



TARUN KHANNA
V. KASTURI RANGAN
MERLINA MANOCARAN

Narayana Hrudayalaya Heart Hospital: Cardiac Care for the Poor

Narayana Hrudayalaya (NH) means God's Compassionate Home in Sanskrit. Situated in the south Indian city of Bangalore, best known as India's Silicon Valley, almost everything about this heart hospital was unique, from its buildings and equipment to the doctors, nurses, and their treatment and care of patients. At the entrance to the main foyer of the hospital was a circular chapel equally divided into four independent quadrants, each a place of prayer and meditation for the four main religious faiths of its patient population—Hindus, Muslims, Christians, and Sikhs (see **Exhibit 1**). Depicting the unity of human faith, the four streams naturally converged at the center of the chapel.

Founded in 2001 by Dr. Devi Prasad Shetty, NH had grown rapidly in four years to house 500 beds, 10 fully commissioned operating theatres (OTs), two cardiac catheterization laboratories, and its own blood and valve banks.¹ The pediatric intensive therapy unit (see **Exhibit 2**), which consisted of 50 beds, was one of the largest in the world with 40% of all procedures performed at NH being pediatric treatments. Since its opening, the hospital had completed over 11,228 open-heart surgeries (OHSes), half of which were pediatric. In 2004 alone, it performed 4,276 surgeries, of which 1,467 were on children. To complement the surgeries, NH also performed 5,430 catheterization procedures that year.

To provide affordable cardiac care to the masses, NH followed a hybrid strategy of attracting paying patients by virtue of its reputation for high quality combined with a relentless focus on lowering its costs of operation wherever possible so that a larger number of people could afford to seek treatment. The surplus gained from paying patients was used to subsidize procedures performed at, or below, cost for patients who could not afford the full fee. In 2004, the proportion of patients who paid NH's full price to those that could not afford to pay was about 60:40. (See **Exhibit 3** for a picture of the entrance foyer at NH on a typical day.)

The break-even price for a typical OHS at NH was approximately 90,000 rupees (Rs.) (US\$2,000) for adults and Rs. 130,000 (US\$2,900) for children. At a price of Rs. 110,000 (US\$2,400) for a regular package involving OHS (inclusive of surgery and hospitalization charges), NH's charges were the

¹ The valve bank (one of four in India) stored valves (harvested from cadavers) used to replace damaged valves during surgery. NH offered these valves to patients and other hospitals free of charge.

lowest in the country, where the average cost of OHS in a private hospital was Rs. 250,000 (US\$5,500). At the upper end, patients who opted for executive wards paid Rs. 140,000–Rs. 195,000 (US\$3,100–\$4,300); this package provided private rooms instead of general wards, although treatment and care across all packages was identical. (See **Exhibit 4** for the prices of various procedures at NH and comparative prices at other Indian hospitals.)

In addition, the hospital offered a scheme called Karuna Hrudaya, which allowed financially constrained patients to pay Rs. 65,000 (US\$1,400) per OHS, with NH absorbing the remaining costs. For patients who could not afford this package, the Narayana Hrudayalaya Trust, a charitable organization with offices within the hospital, helped to arrange funds from a general corpus or by specifically seeking donations from a list of individuals and organizations.

Dr. Shetty, looking a full 10 years younger than his 50 years, proceeded to lay out his vision for the future of the hospital: “We have only completed Phase I. In Phase II, we will have over 100 acres of facilities. We are planning on 800 beds, 30 operating rooms, and 20,000 surgeries a year. Besides the hospital, we will build a teaching institute for cardiologists, cardiac surgeons, and other health-care specialists.”

Even as he spoke of his vision, his youthful appearance melted away. He now looked adolescent, almost a 10-year-old with a dream:

“Look,” he said, pointing in the direction of the neighboring Electronic City and Infosys, one of India’s, and indeed the world’s, leading software services firm, “they are world class, because their quality keeps going up as their costs decrease. Health care is a peculiar beast where in spite of all the new technology, costs keep going up all the time. That is a strange paradox. We are out to buck that trend. We cannot afford to let the masses be deprived of top-class tertiary care. That is why my vision is to create a new health-care economic model, and within a radius of several miles, we want to create a Health City with a capacity of 5,000 beds and treatment for everything—oncology, neurology, nephrology, orthopedics—everything,” he concluded with a youthful smile as though this task was well within his grasp.

In keeping with his expansive vision was this quote adorning the walls of his office: “Most of the things worth doing in the world had been declared impossible before they were done.”

Background

Born in south India, Dr. Shetty studied medicine in Mangalore, India and trained and operated for six years at Guy’s Hospital in London. When he returned to India in 1989, he joined the Birla Heart Research Foundation, a hospital in Calcutta, which he described as a microcosm of the country: “[Calcutta is] a magnified village [of India] with well-equipped hospitals but extremely poor people unable to afford modern health care.”

It was in Calcutta that Dr. Shetty cofounded the Asia Heart Foundation (AHF), a nonprofit organization, with Dr. Alok Roy. Apart from assisting in commissioning the BM Birla Heart Research Institute of Calcutta in 1989 and the Manipal Heart Foundation of Bangalore in 1997, the AHF decided to promote its own hospital in Calcutta, the Rabindranath Tagore Institute (RTI) of Cardiac Sciences, a 150-bed heart hospital with 3 OTs and a 22-bed intensive therapy unit. By 2004, RTI was the largest heart hospital in east India.

In Calcutta, Dr. Shetty was also the personal cardiac surgeon of Mother Theresa and was able to observe firsthand her charitable work, which set the direction for his ambitions in health care.

According to him, “I believe she is singularly responsible for much that I have achieved. Somehow, even though I am a scientist and do not expect to find God, meeting her was almost like an encounter with the divine.”

In 2001, Dr. Shetty founded NH in Bangalore with a generous contribution from his father-in-law, who owned a construction company, Shankaranarayana Constructions (SNC), with expertise in the construction of dams, roads, highways, and power projects. It was SNC that constructed the first phase of the hospital on 25 acres of land adjoining Bangalore’s famous Electronic City on Hosur Road. SNC offered the building on a 30-year lease to NH Private Ltd., a private company owned by Dr. Shetty and his family, which then bought equipment and medical supplies with loans backed by the family. When NH was first built, the hospital consisted of two stories housing five OTs and 280 beds. Between 2001 and 2004, internal funds were used to expand the building to six stories with 500 beds.

By 2004, the hospital was staffed by approximately 90 cardiac surgeons and cardiologists, many with extensive training and experience in top-class international institutions and several of whom had performed more than 10,000 heart surgeries individually in their careers (see **Exhibit 5** for a picture of the team in surgery). Dr. Shetty himself was the first cardiac surgeon in India to conduct neonatal open-heart surgery in the country. With their vast experience, the surgeons at NH were able to achieve international standards in their procedures: NH boasted of a 1.27% mortality rate and 1% infection rate in coronary artery bypass graft (CABG) procedures, comparable with rates of 1.2% and 1%, respectively, in the United States.

Karnataka was the eighth-largest state in India and was known for its information technology and software industries, which were concentrated in its capital city, Bangalore (see **Exhibit 6** for a map of India). The state had a population of approximately 53 million people, over 60% of whom were in rural areas. With an average per capita income of US\$690, Karnataka was one of the more developed states in India. By 2004, the state had a network of nearly 300 hospitals and 1,300 primary health centers with over 50,000 beds.

The Indian Health Landscape

With an estimated population of 1.03 billion in 2003 (of which approximately 400 million were under 18), India was the world’s second-most populous country after China. Its reported per capita income in 2003 was US\$600 (US\$2,900 per capita income on a PPP basis).² While economic growth was impressive since the late 1990s (India registered an average 6% gross domestic product [GDP] growth between 1999 and 2003), the distribution of income remained highly skewed. More than 250 million people lived below the poverty line, and the richest 20% were estimated to hold close to 50% of household income.

In 2003, the Indian government spent approximately 1% of its GDP on public health care (the equivalent of US\$4 per person a year), which placed it at one of the lowest public health-care spending levels in the world (see **Exhibit 7** for comparative health statistics). Private spending was several times higher, and the overall expenditure on health was estimated to be 5% of GDP, compared with the Asian average of 6.3%. While there had been improvements in life expectancy (from around 40 years at the time of independence in 1947 to 64 years in 2003), general indicators of health and nutrition remained poor. The National Nutrition Monitoring Bureau estimated that 85% of

² PPP indicates purchasing power parity, which takes into account price differences across countries.

the Indian population and 47% of children under three years of age did not receive enough nourishment.

With over 15,000 hospitals (the second-highest number in the world) and nearly 600,000 physicians (the fourth-highest number in the world), it appeared that India's health-care system was well equipped. However, the actual number of physicians per 1,000 population was only 0.5 (compared with 2.7 in the U.S.), and since approximately 70% of doctors were located in urban areas while the same proportion of the population still lived in rural areas, actual access to health care was limited by inconvenient and expensive travel.

While public health care was mostly free, the high incidence of corruption at government hospitals lowered the cost differential between public and private health care (stories were told of having to bribe the security guards at hospitals even to visit a patient). In addition, public hospitals and clinics were notoriously understaffed and underequipped. In an article on the public health system in India, Dr. Atul Gawande, a surgeon at Boston's Brigham and Women's Hospital, described a hospital in Nanded (about 400 miles from Mumbai) that had just 500 beds and nine general surgeons to service a population of 2.3 million people: ". . . the faucets don't work . . . examinations take place behind a thin rag curtain with gaping holes in it," he wrote. Everyone he asked said they would borrow money or sell their possessions to access private health care, and according to Dr. Gawande, "even the Prime Minister does not go to his government's hospitals."³

Given that less than 14% of the population was supported by health insurance, treatment was an option only for the rich or those able to borrow to pay the bill. A report by McKinsey & Co. estimated that the richest 7% in the country accounted for 30% of spending in private health care and over 40% of inpatient spending, reflecting the skewed access to private health care.⁴

Ironically, India's private health-care industry, while closed off to the country's majority, was gaining popularity among foreigners. With improving quality and technology at Indian private hospitals, the concept of medical tourism was spreading, with an estimated 150,000 foreign patients receiving treatment at Indian hospitals in 2003. The low cost of treatment at Indian private hospitals (relative to developed countries) was an attraction—for instance, OHS could cost up to US\$70,000 in the United Kingdom and US\$150,000 in the U.S. but was just US\$3,000–\$10,000 at the best Indian hospitals. Dr. Shetty related the story of a friend who operated on a British patient in India: "He [the patient] said there's every chance an Indian would operate on him in the United Kingdom, so why not get operated on by an Indian in India?"

The Demand for Cardiac Care in India

Heart disease was one of the most common illnesses in India—approximately 2.4 million people needed heart surgery every year, although due to lack of affordable treatment, only 60,000 surgeries were performed. The prevalence of the disease had significant implications on its workforce—it was estimated that 28% of the 5 million Indians who died of cardiovascular disease every year were under 65 years old, and almost 25% of heart attacks occurred among the under-40 population. Congenital heart disease was a particular concern—around 224,000 newborns in India were affected by heart disease every year, and the rural population was particularly susceptible due to poverty and unhygienic conditions that worsened the risk.

³ Dispatch from India by Atul Gawande, *New England Journal of Medicine*, December 18, 2003.

⁴ "Healthcare in India: the Road Ahead," A Report by Confederation of Indian Industry and McKinsey & Company, October 2002.

Research showed that Indians were particularly at risk of heart disease, with the Indian subcontinent contributing 45% of the global burden of coronary artery disease. Dr. Shetty said: “Indian genes are three times more vulnerable to heart disease. The average age for heart attacks in the West, for instance, is 65 years, whereas in India, it is 45. When I was a student in London, it was normally a young son who brought his elderly father in for bypass surgery. In my practice in India it is more often the elderly father who brings his son in.”

Heart Disease

The most common heart diseases occurred when the supply of blood to the heart was blocked. This typically happened when the coronary arteries (the vessels that supplied the heart muscle with oxygen and nutrients) were clogged by fat and cholesterol. When one or more of the coronary arteries became partially or completely blocked, the heart was starved of its blood supply—the patient then experienced a recurring pain or discomfort in the chest (angina), and this condition was termed coronary heart disease. When the blood supply was cut off, a part of the heart muscle died and the patient was said to have had a heart attack.

Besides good medical therapy, there were two common methods of treating coronary heart disease—angioplasty and CABG. In angioplasty (a form of catheterization), X-rays and dyes were used to visualize the arteries that supplied the heart.⁵ A balloon catheter was then inserted in or near the blockage and inflated, thus widening or opening the blocked vessel and restoring adequate blood flow to the heart muscle. In most cases, a device called a stent was also placed at the site of the narrowing or blockage to keep the artery open. The whole procedure was performed from a small hole in the artery of the leg or arm under local anesthesia and took approximately one or two hours.

CABG, on the other hand, was a form of OHS and involved creating a detour (“bypass”) around the blocked part of the coronary artery. Veins (typically, from the patient’s leg) and/or arteries were used as grafts and sewn from the aorta (the main blood vessel going from the heart to the rest of the body) to a point below the blockage, thereby creating an alternative pathway for blood to the heart. The operation took between three and six hours (depending on the number of blockages present), and CABG was usually recommended over angioplasty when there were multiple blood vessels with narrowing or when angioplasty was not technically feasible.

Operations Strategy at NH

The operations strategy at NH followed the dual principle of highest quality at the lowest cost consistent with that quality. There were absolutely no compromises when it came to the quality of the hospital’s facilities, equipment, and support services. The 500-bed hospital was housed in a modern setting with spacious areas for all amenities, beginning with the check-in counter, to surgical and treatment wards. Equipment costing Rs. 35 crores (US\$7.8 million) was imported, and all supplies were obtained from vendors that provided the highest quality. Simultaneously, since Dr. Shetty’s vision was to provide health care at an affordable price to the masses, the operations attempted to drive unit costs lower through a high level of capacity utilization and productivity.

Calling his strategy “the Wal-Martization of health care,” Dr. Shetty and his team leveraged their strong reputation in cardiac care to perform a high number of procedures. NH performed

⁵ The procedure of injecting dyes into the coronary arteries to look for any blockages was termed “angiogram.”

approximately 19 OHS and 25 catheterization procedures a day, almost eight times the average at other Indian hospitals (see **Exhibit 8** for volumes of procedures performed at NH and **Exhibit 9** for comparative figures for hospitals in the U.S.). The volume of procedures completed allowed the unit cost of surgery to be significantly decreased. Dr. Shetty explained:

While other hospitals may run two blood tests on a machine each day, we run 500 tests a day—so our unit cost for each test is lower. And this works with all our processes. Also, because of our volumes, we are able to negotiate better deals with our suppliers. Instead of buying expensive machines [like other hospitals], we pay the supplier a monthly rent for parking their machines here—and then we pay them for reagents that we buy to run the machines . . . and they are willing to do this because our demand for the reagents is high enough to make up the profits for them.

Careful dealing with suppliers also helped maintain low costs. “We don’t sign long-term contracts,” explained Dr. Nitish Shetty, the medical superintendent who headed the hospital’s administrative affairs. “We negotiate every purchase because prices in India are very flexible and we don’t want to be locked in to use a supplier who suddenly becomes expensive.” By keeping the administrative team lean, NH also avoided the usual problem of corruption that plagued other corporate hospitals where suppliers had to bribe administrative staff to reach the purchasing manager, thus pushing prices higher.

While the Calcutta hospital and NH had separate purchasing departments (the two hospitals were owned by different entities), there was enough communication between the two departments to increase their bargaining power. The hospitals enjoyed 30%–35% discounts on medical supplies, the largest cost component, since they (together with two smaller units also owned under the banner of AHF)⁶ made up approximately 10% of the cardiac-care market in India. (See **Exhibits 10** and **11** for the latest balance sheet and income statement of NH.)

In addition, NH embraced new technology as another way to reduce costs. Instead of performing chest X-rays with film that cost Rs. 50 and required processing, the hospital used digital X-rays that did not incur recurrent costs. The hospital had also implemented comprehensive hospital management software for its operations, which helped maintain minimum inventory and allowed quicker processing of tests—such advances were said to have increased the hospital’s efficiency, which in turn drove overall costs lower.

“The irony of health care in India is that while this country boasts world-class pharmaceutical companies that manufacture drugs for the developed world [e.g., Ranbaxy Laboratories Ltd; Dr. Reddy’s Lab Ltd., listed on the NYSE; and CIPLA],⁷ the access of the Indian population to medicine is severely limited by high prices,” lamented Dr. Shetty. Approximately 10% of health-care costs in India were attributed to prescription drugs, compared with 11% in the U.S. “An Indian over the age of 60 [the retirement age in the country] could spend Rs. 2,000–3,000 a month on medicines alone, and this is a large sum for most,” added Dr. Shetty. At NH, the prescription drugs made up approximately 8%–10% of the cost of cardiac surgery.

⁶ Chinmaya Hrudayalaya (CMH Hrudayalaya) and CSI Hrudayalaya were both coronary-care units in Bangalore managed by AHF.

⁷ Established in 1935, CIPLA had focused on manufacturing high-quality yet affordable medication for the Indian market and exports to both developed and developing countries. In 1998, the company introduced a combination of AIDS drugs (called a “cocktail”) and stunned the European Commission medical meeting when they announced the sale of the cocktail for around US\$800 per person per year (at that time, major pharmaceutical companies were selling AIDS drugs at approximately US\$12,000 per person per year).

In 2004, Biocon Ltd., an Indian company that developed biopharmaceuticals for sale in developed countries, introduced cardio-diabetes products as part of its first line of generic drugs. NH started using the drugs, which were estimated to be up to 80% cheaper than the market rate for similar medication. “We are a cartel,” claimed Dr. Shetty. “Our connections to other heart hospitals means at our suggestion they, too, will start to use these products.” Again, this reflected a relentless emphasis on costs at NH.

The core cost savings, as explained by Dr. Shetty, were the staff salaries: “Compared to hospitals in the West which spend up to 60% of their revenues on staff salaries [including surgeons’ fees], the comparable percentage for salaries at NH is only 22%. This does not mean our doctors are poorly paid—rather, they work much longer hours [doctors at NH work an average of 12 to 16 hours a day] and perform more procedures.” Also, unlike doctors in other Indian hospitals, NH’s doctors received fixed salaries and not a percentage of the revenues they generated.

From its first day of operation, NH had a sufficient mix of paying and nonpaying patients to sustain its charitable mission (see **Exhibit 12** for the breakdown of revenue received for procedures). “We have never had to turn away a patient for lack of funds,” stated Sreenath, a chartered accountant by profession, who had been with NH since it opened. The mission of providing below-cost care (where necessary) required careful planning and internal financial controls, and to this end, the finance department employed a unique daily accounting system whereby all revenue and costs for the day (including prorated salaries, cost of medical supplies, etc.) were accounted for.

In this way, the finance department—and thus the doctors who received this information and scheduled the surgeries—were able to gauge NH’s immediate ability to fund below-cost surgeries. “Of course there are days when our revenues during the month are low and we have had to postpone subsidized surgeries that are not urgent,” Sreenath explained. “But by monitoring our funds on a daily basis, we are able to plan how much good work we can do on any given day.” While the hospital maintained the typical end-of-month statements and annual financial reports, these were less important in the daily operations. “Looking at a balance sheet at the end of the year is like doing a postmortem,” Sreenath said. “By then, it would be too late for us.”

Telemedicine

A major component of Dr. Shetty’s ambition to provide cardiac care to the rural poor was the use of telemedicine (see **Exhibit 13**). Since cardiac specialists were rare in remote areas, heart attack victims usually turned to general practitioners (GPs), who sometimes prescribed incorrect treatment due to lack of knowledge and/or facilities to correctly diagnose the problem. Dr. Shetty explained: “If a patient with chest pains walks in to see a GP, the doctor usually thinks it is indigestion, so he’ll be given an antacid and sent home . . . 24 hours later, the heart fails and it may be too late.”

Sensing the need for immediate treatment and care in rural areas, Dr. Shetty set up nine coronary-care units (CCUs) across India, linked to NH or RTI (depending on proximity). Each CCU was equipped with beds, medication, computers, electrocardiogram (ECG) machines, videoconferencing devices, and technical staff trained to operate the equipment. In addition, NH trained the GPs at the CCUs to perform checks on patients and administer treatment. With help from S.N. Informatics, a software development company located in Bangalore, NH also created a software program that allowed ECG images to be scanned and transmitted via a Web connection.

When a patient visited a CCU, the GP on duty first took an ECG, which was transmitted to a specialist at NH or RTI. With the patient and the GP on the screen, the specialist then diagnosed the

condition and advised the GP on the appropriate treatment. Patients who needed to be kept under observation stayed overnight at the CCUs, and specialists at NH and RTI conducted daily virtual checks on their condition. In serious cases, the patient, once stabilized, was transferred to NH or RTI for surgery. In very remote areas where videoconferencing facilities could not be set up, a network of around 100 family physicians was still able to use the software to transmit ECG images for diagnosis at NH.

Although telemedicine was not a new concept in India in 2001 (the Apollo Group of hospitals started using telemedicine earlier), NH and RTI made up the country's largest network and were the only hospitals in India that provided the service free. The cost of setting up the CCUs was funded by AHF, as were the staff salaries and operation costs. Almost from the beginning, the project was supported by the Indian Space Research Organization (ISRO), a government agency that adopted telemedicine as a community project and provided connectivity for the CCUs free of charge. ISRO's technology allowed telemedicine to operate by satellite connection, thus providing clearer images than the more expensive (and less reliable) phone lines—"the patient must see the compassion on the doctor's face," said Dr. Shetty.

In addition, the government of the state of Karnataka (in which Bangalore is the capital city) was so enthusiastic about NH's work that the state planned to sponsor a further 29 CCUs. NH continued to monitor all CCUs closely—for instance, when they discovered that a CCU did not keep stock of streptokinase (an injection that had to be administered within six hours of a heart attack), the hospital set a policy of daily "virtual" rounds of CCUs to ensure all systems were working and ready.

"Telemedicine gives ordinary doctors the opportunity to accomplish extraordinary things," Dr. Shetty said. Between 2001 and July 2004, the NH facility performed 9,591 teleconsultations and the CCUs had 4,077 inpatients, many of whom would not have received treatment otherwise. The telemedicine units were also linked to a clinic in Malaysia, a children's cardiac facility in Mauritius, and a medical school in Hanover, Germany, with plans for new connections with Bangladesh, Tanzania, and Pakistan. And Dr. Shetty believed the concept could be extended across other medical areas. "If the patient does not require surgery, then the doctors may not need to touch him . . . once thousand of CCUs are networked, telemedicine can be self-sustaining for a few rupees per patient."

While the telemedicine project utilized government infrastructure (i.e., the support by ISRO and the state government), the initial concept originated and was implemented via efforts at NH. To Dr. Shetty, this reflected the need for individuals and the private sector to take the initiative in areas where the government was typically held responsible. Dr. B.C. Bommaiah, a cardiologist at the hospital, agreed, although he added the need for the right attitude on the part of doctors to implement such initiatives. "Not all doctors will agree to take responsibility for patients that they do not meet in person," he said. "But our doctors will care for someone they see on the screen."

Mobile Cardiac Diagnostic Lab

Both NH and RTI also organized outreach camps for cardiac diagnosis and care. Each weekend, two buses were sent out to rural areas, up to 800 kilometers away from the hospitals in Bangalore and Calcutta (see **Exhibit 14**). Each bus was staffed with at least three doctors, including an experienced cardiologist and two technicians trained to perform echocardiograms. In order to ensure that the best possible diagnosis could be made on-site, the buses were outfitted with echocardiography equipment, a treadmill, a defibrillator, ECG machines, equipment needed for resuscitation in emergencies, and a generator to ensure the machines could be used in rural areas with irregular

power supply. The first two mobile diagnostic labs were donated by the family of Mr. K. Dinesh, one of the founders of Infosys Ltd.

The outreach camps were organized by local associations (e.g., the Lions Club or Rotary Club) that advertised the daylong event in advance and arranged for patients to attend. On average, each camp screened 400 people a day, none of whom was required to pay either the hospital or the organizers. When a diagnosis indicated that the patient required medical intervention, he was advised to visit NH or RTI, where the procedure was performed at or below cost with help from the NH charitable trust.

Training the Next Generation

In addition to their clinical work, the doctors at NH were actively involved in training the next generation of specialists. NH ran 19 postgraduate programs for doctors and other medical staff, including diplomas in cardiac thoracic surgery, cardiology, and medical laboratory technology. The hospital also offered the country's only formal training program for pediatric cardiac surgery, reflecting the rich expertise of NH's doctors in pediatric care.

In 2005, NH was scheduled to offer India's first diploma in cardiology, in collaboration with the Indira Gandhi National Open University (IGNOU). This program was Dr. Shetty's solution to bridging the gap between the 18,000 doctors graduating from India's medical schools each year and the 180 newly trained cardiologists and cardiac surgeons each year. Aimed at producing intermediate-level specialists, the program would require MBBS-qualified doctors (the Indian equivalent to an M.D.) to spend two years training at NH or at 50 other recognized heart hospitals in India.

"India's current situation for training in cardiac care is equivalent to saying you need a degree in automotive engineering to repair cars," said Dr. Shetty. "Obviously if that were the case, we would not have any moving vehicles since we don't have that many engineers!" By equipping GPs with skills to handle emergency and nonintervention cardiology, the program would enable a higher proportion of the population to have access to cardiac care.

A higher supply of cardiologists was expected to drive the costs of care lower, a concept Dr. Shetty believed was extendable to other areas of health care. In nephrology, for instance, the requirement for trained nephrologists to operate dialysis machines was part of the reason that treatment was expensive. If India were to allow trained technicians to operate the machines (as was the case in the U.S.) or (as Dr. Shetty envisioned) offer a diploma in nephrology that would provide intermediate training, more doctors would be able to offer treatment to patients, thus lowering the cost of access to treatment.

Beyond training doctors, a separate department at the hospital coordinated the training of nurses. The 700 nurses at NH were required to complete a year of training, which included a minimum six-month period in a critical-care unit. As a result of intensive instruction, NH nurses were known across the state for their abilities and dedication; a writer to a Bangalore newspaper once likened each of them to Florence Nightingale. The downside to the excellent training, though, was the high turnover as skilled nurses sought better opportunities overseas. Ms. Rohini Paul, the director of nursing, said, "Although we pay the highest salaries [in Bangalore], we lose many of our nurses because the skills they learn here will earn them better pay abroad, but this does not worry us, since there are so many more nurses waiting to join."

In addition to training nurses to specialize in cardiac care, the college of nursing, which was housed within NH, offered degree and diploma courses for trainee nurses. To encourage students from poor remote areas, who would benefit most from these educational opportunities, NH arranged to guarantee bank loans to cover fees and living expenses. In return, the trainee nurses worked at the hospital during their course and for up to two years afterwards, thus supplying much-needed manpower.

The Insurance Scheme—Yeshasvini

The passion to serve the masses also drove Dr. Shetty to develop an insurance program called Yeshasvini. With an established name in Karnataka for his work in cardiac care, Dr. Shetty was approached by a milk cooperative for an endorsement of its product. As he learned about the membership of the cooperative and their demographic profile, however, it occurred to Dr. Shetty that this could be the opportunity he had been seeking to access a clustered and organized group of middle- to low-income people with poor access to health care.

Armed with this vision, the team at NH set up a health insurance scheme for 1.7 million farmers and their families in Karnataka. Yeshasvini was launched in 2002 for farmers belonging to various state cooperatives—all farmers who had been members of a cooperative for at least a year were eligible to participate, regardless of their medical histories. For Rs. 5 (US\$0.11) a month, cardholders had access to free treatment at 150 hospitals in 29 districts of the state for any medical procedure costing up to Rs. 100,000 (US\$2,200). (See **Exhibit 15** for a breakdown of procedures performed at NH alone under this scheme.)

Prior to the scheme, it was estimated that the average occupancy of hospitals in Karnataka was only 35%; although the state boasted 30 private medical colleges, each with over 500 beds, actual occupancy was low, reflecting the lack of affordability rather than a lack of infrastructure. While microinsurance schemes had existed in various forms in developing countries, the efforts were often unsystematic, resulting in little success. Recognizing this, Dr. Shetty chose to utilize the existing government infrastructure, in the form of the state-controlled cooperative societies of Karnataka. In particular, the principal secretary of the cooperative department (of the government of Karnataka), A. Ramaswamy, lent his support to the project and arranged for the involvement of the then-chief minister, S.M. Krishna. Yeshasvini was launched as a state program, with the government contributing Rs. 2.5 for every Rs. 5 paid by the farmers.

By collecting the insurance fees up front for a year, the Yeshasvini Trust (which was created to own the scheme) was able to minimize the initial need for funds. Research by the NH team estimated that only 8% of the policyholders would require medical procedures, thus the total funds collected were expected to cover the cost of treatment for those in need. In order to keep the up-front collection costs to a minimum, the state government made available its post offices to collect the Rs. 5 premium, track monthly payments, and issue a “Yeshasvini member card.” The initial task of getting the hospitals to participate and selling the idea to cooperatives was conducted by the trust, but the daily operations were later handled by a third-party administrator, which also coordinated payment to hospitals.

The first-year records of the scheme indicated that the majority of claims administered were not for cardiac treatment (the most common use of the scheme was for nonsurgical treatment). Hanuman Prasad, who worked with the insurance team at NH, pointed out Yeshasvini was mostly used for low-cost treatments (approximately Rs. 2,000) that people would otherwise have forsaken, since there was little money to spare to treat non-life threatening conditions (see **Exhibit 16** for the types of

procedures performed under this scheme). In its first year, nearly 9,000 people underwent various operations and a further 35,000 received outpatient treatment across the state. By early 2005, the scheme included a quarter of the cooperatives' 10 million members.

As in telemedicine, the insurance scheme relied on using government infrastructure, but most of the planning and implementation was contributed by the NH team. "People are more willing to trust government agencies," explained Prasad. "If we had started this as a private organization, there may have been less interest." Still, Dr. Shetty's and NH's reputation in the state helped garner support for the program, both among the farmers and the hospitals. In particular, the hospitals, which already had low utilization, could see the benefits of participating in a trustworthy scheme that would increase their patient flow without additional costs.

The success of Yeshasvini subsequently prompted Dr. Shetty and his team to consider new avenues for similar programs—for instance, plans were underway to administer an insurance scheme for teachers in Karnataka. Dr. Asha Naik, who was on the initial team for Yeshasvini, felt that the learning and publicity from Yeshasvini would make the second scheme easier to launch: "Since people have heard of Yeshasvini, there is greater awareness of the importance of health . . . of course, there are some things that we will do differently now. We need to use smart, digitalized cards to prevent fraud in using the scheme."

Spurred by this success, Dr. Shetty aspired to build on the insurance program to organize self-help groups in the state. One possibility was to have communities of 200 families living in a common area band together to increase their purchasing power. "We are using health care as the carrot," said Dr. Shetty. "We want to encourage them to come together to purchase medicine, but they should see that this is the same concept for other items. If 200 families want to buy television sets, they will have a higher bargaining power than each family buying it individually."

While Yeshasvini, the telemedicine program, and other outreach schemes (including the mobile cardiac unit) were funded by AHF, a nonprofit organization, Dr. Naik pointed out that the distinction between these programs and Narayana Hrudayalaya Pte Ltd. (the private company that ran the hospital) was merely technical. "We have different legal vehicles for the work we do, but everything is linked to Dr. Shetty, and it's all his ideas that we are implementing," she said. Certainly these programs, while appearing distinct, were all part of Dr. Shetty's dream to "cure the world's poor for less than a dollar a day," starting with the Indian state of Karnataka.

The Plan for Health City

Having built NH into a reputable and profitable hospital, Dr. Shetty was keen to extend the concept of affordable health care to other specialties, with NH serving as the "backbone" hospital. Dr. Shetty offered this rationale: "We have reached a plateau in cost reduction by increasing our volume of surgeries . . . the yearly increase in procedures is now small, but our resources are still underutilized—our machines, sterilization department, blood bank, etc. can be used by other hospitals within Health City, and this will drive unit costs even lower."

To this end, NH started noncardiac units, with the plan to house each specialty in new buildings being constructed in the 35 acres around the hospital. The neurosurgery unit was started in May 2004 with three surgeons and within 10 months had completed 320 operations. A 500-bed orthopedic and trauma hospital was expected to be ready by the end of 2005, while another building was being constructed to house the existing neurosurgery unit and a planned pediatric unit.

In addition, the Emami National Institute for Bone Marrow Transplant (named after the Emami Group of Companies of Calcutta, which fully funded the equipment) was started in 2004 as the state's largest bone marrow transplant unit. The unit was headed by Dr. Sharat Damodar, a hematologist trained in bone marrow transplant who was already working with the cardiac team at NH. Once again, Dr. Shetty managed to reduce the cost of bone marrow transplants from the national average of Rs. 1.2 million (US\$27,000) to Rs. 400,000 (US\$8,900), this time by leveraging the hospital's existing infrastructure. The blood bank, for instance, had previously discarded unused blood after 10 days (as it was unsuitable for cardiac surgery) but could now utilize blood for up to 26 days after collection in transplant procedures. In addition, the investigations performed for the bone marrow transplant utilized the existing equipment at NH, thus adding few fixed costs.

The plan, according to Dr. Shetty, was to build a total of 10 hospitals in a common area, with each hospital housing one or two specialties. The hospitals would be self-sufficient within each specialty (thus each building would have its own OTs, intensive care units, etc.) but would draw on common facilities such as blood banks and laboratories already established at NH. By employing specialists in each field who would be able to perform high volumes of surgeries and by leveraging the underutilized common facilities, Dr. Shetty expected to offer tertiary health care at below-average costs. For instance, the cost of brain surgery at NH was expected to be Rs. 45,000 (US\$1,000), while major spine surgery would cost Rs. 25,000 (US\$550) at NH, approximately half the cost at other Indian hospitals.

What Is Next?

Dr. Shetty explained:

If one were to evaluate our business as a strategy exercise, it is not unreasonable to view our three lines of business as somewhat different forays in health care. The first is our heart hospital and all the associated activities. Next is the Yeshasvini insurance scheme. Frankly, that does not consume much administrative or medical time—we simply came up with an idea and a means to organize its administration. We get some surgical referrals from the scheme, but that's not the mainstay. Then, of course, is our vision for the Health City with many specialties all within a geographical proximity, so we can utilize the common infrastructure, labs, supplies, transport, etc., to further bring down costs while improving quality for the masses of people who even lack basic care.

In response to the question as to which of the three he thought had the best chance of realizing his vision and passion, without a moment of hesitation, Dr. Shetty said, "All three, of course." There can be no doubt that Dr. Shetty and his team had revolutionized cardiac care at his hospital, but to what extent could he expand the Wal-Martization of health care beyond his area of specialization?

In addition, health-care solutions like NH raised the question of what drove its success and how this could be sustained. To what extent was this success the driving force of one man's vision and charisma, versus a fundamental change in the institutions underpinning Indian health care? Could this be adopted in other developing countries?

Exhibit 1 Circular Chapel at NH



Source: Narayana Hrudayalaya.

Exhibit 2 Pediatric Unit at NH



Source: Narayana Hrudayalaya.

Exhibit 3 Entrance Foyer of NH on a Typical Day



Source: Narayana Hrudayalaya.

Exhibit 4 Pricing of Procedures (all prices in Rs.)

Procedure	Break-even Cost at NH	Price (General Ward)	Price (Karuna Hrudaya Package)	Average Price at Indian Private Hospitals
OHS	90,000	110,000	65,000	250,000
Angioplasty	40,000	65,000	N/A	90,000
Angiogram	4,500	4,500	4,500	12,000

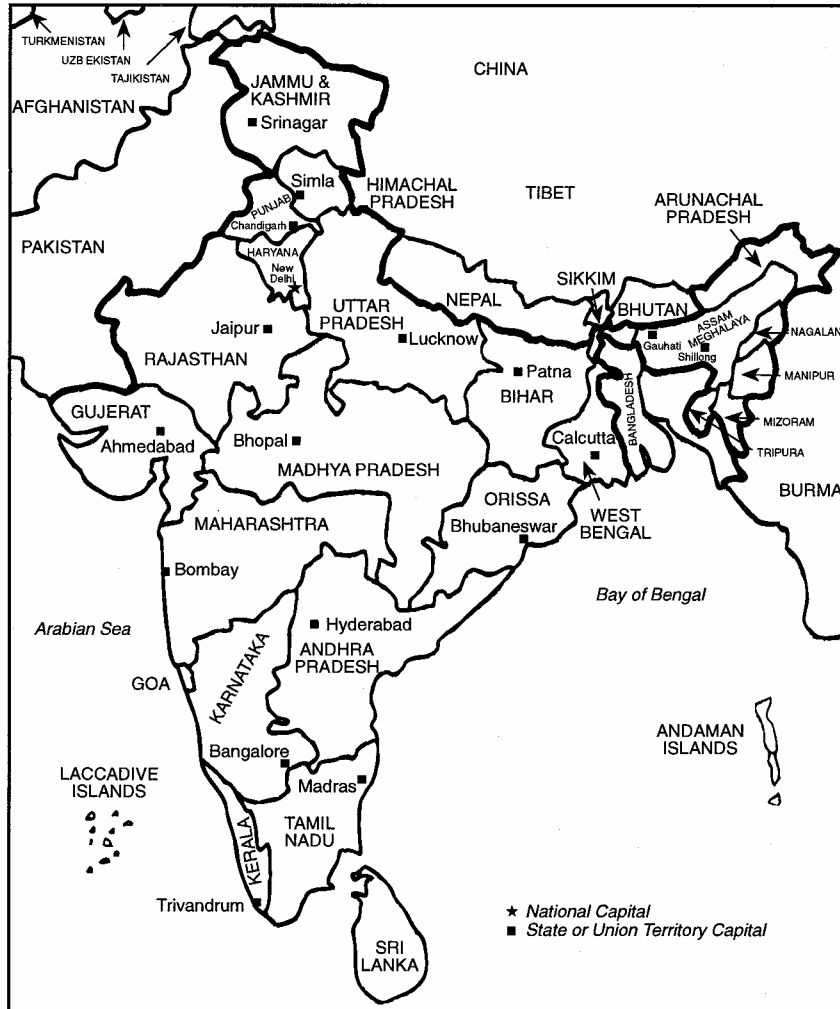
Source: Narayana Hrudayalaya.

Note: Angiogram is a non-surgical procedure to detect blockages in the coronary arteries.

Exhibit 5 One of the NH Teams in Surgery

Source: Narayana Hrudayalaya.

Exhibit 6 Map of India Showing Southern State of Karnataka and its Capital City, Bangalore



Source: Casewriter.

Exhibit 7 Comparative Health and Health-care Statistics

	India	Karnataka	U.S.	China
Population (million)	1,027	53	288.4	1,276
Life expectancy (years), 2002	64	64	77	71
Infant mortality rate (deaths per 1,000 births), 2002	67	55	7	31
Public health expenditure (% of GDP), 2001	0.9	0.7	6.2	2.0
Private health expenditure (% of GDP), 2001	4.2		7.7	3.4
Per capita health expenditure (PPP USD), 2001	80		4,887	224
Overall spending on health care as % of GDP, 2003	6.0		14.1	5.0
No. of physicians per 1,000 population	0.5	0.4	2.7	1.6
No. of hospital beds per 1,000 population	0.9	0.3	3.4	2.3
Population without access to improved water source (%), 2000	16			25
Children underweight for age (% under 5), 1995–2002	47			11

Source: *Medical Markets Fact Book 2004*, Human Development Report 2004, "Healthcare in Karnataka," Hinduonnet.com.

Exhibit 8 Volume of Procedures at NH

	Inpatients	Outpatients	Catheterization Lab Procedures	Surgeries
April 2001–March 2002	4,242	9,875	2,116	1,842
April 2002–March 2003	7,226	10,863	3,367	2,742
April 2003–March 2004	10,262	15,382	4,777	3,570
April 2004–May 2004	2,029	3,466	821	714

Source: Narayana Hrudayalaya.

Exhibit 9 Comparative CABG Volumes

	Cleveland Clinic (Ohio)	Mayo Clinic (Minneapolis)	Mass. General Hospital (Boston)	NH
No. of CABG surgeries a year	1,151	2,500 ^a	1,000	3,570
Average surgeries a day	3	7	3	10
Number of cardiac surgeons	11	9	9	18
Average surgeries per surgeon	105	278	111	198
Rank by <i>U.S. News & World Report</i> (2004) ^b	1	2	5	--

Source: Hospital websites, *U.S. News & World Report*, 2004.

^aOverestimated—Website gives figure for all cardiac surgeries.

^bRanking for "Heart and Heart Surgery."

Exhibit 10 Balance Sheet of NH Pte Ltd. (audited, for year ending March 31, 2004)

Particulars	FYE March 31, 2004 (‘000 Rs.)	FYE March 31, 2004 (‘000 US\$)
ASSETS		
Current Assets	146,042	3,244
Cash and Bank Balances	16,025	356
Sundry Debtors	31,854	708
Inventories—Stock of Medicines and Consumables	24,415	542
Loans and Advances	73,748	1,638
Non-Current Assets	241,534	5,369
Fixed Assets	404,800	8,997
Less: Depreciation	-163,291	-3,629
Deferred Expenditure	25	1
Total Assets	<u>387,576</u>	<u>8,613</u>
LIABILITIES		
Current Liabilities	118,946	2,643
Current Liabilities	117,114	2,603
Provisions for Income Tax	1,832	40
Non-Current Liabilities	210,178	4,671
Secured Loans	205,178	4,560
Unsecured Loans	5,000	111
EQUITY	58,452	1,299
Share Capital	2,500	56
Share Application Money Pending Allotment	62,289	1,384
Accumulated Losses	-6,337	-141
Total Liabilities and Equity	<u>387,576</u>	<u>8,613</u>

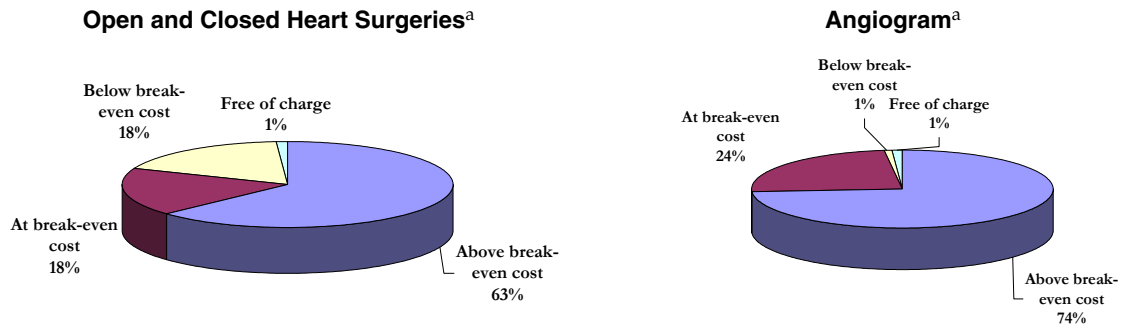
Source: Narayana Hrudayalaya.

Exhibit 11 Income Statement of NH Pte Ltd. (audited, for year ending March 31, 2004)

Particulars	FYE March 31, 2004 (‘000 Rs.)	FYE March 31, 2004 (‘000 US\$)
INCOME		
Income from Medical Services		
Income from Inpatients	529,660	11,770
Income from Outpatients	60,356	1,341
Donations	1,050	23
Other Income	<u>1,182</u>	<u>5</u>
	<u>592,248</u>	<u>13,161</u>
EXPENDITURE		
Operative Expenses		
Medicine and Consumables	253,278	5,628
Fees to Consultants	77,243	1,717
Other Operating Expenses	37,255	828
Maintenance Expenses	15,873	353
Payments to and Provisions for Employees	49,773	1,106
Administrative and Other Expenses	46,562	1,035
Financial Expenses	18,055	401
Preliminary Expenses Written off	12	0
Depreciation	<u>57,543</u>	<u>1,279</u>
	<u>555,596</u>	<u>12,347</u>
Net Profit before Tax	36,653	814
Provision for Taxation	1,236	27
Net Profit after Tax	35,416	787
Balance b/f from Previous Year	-41,754	-928
Profit(+)/Loss(-) carried forward to Balance Sheet	-6,337	-141

Source: Narayana Hrudayalaya.

Exhibit 12 Breakdown of Revenue Received for NH Procedures (for year ending March 2004)



Source: Narayana Hrudayalaya.

^aBreak-even cost for both surgeries is approximately Rs. 75,000 and for angiogram is approximately Rs. 4,500.

Exhibit 13 Picture of Telemedicine Facility at NH



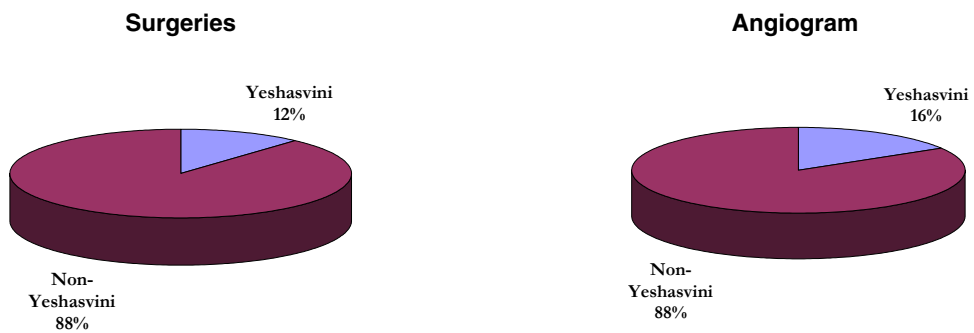
Source: Narayana Hrudayalaya.

Exhibit 14 Picture of One of the Buses Used for Outreach Camps



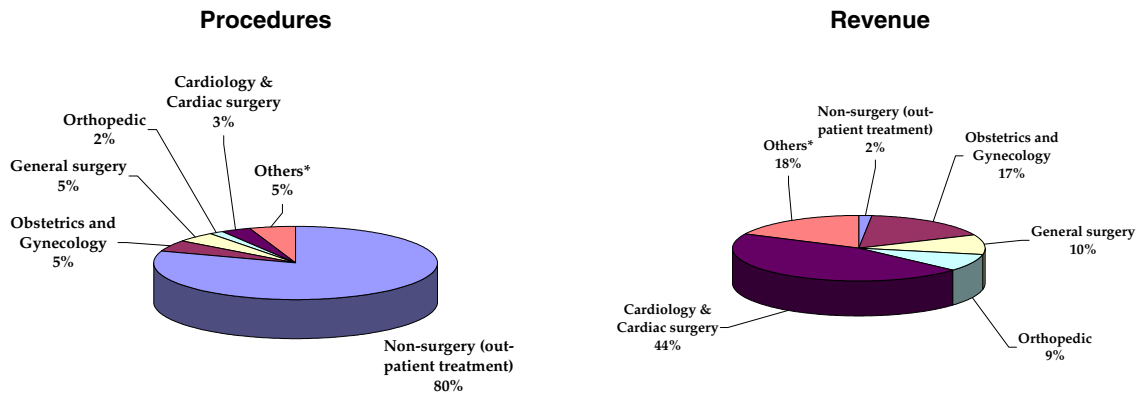
Source: Narayana Hrudayalaya.

Exhibit 15 Breakdown of Procedures at NH under Yeshasvini (June 2003–March 2004)



Source: Narayana Hrudayalaya.

Exhibit 16 Yeshasvini: Breakdown of Procedures and Revenue (June 2003–March 2004)



Source: Narayana Hrudayalaya.

*Others include gastroenterology, ear nose and throat (ENT), ophthalmology, neurology, urology, and thoracic surgery.