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As with the Aravind and Lifespring examples, the NHL model began with a sharp focus on delivery of a specialized target to bottom of pyramid users. In this case the founder and visionary was Devi Shetty who originally trained as a cardiologist and whose vision was to bring cardiac care within reach of this group. More than 2 million Indians need, but cannot afford, heart surgery; in 2011 heart disease overtook communicable diseases as the major cause of death and this has significant knock-on economic effects since family breadwinners are often the victims mainly affecting breadwinners. His first step was to establish a 150 bed hospital in Bengaluru in 2001 but this model has spread rapidly on the back of significant productivity gains. His NHL 'health city' complex now on the site is the world's largest and also the cheapest heart care institute. It includes the world's largest heart and cancer hospitals, a specialty hospital for all the plastic reconstructive surgery, an institute for organ transplant, a hospital and also training and research institutes.

The 1,000-bed heart facility provides high-quality yet very inexpensive heart surgery; in 2008 there were 3,174 cardiac bypass surgeries and 2,777 paediatric operations, more than twice the volumes achieved in leading specialized hospitals in the US. Their success rate is higher than that of their counterparts in New York State, and the mortality and hospital-acquired infection rates equal those of the best hospitals worldwide. The hospital reports a 7.7% port margin, higher than the average for US hospitals, but charges US\$3,000 or less per surgery, compared with US\$5,000-7,000 in private hospitals in India and up to US\$50,000 in the US. With further changes in processes, negotiations with suppliers and creative partnerships, NHL plans to reduce its costs even further.

Its significant improvements in productivity have come through systematic process innovation which has reduced the cost of a heart surgery to Rs 75,000 for a 3-4 day surgery and care. Large corporate hospital chains charge Rs 2.25 lakh or more for this. Similarly, because of scale in dialysis, prices are cheaper by 15-30 per cent.

Once again the underlying principles are simple and would be recognized by Henry Ford or Taichi Ohno of Toyota – economies of scale achieved through standardization and linked to continuous and systematic improvement over time. For example, the pediatric cardiac unit is the largest facility in the world with around 50-60 cases undergoing treatment at any one time - probably, the number of cases that other hospitals would handle in a year. Such scale drives significant economies in key items of procurement of equipment drugs, and other consumables as well as allowing for more efficient utilization of human resources. (For example, NHL is currently the largest customer for heart valves in the world).

Central to the model is policy deployment – focusing on a core goal – cost reduction without compromising quality – but then recognizing the myriad ways in which that can be delivered by mobilizing high involvement innovation (Bessant and Francis 1999; Bessant 2003). Examples include cutting the cost of items like sutures and gloves by nearly 50% through a combination of incremental innovation and negotiations of volume discounts with suppliers. Careful attention to value and

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utilization has brought a sharp focus to innovation in equipment utilization; for example air conditioning is only deployed in areas where it is required for medical reasons, such as in operating theatres. (This 'value stream mapping' approach is a core component of lean thinking methodology) (Hines, Cousins et al. 1999).

Another theme recognizable in the manufacturing world is that of using simple low cost machinery as opposed to complex multi-function devices which carry higher capital and maintenance costs. Existing equipment is also supported through careful maintenance to extend its lifetime using approaches drawn from the 'total productive maintenance' experience in manufacturing (Vaag 2001).

Land and buildings are major components of hospital costs but NHL have managed to reduce these by concentrating on out of town sites which are cheaper and by partnering with government who provide subsidies in return for NHL treating a proportion of patients (typically 5%) at no cost. Another strategy is to take over 'failed' investments – such as a hotel – and re-use the facility; the conversion cost is considerably lower than purpose-building.

Human resource policies are another key component; where necessary NHL makes use of skilled doctors but for a wide range of activities it employs nurses and other staff. By training and specializing them NHL builds capacity and flexibility into the system. However non-core activities such as security or cleaning are outsourced. Cost savings also come from changing the relationship with doctors who concentrate their efforts in NHL hospitals in return for a high but fixed salary – as opposed to consulting with several hospitals. This means they do not waste time travelling between patients but also builds experience and learning across established teams.

The scale of operation also allows for considerable learning effects; NHL carries out 10 times the volume of heart surgeries of other hospitals currently accounting for around 12% of all heart surgeries (90,000pa). With such high volumes surgeons at NHL become more experienced; NHL currently has the best success rate of any cardiac hospital in the world. Similar patterns can be seen in other areas; for example NHL performs the maximum number of dialyses by any hospital chain in India and the Mazumdar Shaw Cancer Centre does the most bone marrow transplants.

As with LifeSpring the standardization of the core model makes it relatively easy to replicate and scale and in a period of just over 10 years NHL has expanded its operations to 11 cities with 14 hospitals and 5000 beds. The NHL chain is now the 4<sup>th</sup> largest in India and offers care across a number of treatment areas beyond cardiology; NHL now offers care in orthopaedics, oncology, nephrology, neurology, eye care, dermatology and dental care. It has even moved into cosmetic treatment such as rhinoplasty, liposuction and breast reduction or augmentation.

Of particular relevance in NHL is the idea of system level thinking. It is not just the direct medical care but innovation in the much wider system which makes this such a powerful model. Examples include close links with pharmaceutical firms who work with NHL on clinical trials and with equipment makers, who not only offer lower prices in return for guaranteed volumes but are also experimenting with new business models. For example, NHL has been able to convince equipment vendors to install machines and accept returns on a pay-per-use model since volumes of use are so much higher than conventional

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hospitals.

It has also been very active in developing the wider health infrastructure in India, for example through involvement with micro-insurance for bottom of pyramid citizens.

Shetty pioneered the idea of the Yeshasvini medical insurance scheme which was originally targeted at the estimated 2.2 million farmers and peasants in the Karnataka region who were part of the Karnataka Milk Federation. (It has since been extended to a wider range of people across the region). Established in 2003, this scheme offers a comprehensive package covering surgery and associated out-patient care for an average cost of €2.2/year for adults and €1.2/year for children. Its viability is based on some simple principles; typically less than 0.8% of the population requires surgery and no-one willingly wants it; as a consequence fraud levels are very low.

As with the previous models the core goal of delivering low cost insurance is then supported by extensive innovation across the system to drive down costs through standardization of operating procedures, simplification of administration (for example, the farmer's co-operative is responsible for collecting payments, and the regional government allowed post offices to handle the issuing of membership cards) and improvements in resource utilization. The scheme concentrates on common types of surgery – 1650 varieties – and also offers outpatient consultation pre and post surgery. To deliver it mobilizes a network of around 400 hospitals with under-utilized operating theatres (utilisation rates in the region can be as low as 35%); around 30,000 operations and 85,000 consultations were carried out during the first two years of the scheme's operation.

A recent evaluation of the scheme by health economists concluded that *'the programme is found to have increased utilisation of health-care services, reduced out-of-pocket spending, and ensured better health and economic outcomes....'* (Aggarwal 2010) The scheme is self-funding although the government contributes a third of the 7.5 rupees premium.

NHL are also involved in hospital design since they are now a major customer for construction; in this way their influence on design-for-purpose can drive further economies and improvements in quality of service. NHL are also pioneering telemedicine approaches to extend the outreach and 'front-end' of the healthcare system. Through an extensive network of on-line consultations NHL can prepare for patients coming into its facilities and reduce in-house costs, duration of stay, etc. whilst enhancing the quality of care provided.

As with many social entrepreneurs there is a clear business vision – it is not simply a philanthropic charity or aid dependent system but a viable business model in which cross-subsidy takes place. Wealthier patients still receive cheaper care but the margin between actual delivery costs and selling price to them generates a surplus which can be used to help those least able to afford it. About 5 per cent of its patients (equivalent to 50-60 free surgeries/week) receive free treatment and an additional 27 per cent receive subsidized treatment.

NHL have already demonstrated the transferability of its standardized model; it can operate a 'drag and drop' approach and is now exploring moving beyond India with facilities in Malaysia. Of particular significance is another investment in the Cayman Islands where the aim is to tap into the neighbouring

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US market which is only an hour away. A 250-300 bed facility is being built which will cater for a growing segment of the population worried by spiraling US healthcare costs.

For more information see:

<http://www.narayanahospitals.com/>