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THE GLOBE

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India might be the last place on earth where you'd expect to find health care innovation. Government programs have finally brought some infectious diseases under control, but the nation's ability to meet the basic medical needs of its citizens remains abysmal. Despite robust economic growth over the past two decades, the infant mortality rate is three times higher than China's and seven times greater than that of the U.S. Of the 2 million Indians in need of heart surgery, fewer than 5% get it. The majority of the country's estimated 63 million diabetics and 2.5 million cancer sufferers haven't been diagnosed, let alone treated. Seventy percent of India's 12 million blind people could be cured by a simple surgery—if it were available to them.

Although India boasts 750,000 doctors and 1.1 million nurses, practitioner density is about one-fourth what it is in the U.S. and less than half that of China. Hospital beds are in short supply, and most medical facilities are dated, cramped, and often unhygienic. In a country where the nominal per capita income is only \$1,500 a year, patients typically have to pay 60% of health care expenses from their own pockets. Still, Indians believe that good medical treatment is something everyone should have access to regardless of their ability to pay.

Necessity spawns innovation. Despite the pressing demand and constrained supply, a few relatively new Indian hospitals have devised ways of providing world-class health care affordably—and to scale.

ABOVE A Narayana Health clinic in Mysore, India

PHOTOGRAPHY: GETTY IMAGES

These hospitals target well-off patients, which forces them to provide care that meets global quality standards. But their purpose is to serve everyone, including patients with very low incomes, which puts pressure on the organizations to lower costs dramatically. Such a business model scales because the low costs of these hospitals attract large volumes of patients and allow the overall enterprise to be profitable. As a result, the hospitals are able to sustain their operations not through the usual government subsidies, charitable donations, or insurance reimbursements but through their revenues. Aravind Eye Care System, for instance, has paid for all its expansion projects from its profits, even though two-thirds of its patients receive free or subsidized care. These extraordinary private Indian hospitals should serve, we believe, as an inspiration to those in other developing nations and as a wake-up call to hospitals in Europe and the United States.

In fact, America's health care system may soon find itself competing with one of India's innovators. Building on the success of India's medical tourism boom—a \$1 billion business that is growing by 30% a year—Narayana Health (NH) is opening a 2,000-bed multispecialty hospital in the Cayman Islands. A short hop from the American mainland, it will begin providing care in early 2014. Uninsured and underinsured patients will be able to receive high-quality treatment at an internationally accredited hospital for less than half of what they would pay in America. The proximity of NH's beachhead may well pressure U.S. hospitals to develop the innovative practices and systems that we describe in this article.

India's Hospital Exemplars

Two years ago, we kicked off a project to understand how some Indian hospitals are able to provide world-class health care at ultralow cost. We identified more than 40 hospitals with innovative strategies and selected nine of them for an in-depth study. Seven of the hospitals are for-profit and two, not-for-profit. Four focus on a single spe-

cialty, and the other five are multispecialty institutions. Seven of the exemplars operate as academic centers and integrate education and clinical research with health care delivery. We visited all the hospitals, gathered data, and conducted more than 100 interviews with the founding doctors, their leadership teams, physicians, staff, patients, and industry experts over several months.

The Indian hospitals we studied treat medical conditions that range from problems of the eye, heart, and kidney to maternity care, orthopedics, and cancer. Their

Innovation at Indian hospitals results not from a grand design but from constant experimentation, adaptation—and necessity.

charges for most procedures are as much as 95% lower than those at U.S. hospitals. That isn't because the Indian providers offer low-quality services; five of the exemplars are accredited by either Joint Commission International (JCI), the international arm of the Joint Commission—an independent nonprofit that certifies the quality of more than 20,000 health care organizations in the U.S.—or its Indian equivalent, the National Accreditation Board for Hospitals & Healthcare Providers, which uses standards similar to those of JCI. A sixth is seeking accreditation and a seventh has chosen not to do so for fear that the process could stifle experimentation and curtail innovation. The other two are not big enough to seek accreditation yet.

Some of these hospitals—for instance, the Apollo Hospitals Group's flagship in Hyderabad—have recorded equivalent or better outcomes than the international standards for medical complications associated with knee, coronary, and prostate surgery as well as for infections related to

the operating theater and catheters. NH's 30-day postsurgery mortality rate for coronary artery bypass procedures at its Bangalore hospital is below the average rate recorded by a sample of 143 hospitals in Texas. Similarly, the five-year survival rate for breast cancer patients at HCG Oncology is comparable to U.S. benchmarks. Decan's five-year survival rate for peritoneal dialysis patients is the same as that for patients in the U.S. undergoing hemodialysis, the more expensive treatment commonly used there. Rates of complications associated with eye surgery at Aravind compare favorably with those of the best hospitals in the UK's National Health Service.

How are some Indian hospitals able to provide such high-quality health care at ultralow prices? The obvious answer—the differential in the cost of labor—does play a role: Cardiothoracic surgeons, nephrologists, ophthalmologists, and oncologists in India earn anywhere from 20% to 74% of what their American counterparts do. For instance, Aravind's ophthalmologists earn \$50,000 annually compared with the \$253,000 average for U.S. ophthalmologists. NH's cardiothoracic surgeons gross between \$150,000 and \$300,000, whereas the median income for their U.S. counterparts is \$408,000. And the salaries of nurses, medical staff, and administrators in India are dramatically lower; some earn only 2% to 5% of what a U.S. hospital would pay.

But the labor cost differential is just a small part of the story. We calculated the price of an open-heart surgery at NH after adjusting the salaries of NH's doctors and other staff to match U.S. levels. Even with the higher wages factored in, the cost was still only 4% to 18% of a comparable procedure in a U.S. hospital (see the exhibit "Salaries Are Only Part of the Equation").

Moreover, other costs in India are higher than in the United States. Equipment, such as MRI machines, and supplies, such as stents, are more expensive, and so are the costs of capital and urban land. As a result, NH's 21-point labor cost advantage relative to the Cleveland Clinic, for example, is mostly offset by a 17-point disadvantage

Indian Hospitals' Ultralow Costs



in NH's cost of supplies, pharmaceuticals, and other direct expenses.

To deliver on their dual commitments to high quality and ultralow cost, the Indian hospitals we looked at developed three powerful organizational advantages: a hub-and-spoke configuration of assets, an innovative way of determining who should do what, and a focus on cost-effectiveness rather than just cost cutting. Those process innovations allow the hospitals to lower their costs without compromising quality; in fact, the first two lower costs while simultaneously *improving* quality. The innovations result not from a grand design but from constant experimentation, learning, adaptation—and necessity.

Let's look at the process innovations in turn.

A Hub-and-Spoke Configuration of Assets

Most of the hospitals in our study started by establishing urban hubs in which they concentrate high-quality talent and sophisticated equipment. Spoke facilities are then arrayed around the hubs to reach underserved patients in far-flung towns and villages. Unlike suburban outposts of urban hospitals in the West, the spokes aren't miniature hubs but rather gateways. In the U.S., most hospitals invest in duplicate equipment and offer a full range of services in their suburban facilities, but they're unable to get much out of those investments in remote locations. Even when Western hospitals consolidate, their aim is to gain market power rather than to lower costs.

In India, the spoke facilities focus mainly on diagnosis, routine treatment, and follow-up care; they channel patients to the hubs for sophisticated procedures and surgery. HCG, for instance, has 17 spoke hospitals arrayed around four urban hubs in Ahmedabad, Mumbai, Chennai, and Bangalore. Its specialists work in the hubs and have access to high-end equipment such as PET-CT scanners, cyclotrons, and linear accelerators, while at the spoke facilities, less specialized doctors provide care using less sophisticated equipment. The

Cancer Treatment

\$2,900

HCG ONCOLOGY

\$22,000

U.S. AVERAGE

SOURCE HCG; COSTS ARE FOR A FULL SET OF INTENSITY-MODULATED RADIATION TREATMENTS

Kidney Dialysis

\$12,000

DECCAN HOSPITAL

\$66,750

U.S. AVERAGE

SOURCE DECCAN HOSPITAL AND U.S. RENAL DATA SYSTEM, 2012 ANNUAL REPORT; DECCAN AND U.S. COSTS ARE FOR PERITONEAL DIALYSIS PER PATIENT PER YEAR

most highly trained oncologists, pathologists, and other physicians work in HCG's center of excellence, a sort of super-hub, in Bangalore. The center houses equipment—such as an \$8 million high-precision, robotic radiosurgery system called the CyberKnife—that HCG can't afford to duplicate even in its other urban hubs.

The hub-and-spoke approach is facilitated by the use of technology—such as telemedicine, which enables the remote delivery of health care over the phone—allowing doctors in the hubs to effectively and efficiently serve patients seeking care at the spokes. Physicians can, for instance, read medical images remotely and discuss the findings with their patients. Unless expensive equipment, complex tests, or consultations with super-specialists are required, patients receive care closer to their homes. That lowers the costs—such as lost wages during time away from work, transportation expenses, and room and board—that often deter poor people from seeking health care even when it is free.

A hub-and-spoke architecture also helps create large volumes. By reducing the barriers to treatment, NH now carries out more open-heart surgeries and Aravind does more eye surgeries than any other hospitals in the world. In turn, this has increased physician productivity: At NH, each surgeon performs from 400 to 600 procedures a year, compared with 100 to 200 by U.S. surgeons. Similarly, Aravind doctors each perform from 1,000 to 1,400 eye surgeries a year, compared with an average of 400 by doctors in the United States.

As volume rises, doctors, equipment, and facilities are used more efficiently and costs fall. A U.S. hospital might use a PET-CT scanner to evaluate three to five patients a day; HCG conducts up to 20 scans a day. Several Indian exemplars run their MRI machines 24/7, sometimes charging lower prices at night when the machines would normally be idle, as an incentive to patients to get scans done at inconvenient times. Higher volumes also allow these hospitals to reap economies of scale in purchasing medicines, supplies, and medical equipment.

The hub-and-spoke configuration allows hospitals not only to lower costs but also to improve quality. It does that by:

Attracting and retaining doctors seeking to improve their skills rapidly.

The high volume and sheer variety of cases attract talent to these hospitals; doctors can build their capabilities faster in them. All seven of the academic hospitals we studied recruit many of their doctors from among their students. The caliber of the recruits, in turn, contributes to the high quality of outcomes at these hospitals.

Developing and continually updating treatment protocols that reduce errors.

Unlike many U.S. hospitals, the Indian health care providers have developed protocols for even relatively complex procedures, such as knee and hip replacements and cardiac and cancer surgery. For instance, at CARE Hospitals, angioplasty patients are assigned to one of three risk classes on the basis of objective criteria such as age, weight, medical history, and

lifestyle, and a different protocol is followed for each, taking extra precautions for high-risk patients. (U.S. hospitals don't always develop or follow such protocols, which is one reason Atul Gawande, an American surgeon and journalist, wrote *The Checklist Manifesto*.) The results are impressive: Whereas data suggest that one in 200 angioplasty patients in the U.S. will require emergency surgery and half of those patients will die, only two out of 40,000 angioplasty patients at CARE Hospitals have required emergency surgery and just one has died on the operating table since the hospital's inception in 1997.

Creating specialists in relatively rare subspecialties of medicine. The large number of patients that come for treatment enables hub doctors to focus on specific types of medical problems. As volumes increase, relatively rare conditions are treated often enough that doctors become world-class experts in those areas. That's how NH has become a global leader in pediatric open-heart surgery, attracting patients from across Asia and Africa. High volumes have allowed Apollo to become a leader in organ transplant surgeries and made L V Prasad Eye Institute (LVPEI) a top provider in corneal transplants.

Promoting innovation that suits local conditions. Doctors in India pioneered the beating-heart method of surgery, by which they can operate without shutting patients' hearts down. This technique enables surgeons to perform the procedure without expensive heart-lung machines, which are rare in a developing economy. The method also leads to fewer complications, requires shorter hospital stays (which results in a lower incidence of hospital-related infections), and allows patients to recover faster. High patient volumes have allowed Indian doctors to master the technique over time.

Examples abound of innovations sparked by the need to overcome constraints in emerging markets. Aravind has perfected the manual small-incision cataract surgery technique. It requires less sophisticated equipment and less seasoned

Indian Hospitals' High Quality



SURVIVAL RATES

Breast Cancer

86.9%

HCG ONCOLOGY

89.2%

U.S. AVERAGE

SOURCE HCG AND SEER DATABASE
5-YEAR SURVIVAL RATE FOR BREAST CANCER,
STAGES 1-3 COMBINED

SURVIVAL RATES

Renal Disease

50%

DECCAN HOSPITAL

41%

U.S. AVERAGE

SOURCE DECCAN AND U.S. RENAL DATA SYSTEM,
2012 ANNUAL REPORT; 5-YEAR SURVIVAL RATE FOR
END-STAGE RENAL DISEASE PATIENTS UNDERGOING
PERITONEAL DIALYSIS

surgeons and uses cheaper lenses than the phacoemulsification technique favored by U.S. hospitals. CARE Hospitals and other Indian providers typically perform angioplasties by going in through the wrist (rather than the groin, which takes more time to heal), allowing them to discharge patients the same day. Deccan Hospital uses peritoneal dialysis, a home-based treatment for patients with chronic kidney disease that is substantially cheaper than hospital-based hemodialysis, the more common treatment in the United States. And LVPEI has developed technology that allows a single cornea to be sliced and used for more than one transplant patient.

Rethinking Who Does What

By shifting tasks, the best Indian hospitals match the skill levels of their people with the basic requirements of tasks. Assigning doctors to tasks that nurses can do, for instance, not only raises costs but may also reduce quality; doctors are often less proficient at routine tasks than are nurses.

Indian hospitals have taken task-shifting to a new level by creating fresh categories of low-cost health care workers at one end of the spectrum and highly focused specialists at the other. Unable to lure trained personnel to rural villages, for example, LVPEI has hired and trained high-school graduates as "vision technicians" in its spoke facilities, where they take over some of the functions of optometrists. Similarly, Aravind has trained village girls to become ophthalmic paramedics; they constitute 64% of Aravind's workforce and perform tasks such as admitting patients, maintaining medical records, and assisting doctors.

At the high-skills end of the spectrum, NH encourages general physicians to become specialists, and specialists to become super-specialists. It trains nurses to advance to the higher-skilled position of nurse intensivist, akin to a nurse practitioner in the United States. Similarly, HCG has developed a cadre of nurses to assist oncologists and intensivists, and LVPEI's vision technicians have the option of enrolling at its optometry school to become optometrists.

The exemplar hospitals maximize their efficiency by increasing the number of staff supporting their most skilled surgeons and specialists, radically extending their reach. Each Aravind surgeon, for example, has help from six paramedics in the clinical domain and four assistants for administrative and support services. Paramedics go to a village, screen patients, transport them to the spoke hospital, check their vitals, get tests performed, prepare patients for surgery, deliver postsurgical care in the ward, transport them back to the village, and provide follow-up care. The surgeon performs only the actual procedure. To cut costs, U.S. hospitals often eliminate low-skill staff jobs, which forces doctors to spend more time on routine tasks—resulting in the wrong kind of task shifting.

Another way of increasing surgeons' productivity is to decrease the amount of time it takes to move one patient out of the operating theater and bring in the next one. That is the key factor limiting efficiency and a key driver of costs, according to a

SALARIES ARE ONLY PART OF THE EQUATION

Lower wages in India contribute to the lower health care costs there—but not as much as you might think.

global study of performance benchmarks in knee-replacement surgeries. Eric Wadsworth, the coleader of Dartmouth's health care delivery science program, concurs. "Instead of looking at when patients are wheeled into and out of surgery, hospitals should look at the interval between when one patient is wheeled out and the next is wheeled in."

Aravind tackles the challenge in cataract surgery by setting up two surgical stations side by side, with the surgeon positioned between them, assisted by a swiveling microscope and two pairs of paramedics. For each patient, one nursing paramedic hands the doctor sterile instruments and the right implants, focuses the microscope, and bandages the patient. The other paramedic—called a running nurse—replaces used surgical instruments with sterilized ones and moves the patient into and out of the operating theater. Switching smoothly from one patient to another, Aravind's doctors briskly perform operations in 10- to 12-minute intervals, completing five or six in an hour rather than the one or two that a surgeon can handle in a conventional operating suite assisted by a single nurse.

An extreme form of task shifting is self-service, where patients and family members take over tasks traditionally performed by hospital staff. At the NH hospital in Mysore, for instance, family members provide non-ICU postoperative care. As with other kinds of task shifting, success depends in large part on proper training. Working with Stanford University, NH has developed a four-hour audio and video curriculum that explains how to care for patients during the three days following heart surgery. Allowing family members to provide those services reduces costs, allows for personalized care, and ensures continuity of care at home, reducing post-surgical complications.

Asserting Frugality

Maximizing the volume of procedures performed is obviously not the goal of any hospital, but many aspects of the current U.S. system—especially approaches such

Narayana Health reports that the cost of open-heart surgery is

\$3,160

one-third of which goes to salaries.

TOTAL SURGERY SALARIES

\$1,054

PLUS OTHER COSTS

\$2,106

Salary costs are split evenly between doctors and other staff. Assuming that U.S. doctors are paid twice as much as their Indian counterparts, on average, and other staff 20 times as much, here's the salary cost at U.S. levels:

SALARIES AT U.S. LEVELS

DOCTORS' WAGES

\$527 x 2

+

STAFF WAGES

\$527 x 20

TOTAL SALARIES AT U.S. LEVELS

\$11,594

So what is the total cost of the surgery when salaries are comparable to those in the United States?

NARAYANA HEALTH'S TOTAL COST OF SURGERY AT U.S. LEVELS

SALARIES AT U.S. LEVELS

\$11,594

+

OTHER COSTS

\$2,106

TOTAL COST OF OPEN-HEART SURGERY

\$13,700

WHICH IS STILL LESS THAN THE TOTAL COST OF OPEN-HEART SURGERY IN THE U.S.

\$75,662–

\$342,087

(RANGE IN TEXAS, 2010 DATA)

as fee-for-service payment models—create incentives for health care providers to move in that direction. In the hospitals we studied in India, the goal is to maximize the number of patients treated rather than the number of procedures conducted. To achieve that goal, those hospitals must embrace a mind-set of old-fashioned frugality, applied in ways both innovative and remarkably mundane. Cost cutting is an ongoing priority, even among doctors.

Among the hospitals' most straightforward cost-cutting measures are efforts to prolong the working life of expensive technology through careful maintenance and repair. To that end, NH has contracted with a U.S. maintenance company, TriMedx, to help double the life of diagnostic equipment. Some hospitals routinely reuse medical devices sold as single-use products—such as \$160 steel clamps employed during beating-heart surgeries, which CARE Hospitals and NH sterilize and reuse 50 to 80 times. "If no hospital in the world throws away their needle holders, forceps, and scissors, which are drenched in blood after every operation, why throw out the

clamps?" asks Devi Shetty, NH's founder-chairman. In fact, JCI allows accredited hospitals to reuse devices as long as they adhere to its strict sterilization procedures.

Indian hospitals economize on decorating lobbies, wards, patient rooms, hallways, and offices. Senior managers often share small offices, freeing space for mission-critical areas such as operating theaters. Several hospitals lease rather than buy land and buildings; both are quite expensive in India. Some choose not to purchase expensive diagnostic equipment but rather strike pay-per-use deals with equipment providers, as NH has done for more than one of its hospitals. Suppliers such as GE, Philips, and Siemens are happy to offer such arrangements because the volume of patients is huge.

The hospitals we studied think carefully about matching the sophistication of equipment to the task. LifeSpring orders smaller and simpler beds for its maternity wards but does not skimp on the delivery tables for operating rooms in its 12 hospitals in Hyderabad. Vaatsalya has opted for lower-resolution, black-and-white ultra-

sounds and three-parameter patient monitors, where appropriate, instead of five-parameter monitors in its 18 hospitals in Karnataka and Andhra Pradesh.

To reduce waste, Apollo Hospitals asked suppliers to shorten the length of sutures in each packet—and to lower the price accordingly—after it found that its doctors were routinely discarding one-third of each suture after procedures. Some health care providers have gone further by coming up with less costly substitutes for supplies or equipment. CARE Hospitals, for instance, has developed stents priced from \$240 to \$360 apiece that perform as well as imports that cost 10 times as much. It has set up a subsidiary to manufacture the stents, along with catheters and other devices. Aravind has signed a technology-transfer agreement with the Florida-based IOL International and set up a company in southern India, AuroLab, to manufacture intraocular lenses. When the lenses debuted in the U.S., they sold for \$200 each. By the mid-1990s, AuroLab was turning out lenses for \$5 apiece, and the price had dropped to \$2 a unit by 2013.

The focus on costs applies to physicians' wages as well. The exemplar hospitals pay doctors a fixed salary, offering no bonuses or other incentives for internal referrals for tests or procedures—an approach much discussed by health care thinkers in developed countries but usually not implemented because of fee-for-service incentives. The best Indian hospitals offer fixed prices for a package of common medical treatments rather than pricing for individual procedures or tests. The fixed-price model discourages doctors from ordering unnecessary procedures, while protocols ensure that essential procedures aren't skipped.

The hospitals we studied infuse cost awareness across the organization in many ways. At NH, all doctors receive a daily text message with the previous day's P&L data. The practice induces doctors to be prudent; they can see how their decisions about which medicines, supplies, or tests to use affect the cost of treating patients. It also motivates them to suggest ideas for cost savings and process improvements. NH's

Apollo Hospitals asked suppliers to shorten the length of sutures—and to lower the price—after it found that its doctors routinely discarded one-third of each suture.

doctors get comparative performance data for their own hospital and 21 others in the group, which encourages them to share best practices. In contrast, most U.S. hospitals lack an understanding of their costs: Few CFOs, let alone doctors, seem to know the real cost of delivering services.

Lessons for U.S. Hospitals


Just how transferable is the Indian model to the developed world? Barriers certainly exist, among them regulations, fee-for-service incentives, pharmaceutical lobbies, trade unions, medical malpractice lawsuits, and investments in extensive hospital infrastructure. However, the hurdles may be lower than many suppose. U.S. hospitals, for example, treat higher volumes of cardiac, kidney, and cancer patients than their Indian counterparts do, suggesting that opportunities exist to reap learning-curve benefits and economies of scale. Salary differences, large as they are, aren't insurmountable since they constitute only a small part of the cost differential.


Innovation has flourished in the U.S. in the development of new medications, procedures, devices, and medical equipment—but in the field of health care delivery, there has been too little progress. Health care is still viewed as a craft, especially by doctors who guard their right to make autonomous decisions and view each patient as unique.

Some of the practices we have described are being implemented by progressive U.S. hospitals. California-based CareMore, for instance, engages in task shifting, having created a category of health worker known as extensivists, who coordinate care for Medicare patients, producing better outcomes at a lower cost. Iora Health clinics in Las Vegas and Brooklyn employ former schoolteachers and athletic trainers to help

patients make behavioral changes, freeing physicians to focus on diagnosis and treatment. Boston-based Steward Health Care uses a tele-ICU system to provide efficient intensive care across its 10 hospitals. The Vermont Department of Health is implementing a hub-and-spoke arrangement to treat people with opioid addiction.

In the coming decade, U.S. hospitals will be under even more pressure to lower costs, improve quality, and expand access—the very things the Indian hospitals we studied have been tackling. Demand will surge as aging baby boomers are joined by the millions of patients who will be covered by the Affordable Care Act in 2014. U.S. hospitals should use the swelling demand to get more out of the investments they've made—by reconfiguring assets, shifting tasks, promoting innovation, and cultivating frugality. Such moves don't require changes in legislation; only a commitment to reverse the inexorable rise in costs.

INDIAN HOSPITALS, doctors, and administrators have traditionally looked to the West for advances in medical knowledge, but it's time the West looked to India for innovations in health care delivery. Changes in the U.S. health care system will not come easily or quickly. However, the U.S. health care system could operate very differently if it were exposed to the kind of low-cost innovation that drives the best Indian hospitals.  **HBR Reprint R1311K**

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