheduled, Dr Vinekar was needed on the trips. In most other situations, he could give his opinion from his office in Bangalore.

Apple's iPhone was selected as the platform and together with a start-up company, namely, i2i Tele-Solutions, software solutions for the KIDROP project were designed. This software was compliant with the standards related to image compression and information transmission for medical applications, namely, with DICOM and HL 7 standards. (DICOM is a standard for handling, storing, printing, and transmitting information in medical imaging. It includes a file format definition and a network communications protocol based on the universally used TCP/IP and HL7 refers to Health Level Seven International, the global authority on standards for interoperability of health information technology with members in over 55 countries).

Further, iPhone's relatively larger screen, easy-to-use, with pinch and drag capabilities, high resolution, graphics capability, good picture quality, and security were other factors that contributed to the choice. In addition to this, features on all iPhones were similar with respect to operating software and platform for development, leading to lower efforts in developing the needed software, in contrast to other phones, where handset features varied across different models. The firm, i2i Tele-solutions, had to work closely with the ophthalmologists in the KIDROP team at NN to understand the clinical requirements for viewing, diagnosing, and reporting. The Apple development kit, available on a Mac platform, was used to interface it with patient images and data available on servers, and compression algorithms (ABO compression) were used to send data wirelessly on the available low bandwidth channels.

The Hospital had funded this pilot project, in terms of the equipments required, cost of logistics, and professional time. It felt that it had to do this as a part of its mission. Over a period of time, the project established tie-ups with private hospitals such as Apollo Hospital, Columbia Asia Group of Hospitals, etc., and some private hospitals such as JSS, M S Ramaiah Medical College etc. NN could charge the patients in these hospitals some amount since their patients could afford these charges.

Presently, the charges by NN in different hospitals were as follows:

High-end hospitals: Full Charges (see Exhibit 7).

Medium level Private hospitals: Discounted charges, about 30-50 per cent (variable) of the full charges.

Government hospitals: Free

All these had provisions for waiver, partial or full, in deserving cases. In no case was a treatment delayed or withheld due to payment issues.

Exhibit 8 shows the number of children seen and treated for ROP over the last three years. The average cost recovery from paying patients was about `200 per patient. About 60 per cent of all patients were not charged and the average earnings per month were estimated to be `135,000. At least a third of this would go towards actual out-of-pocket expenses of the team (such as the salaries of the team members, cost of travel, reimbursement of food, and incidental expenses). If one accounted for the time of the doctor and the

interest/depreciation charges, the project would be remunerative only if the numbers were large, as in the case of KIDROP. It was expected that, with the progress of the project, and increased use of technology, the doctor would not have to travel so much, and hence the cost of the doctor as a percentage of the total costs could also be expected to come down.

Extending to Other Districts of Karnataka

By October 2010, the KIDROP project had covered 23 centres within a 350 km radius in the 28 months of its existence, screening over 3,000 fresh cases of babies within this time frame. The number of screenings was more than 17,000, including repeat screenings. Given its success rate, it had very recently become a part of the National Rural Health Mission, a national level integrated program aimed at improving the health indicators of the rural population.

Recognizing the contribution of this project, the Government of Karnataka (GoK) adopted it in its National Rural Health Scheme, funded by the Central Government and implemented through the states. As of October 2010, the project was on the verge of take-off, and it was to be implemented first in North, then Central and lastly in coastal Karnataka. The target was to cover the entire state over the next three years (See Exhibit 9 for the Map of India Karnataka state with district boundaries).

In this scheme, the government would bear the cost of the Retcam camera, the cost of the equipment for laser treatment and other needed machines and equipment, vehicles, and the cost of technicians, their training and incidentals, travel, the buildings needed to house the equipment (usually in the premises of a government hospital) etc. NN would bear the cost of doctors and would train the technicians and ensure the project implementation including free treatment to all those who could not afford it. It did not expect to make any cash surplus from this initiative but would be their "contribution to society" according to Dr Anand Vinekar and Dr Rohit Shetty.

The equipment for North Karnataka arrived in December 2010. An important concern was the high cost of the Retcam ($120,000 in India). The quest for improvements in camera design at lower costs remained a significant unmet need.

Northern Karnataka districts were far from Bangalore and it was not possible to work in the same way as the team had worked in the pilot project in Bangalore and its adjacent districts. It would now require a dedicated team of doctors and technicians. It would also require the use of technology in such a way that the technician would be able to work independently and upload the images. He/ she would perhaps also have to take the first level decisions as to when a baby would need the next check up and tentatively suggest a date for either screening or laser treatment, in tele-consultation with the doctor. This implied training the technicians to correctly capture the retinal images and interpret them. It would also require training of the peripheral doctors all of whom were not familiar with the problem of ROP. The network of hospitals to give access to the infants would need to be built, and their continued cooperation had to be ensured. Dr Vinekar and team conducted surveys in six districts between March and October 2010 to enroll centres in the North Karnataka belt.

Further expansion into the other areas of Karnataka would pose additional challenges. From the discussions with different personnel, the following issues emerged:

(i) *Relationship with GoK*

Clearly, GoK, with its significant role, including funding, would be the dominant partner. The project would not only depend critically on continued funding, but would

also have to follow government procedures, which could lead to delays. For example, the equipment purchase for North Karnataka was reported to have faced some delays. The personnel would be government staff and motivating them would be a challenge. One of the persons interviewed said, "The success of the project would depend critically on the motivation and commitment of its personnel." The existing team was highly mission-driven, with a total commitment to this cause. Each zone would need a project director assisted by lower level staff, and they would have to function as a cohesive and committed team.

(ii) *Organizational Issues*

The structure at each level and its relationship with NN would need to be defined and clarified. The hospital would need to be involved actively, especially in the early stages, and at present only Dr Anand Vinekar was in this project. The extent and nature of involvement at the field level would have to be redefined with experience. The success in North Karnataka would be critical to ensure the implementation of the project in the rest of the state.

(iii) *Technological Issues*

a. Proprietary Platforms and Interoperability: KIDROP had chosen the i2i and iPhone proprietary platforms for implementation. At the given point in time, the platform provided unique functionality critical for operations. However, as it scaled up, there could be concerns regarding interoperability with other systems as well. For example, if KIDROP wanted to build synergies with existing similar programs, then, unless both systems worked on similar technological platforms, there could be problems.

   Although the handset software was proprietary (the i2i solution running on Apple iPhone), but since iPhone services could be run on any GSM/CDMA network, patients/doctors could switch their service providers and yet continue to use services as before.

b. Influence of High End Mobile Devices on Business Operations**:** In KIDROP, only surgeons required an iPhone. The current state of technology did not lend to the retina photographs being taken by an iPhone, because such photographs required very wide angled lenses which the phone cameras did not have.

c. Availability of Wireless Broadband**:** Although network operators had upgraded networks to offer VAS through GPRS, the non availability of 3G and other wireless broadband services on a commercial basis was a constraint for service delivery. The government had delayed auction of 3G and other broadband services, to the detriment of take off of innovative services. While most operators viewed wireless broadband services as being relevant for only economically well off sections, as they could afford to pay for the higher bandwidth costs; the government and public agencies appeared to have overlooked its potential to deliver development-oriented services and mitigate the poor quality of physical infrastructure. This led to a vicious cycle as the lack of scale of such applications did not permit the benefits to be visible. In the absence of visible benefits, public support for such applications was reduced.

(iv) *Management Control and Reporting Systems*

Since the operational involvement of NN in this project would be limited, and this would essentially be a remote controlled operation, there would be a need for defining the control parameters: the number of hospitals to be visited, the number of patients, number of laser procedures to be conducted, earning mix (if private hospitals were to be involved), patient satisfaction etc. The system of tracking patients and the regularity of reporting for successive checks during the screening period as well as post-surgical period would need to be installed and put in place. Whether NN would have to augment its core staff in its unit, including doctors had to be decided too.

(v) *Financial Sustainability*

The policy for charging the patients had to be decided. The treatment in government hospitals would perhaps continue to be free. Would it help if some private hospitals were also included? From a larger perspective, what degree of financial sustainability should the project aim for? What would be the contribution of the GoK from its grants for the Rural Health Scheme and what would NN need to plan to incur as expenses?

(vii) *Tying up with Other Programmes of the Government*

How could this be tied up with other Government initiatives in Karnataka such as Yasaswini, Arogya Bhagya etc. addressed to pregnant and new mothers? (See Exhibit 10 for a brief description of these projects).

The number of doctors per 100,000 population in India was around 59. Probably there were only about 400 vitreo retinal surgeons in the country as a whole, going by the membership of their professional body, Vitreo Retina Society of India (VRSI). Of these, the number of pediatric retina specialists would not be more than 15-20, according to Dr Vinekar. This made the task of just finding the required number of surgeons daunting, if the project were to be scaled up in the country as a whole.

"The way things have moved forward. I am happy. I hope this project becomes a successful example of a Public Private Partnership," said Dr Shetty.

Exhibit 1: Retinopathy of Prematurity (ROP)

When a baby is born premature, its various organs are not fully developed and the subsequent development has to take place outside the womb. This essentially puts the babies in a precarious condition on many fronts. These babies are very fragile and are to be handled with great care. The good news is that a large percentage of them do make it and grow into normal human beings.

The development of the visual facility is not obvious and generally was not monitored in the past. The baby could respond to light but still it might not be seeing properly. The development of the eye essentially is the development of the blood vessels in the eye, especially in the retina, and this takes its own course. A simplified thumb rule was that if a baby were born 6 weeks premature, then 6 weeks after the (actual premature) delivery, the eye should be fully mature in the retina. In most cases, this happens, but in some cases, this vascular development does not take place. If the blood vessels do not progress, the retina, forfeited of blood supply, starts detaching and then the child becomes permanently blind. See Exhibits 3a, b, and c for the images of a typical premature eye, normally developed eye after the period when its birth would have been actually due (the so called expected date of delivery), and improperly developed eye at this stage.

Source: Compiled by the authors

Exhibit 2: Number of Surgeries conducted in 2010 at Narayana Nethralaya

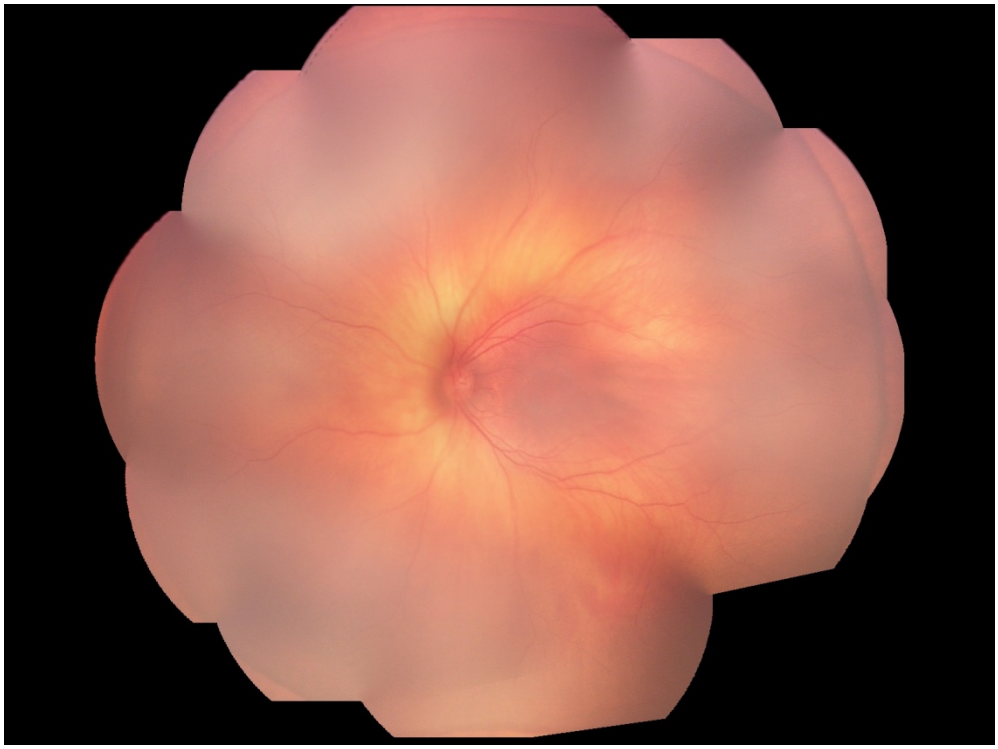
Surgery type	Total Surgeries	Free or Subsidized (`)	Free or Subsidized (%)
Cataract	10,973	1,260	11.48
Cornea & Refractive	1,619	568	35.08
Retina & Vitreous	1,374	666	48.47
Pediatric Ophthalmology	522	411	78.73
Oculoplasty & Aesthetics	523	227	43.40
Glaucoma	482	309	64.10
Total	**15,493**	**3,440**	**22.20**

Source: Data given by Narayana Nethralaya.

Exhibit 3 (a): A Montage of Retcam Images that shows incomplete growth of Retinal Blood Vessels in a premature infant 3 weeks after Birth

Source: http://www.iitcoe.in/images/stories/broadband/anand_vinekar.pdf, May 30, 2011

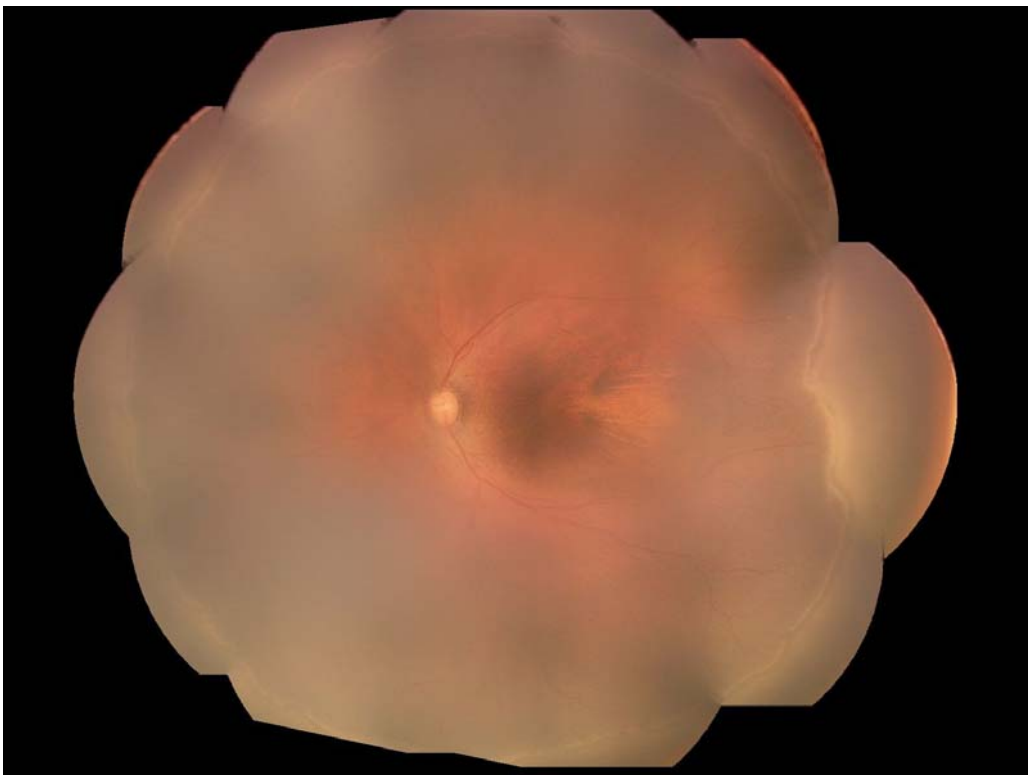
Exhibit 3 (b) : A Montage of Retcam Images that shows complete growth of Retinal Blood Vessels in a premature infant 8 weeks after Birth



Note: Compare this carefully with the image given in Exhibit 3 (a).

Source: http://www.iitcoe.in/images/stories/broadband/anand_vinekar.pdf, May 30, 2011

Exhibit 3 (c): A Montage of Retcam Images that shows a Stage of ROP Disease seen in the Photo as a White Demarcation at the Junction where the Blood Supply Growth has stopped. If the stage progresses to a critical state, it requires Treatment with Laser.



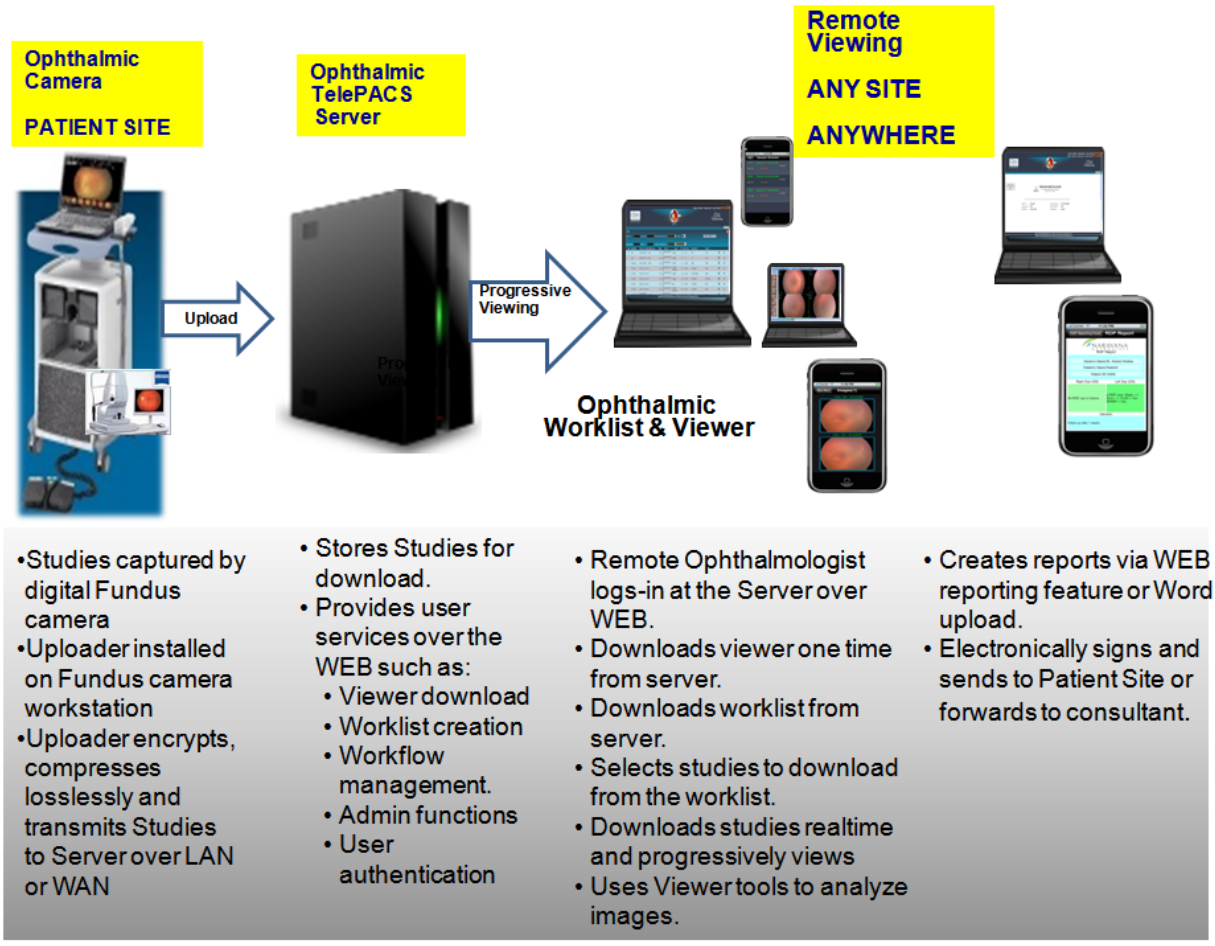
Source: http://www.iitcoe.in/images/stories/broadband/anand_vinekar.pdf, May 30, 2011

The regular screening of the eye can show the progression of blood vessels, and these images enable the doctor to intervene at an appropriate stage if needed, through a laser procedure. Laser ablates the area of the retina without blood and restores the blood supply to this area thereby restoring vision in a large percentage of cases.

The monitoring of the progress of development of the blood vessels consists of taking high resolution images of the retina periodically and identifying the areas of distress for the retina. This enables the doctor to assess both the present condition and the progress over a period and the doctor can decide whether and when a surgical intervention is necessary.

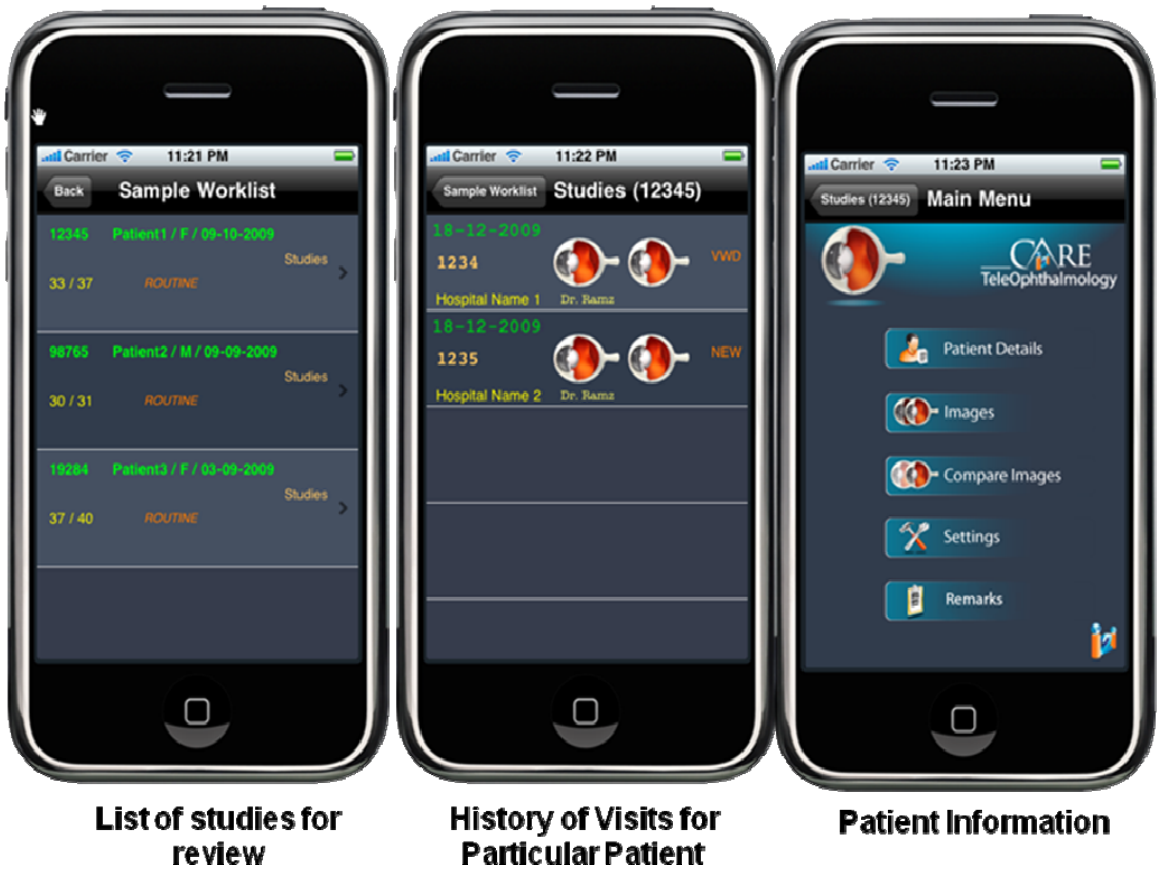
Premature births seem to depend on the health of the mother, and hence the lower socio-economic strata are more vulnerable. Unfortunately, the awareness of this problem is very low among these groups, and even among the doctors who manage the premature babies. The result is that babies are left untreated and some babies become blind. Since no screening or diagnosis had been done, it would be assumed that they would be 'blind from birth' whereas the incidence of real blindness from birth is very small. Most of these conditions are treatable, if diagnosed and treated on time. But the window is short: the treatment needs to be completed within 72 hours of reaching the critical stage of disease, before any detachment of retina happens. This puts a great deal of pressure on the parents and the main hospital, who may be dealing with other serious problems encountered with premature babes. If the baby had been discharged (many get discharged if they get over the vulnerable phase), the parents need to be informed and advised about the need for regular return visits for eye check-ups. The priority accorded to this problem tends be low, and parents often need to be convinced and cajoled into bringing the babies for regular screening (if they have been discharged) and for submitting to surgery, if needed.

Exhibit 4: Ophthalmic Workflow and Information flow



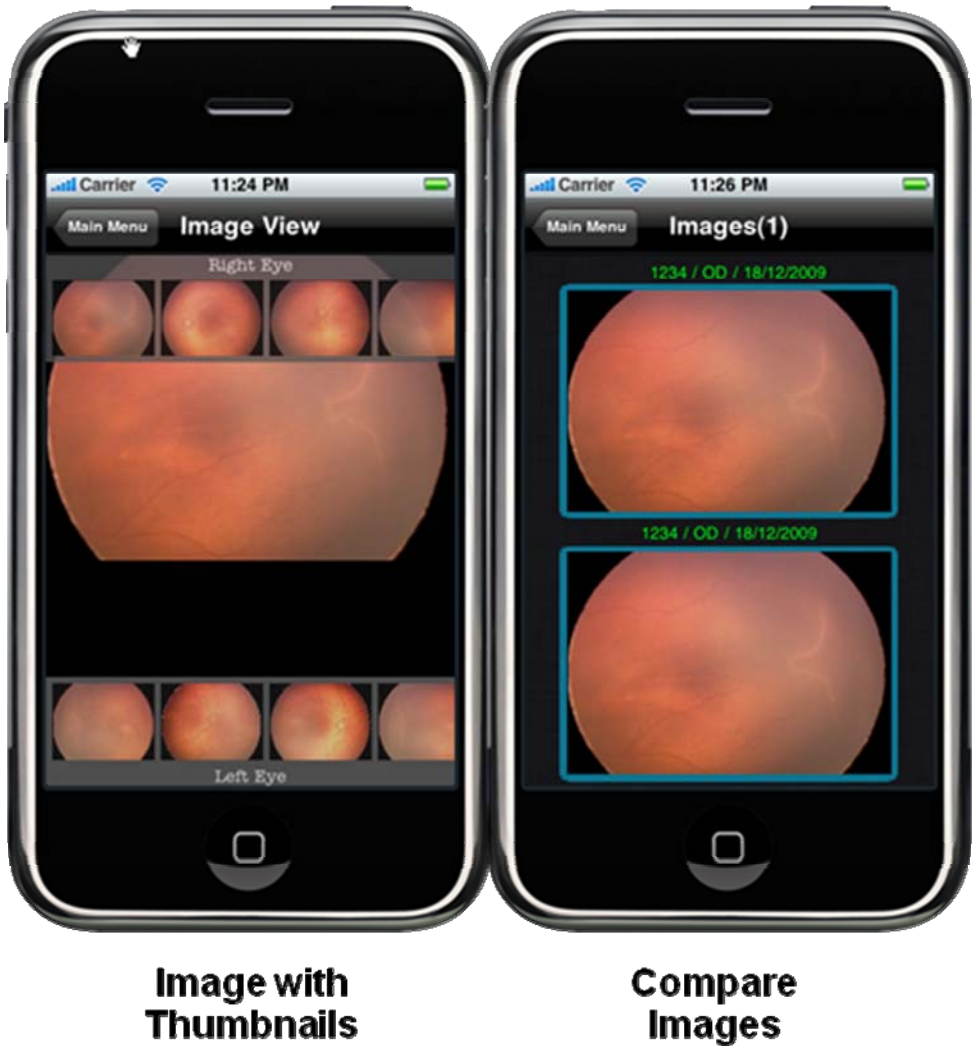
Source: http://www.iitcoe.in/images/stories/broadband/anand_vinekar.pdf, May 30, 2011

Exhibit 5: Reporting and Diagnostic Features on iPhone



Source: http://www.iitcoe.in/images/stories/broadband/anand_vinekar.pdf, May 30, 2011

Exhibit 6: iPhone Thumb Nail and Expanded Retinal Images



Source: http://www.iitcoe.in/images/stories/broadband/anand_vinekar.pdf, May 30, 2011

Exhibit 7: Full Charges for Services by NN ROP

(in `)

Consultation fee (file registration)	200 (one time)
Retcam Shuttle Imaging	600 per visit
Spectralis / Bioptigen OCT imaging	600
Pediatric Retinoscopy	300
Pediatric FFA	750
Pediatric ICG	2,000
Functional Vision assessment and Early Intervention	500
Laser & OT charges	Case by case, varies from zero up to 20,000)
Retinal Surgery (vitrectomy) for ROP in OT under GA	Depends on the case. Can be up to 50,000

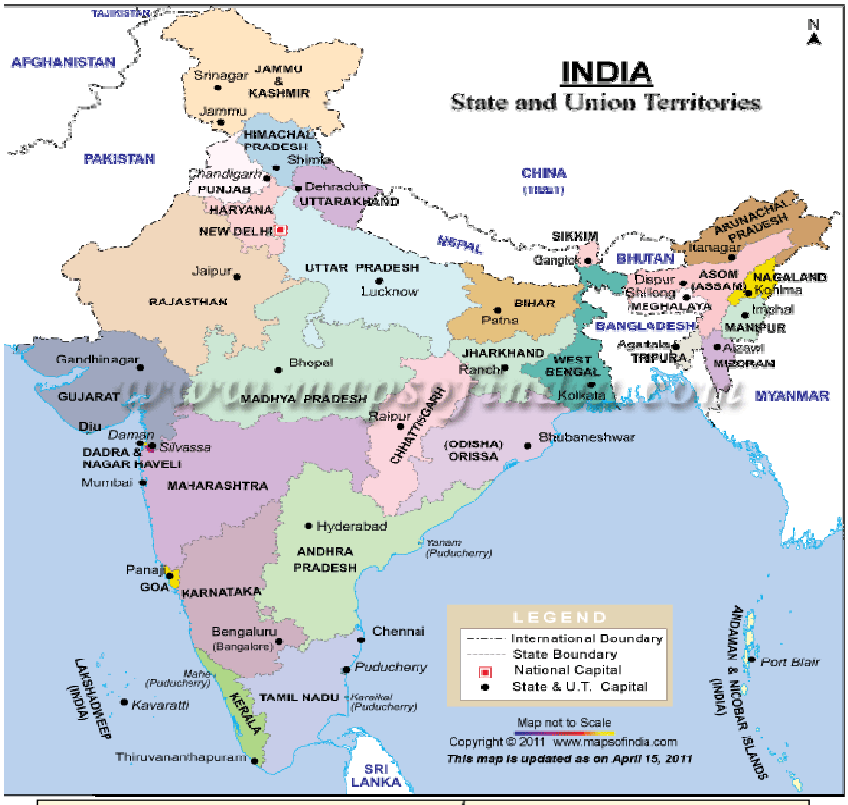
Source: Data given by Narayana Nethralaya

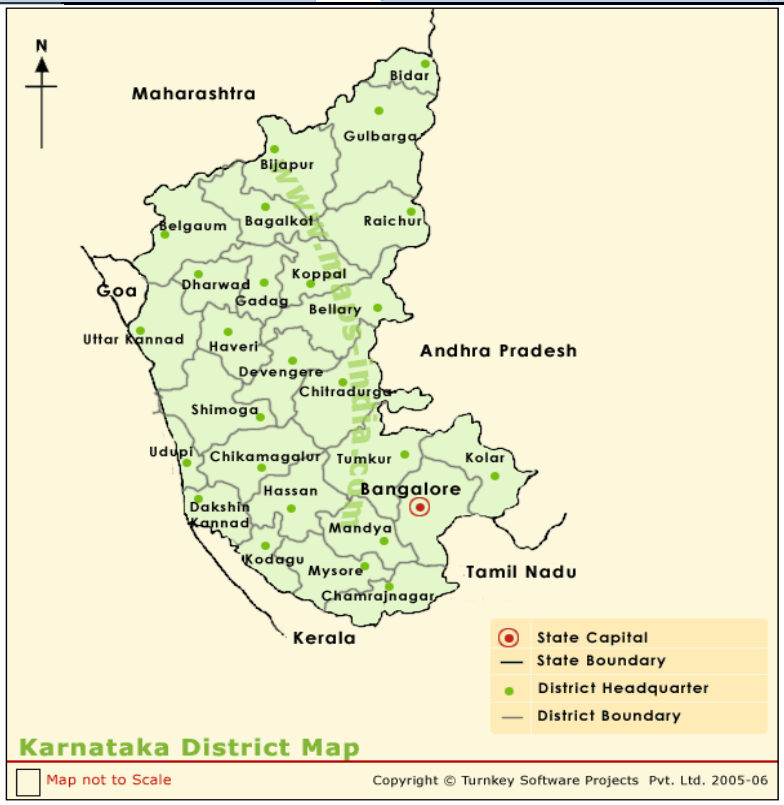
Exhibit 8: Number of Children Seen since Start

	From February 2008	From January 1, 2010
No. of infants imaged	17,550	6,550
New cases	3,258	1,024
Treated with laser	392	112

Source: Data given by Narayana Nethralaya.

Exhibit 9: A Map of India & Karnataka State (with districts)





Source: http://www.mapsofindia.com/maps/india/india-political-map.html and http://www.maps-india.com/karnataka/karnataka-district-map.html

Exhibit 10: Various Health Schemes Launched by the Government of Karnataka

Serial No	Name of the scheme	Details
1	*Janani Suraksha Yojana* - Helping the poor pregnant women after delivery	*Janani Suraksha* scheme is continuation of the previous delivery allowance scheme of the central government. The objective is to give financial assistance to the poor pregnant women during delivery. Under this scheme, pregnant women belonging to below poverty line families and Scheduled casts and tribes are specially focused upon.
2	*MADILU* - Caring for the mother and the child	*Madilu* scheme is started by the government to provide post-natal care for the mother and the child. The objective of this scheme is to encourage poor pregnant women to deliver in health centres and hospitals in order to considerably reduce maternal and infant mortality in the state.
3	*THAYI BHAGYA* Scheme - Public-Private Partnership in maternal health care	This scheme provides totally free service for the pregnant women belonging to BPL families, in registered private hospitals. The background for working out this strategy is • Shortage of specialist doctors, especially the gynecologists, anesthetists and pediatricians Taluk hospitals and CHCs. • There are considerable numbers of specialist doctors in urban private hospitals. • By entering into Public-Private partnership with these hospitals, rural women can be provided with facilities for proper institutional deliveries.
4	*Yesaswini*	Initiated by Dr Devi Shetty of Narayana Hridayalaya, Bangalore. The scheme aims to provide cost effective quality healthcare facilities to the Co-operative farmers spread across the state of Karnataka. The scheme operates under the aegis of the Karnataka State Co-operative Department

Source: http://stg2.kar.nic.in/healthnew/NRHM/PDF/KUTUMBA/KutumbsEnglish Jan2009. pdf, May 30, 2011.