

innovations

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Sharing the Health

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commentaries by Lawrence Summers; William Foege; Laurie Garrett; and
Matthew Basilio & Connie Chen

Cases Authored by Innovators

The Aravind Eye Care System: Making Sight Affordable
V. Kasturi Rangan and R.D. Thulasiraj
commentaries by Larry Brilliant and Girija Brilliant; Geoffrey Tabin

*Institute for OneWorld Health: Seeking a Cure for Inequity
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Organization of the Journal

Each issue of *Innovations* consists of five sections:

1. **Invited essay.** An authoritative figure addresses an issue relating to innovation, emphasizing interactions between technology and governance in a global context.
2. **Cases authored by innovators.** Case narratives of innovations are authored either by, or in collaboration with, the innovators themselves. Each includes discussion of motivations, challenges, strategies, outcomes, and unintended consequences. Following each case narrative, we present commentary by an academic discussant. The discussant highlights the aspects of the innovation that are analytically most interesting, have the most significant implications for policy, and/or best illustrate reciprocal relationships between technology and governance.
3. **Analysis.** Accessible, policy-relevant research articles emphasize links between practice and policy—alternately, micro and macro scales of analysis. The development of meaningful indicators of the impact of innovations is an area of editorial emphasis.
4. **Perspectives on policy.** Analyses of innovations by large scale public actors—national governments and transnational organizations—address both success and failure of policy, informed by both empirical evidence and the experience of policy innovators. The development of improved modes of governance to facilitate and support innovations is an area of editorial focus.
5. **Letters.** Readers comment on essays and papers published in previous issues.

The Cataract Blindness Challenge

Innovations Case Discussion: Aravind Eye Care System

The first Champilimaud Award for the “contribution to vision in the developing world,” accompanied by a prize of Euro 1 million, was given in 2007 to the Aravind Eye Hospitals in Tamil Nadu, India. They could not have made a better choice. Aravind Eye Hospitals are the highest volume cataract surgery facility in the world. Their five hospitals examined over 2.3 million people and performed over 270,000 surgeries in 2006. Aravind is not only the highest volume cataract surgery system in the world but also a trendsetter that has lifted the quality of cataract surgery in India and set a new paradigm for delivering high volume, high-quality surgery to the poor in a self sustaining manner. The founding genius was a spiritual guru for all who now work in international eye care.

Dr. Govindappa Venkataswamy, affectionately known by family and friends as “Dr. V,” passed away at age 87 in July 2006. He was born in 1918 in a poor farming village. There was no school in his village. After tending the water buffalo in the mornings, he would walk more than three miles to school every day. When a school finally came to his community, there were no writing materials and the students learned to write with sticks in the sand on the floor of their thatched roofed schoolroom. Despite these obstacles, the brilliant young Venkataswamy earned a scholarship to Stanley Medical College in Madras. Because of three cousins who died during childbirth, he chose to specialize in obstetrics.

In his final year of training Dr. V was stricken with a severe form of rheumatoid arthritis. The young Venkataswamy was hospitalized for nearly two years. Agonized by constant, severe, physical pain he watched helplessly as his fingers twisted and deformed to the point where he knew he would be unable to work as an obstetrician, delivering babies. He sought spiritual solace through the philoso-

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pher Sri Aurobindo at his ashram in Pondicherry. His meditation led him to a new direction, a quest to “not aspire to some heaven, but to make every day life divine.” He found his new purpose in ophthalmology. He taught himself new techniques to perform delicate eye surgery and designed special instruments to fit and work with his crippled hands. After completing his ophthalmology residency, he entered government service.

In 1976, at age 57, Dr. V was forced to retire from his job as a government service ophthalmologist. Two years earlier, he had visited America and dined at a McDonalds. He became obsessed with how McDonalds was able to deliver millions of hamburgers with the same excellent quality, quickly and efficiently, to every customer. He decided that he should be able to deliver a consistent product of excellent cataract surgery, quickly and efficiently, to all the poor blind people in need in India. Thin and wiry, barely five feet six inches tall, with graying hair and his frail body obviously twisted by arthritis, Dr. V still radiated a quiet, gentle confidence that rallied the talents of family members and colleagues. Less than a year out of retirement he opened the first Aravind hospital, named for Auribindo, a twelve-bed eye hospital in his brother’s home in Madurai. He set about to bring McDonalds efficiency and consistency to cataract surgery delivery. The history of the Aravind System is well chronicled in the accompanying article. One of the keys to their success was delivering a reliable product. Dr. V developed an assembly line method of serving up sight restoring cataract surgery.

Eye care is one of the greatest public health challenges for the twenty-first century. Fifty million people in our world suffer in needless darkness. The vast majority will remain blind until they die. Ninety percent of this blindness could have been easily prevented or treated. Half are from treatable cataracts where inexpensive surgery can restore perfect sight. Several studies have shown that sight restoration with cataract surgery is among the most cost-effective interventions in health care. Preventing visual loss from other major blinding diseases—trachoma, onchocerciasis, and vitamin A deficiency—ranks with childhood vaccinations as among the most efficacious prophylactic treatments. Although the numbers are daunting, eliminating blindness from our world is a realistic goal. The World Health Association and International Association to Prevent Blindness have set a goal for overcoming needless sight loss by the year 2020.

Despite advances in other areas, the number of people blinded by cataracts continues to increase. The number of cataract surgeries performed on people with mild visual impairment is increasing every year. However, the number of people rendered completely blind continues to grow. If we continue to operate at our current rate, with increasing life expectancy, the number of people blinded by cataracts will double by 2020.

Advances in health care technology over the past century have led to marked improvements in the treatment of many conditions. Ophthalmology, in particular, has seen fantastic advancements that have led to improved outcomes for a wide variety of maladies. From laser treatment of retinal disease, to ultrasonic microincisional cataract surgery, the quality of modern eye care has increased dramatical-

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ly each year. However, these new technologies have also led to a steady rise in health care costs. In the developed world cataract surgery in particular has become ever more sophisticated and refined and ever more expensive. With increased public awareness that most people see well, and resume full activity soon after modern, state-of-the-art cataract surgery, patients in the Western world now come for cataract surgery as soon as they experience mild blurring. Ultrasonic phacoemulsification cataract removal with the placement of a posterior chamber intraocular lens implant has become the most frequent operative procedure performed in America with an annual cost to Medicare of 3.5 billion dollars.

The main thrust of research in cataract surgery has been on creating incrementally better outcomes through ever more sophisticated and expensive techniques. As the technology continues to improve, the costs continue to rise. Many of the best doctors in the developing world want to emulate the methods performed by their colleagues in the West. The middle and upper classes of even the least developed nations demand, and are willing to pay for, what they perceive to be the latest and greatest surgical methods. Meanwhile the barriers to cataract care for the majority of the world's poor are becoming ever more daunting

Despite the incredible success and improvements in cataract management in the developed world, most people who are blind from treatable cataracts are being left behind and will die before they ever see a doctor. Moreover, if we apply the same standards for when a patient is considered ready for surgery that we use in the United States to the destitute of the world, then the number waiting for cataract surgery is staggering. If we decide to operate when a person has difficulty working at a job demanding reasonable vision, the number of poor people requiring surgery is well over 100 million! The gap between those who are totally blind and need surgery to survive, but are unable to attain it, and the wealthy of the world who receive expensive surgery for mild visual problems, continues to widen.

There are several reasons why the poor are unable to obtain care. There are economic, social, and environmental barriers that must be overcome and addressed when designing a public health cataract intervention program. First and foremost is providing top quality surgery. The greatest requirement in having poor patients come for surgery is to provide them with superb visual restoration. Even the poorest of the poor recognize quality. When a neighbor or a friend has high-quality surgery it leads to other people seeking care. If the surgical outcome is bad, then patients will not come. Next there needs to be excellent management of human resources to maintain the high quality while delivering care with maximum efficiency in a cost-effective manner. Use of human resources and the training of ophthalmic assistants, technicians, nurses, and lay helpers can increase public awareness and accessibility for all people. Finally, strategies must be implemented for cost recovery to allow the highest quality of care to be delivered to the poor in a sustaining fashion. With a small charge to those patients who can pay, and an enormous volume of surgery, free care can be provided for the destitute. High-quality care, training, education for the patients, and cost recovery from patients

who can afford care all combine to make the Aravind Hospitals the leader in cataract care to the poor in India.

The Aravind approach has been called compassionate capitalism. Not only do they provide excellent free care but they have solved the issue of sustainability. At the core of their success was developing “Aurolab,” which manufactures and distributes needed pharmaceuticals, disposables, and most importantly lens implants for cataract surgery. With Aurolab-produced products and an efficient system, Aravind has brought the cost of a single sight restoring cataract surgery to under

10 dollars per surgery. Then with an enormous volume, the 30 percent of the patients who can pay not only subsidize the free care for the remaining 70 percent of patients but also allow the hospital to expand and remain state of the art.

The lens of the eye is similar to a peanut M&M’s candy. It has an outer shell called a capsule surrounding a hard peanut, the lens nucleus, that is encased in a soft cortex of protein. With a cataract, the normally clear crystalline proteins in the nucleus and cortex become opaque. Early cataract surgery involved slicing the eye almost in half, removing the

entire lens complex, and then giving thick, “Coke bottle” aphakic glasses to help focus light. In the best of hands, the results were moderate and visual recovery slow because of high astigmatism induced by the large wound and distortions of the image seen through the thick glasses. A major advance occurred when a British Surgeon, Harold Ridley, noted that a Royal Airforce pilot from World War Two had a small chip of windshield in his eye for more than twenty years without causing inflammation or damage. He postulated that he could make a replacement for the natural lens of the eye from the material of the windshield. This revolutionized cataract surgery.

Sir Harold Ridley’s idea has led to the great advances in cataract surgery. Ophthalmologists now make a tiny self-sealing incision in the eye and a circular opening in the capsule (candy shell). The nucleus and cortex are removed and a replacement lens with the power calculated to give the patient excellent vision is placed back in the capsule in its normal anatomic position, restoring natural vision. Unfortunately, the cost of the replacement lens implants manufactured in the developed world was prohibitive—well over a hundred dollars for the least expensive brands. In order to provide cost-effective care, Dr. V. realized that the cost of the intraocular lens implant used to restore best quality vision after cataract surgery had to be reduced. In conjunction with Aravind, he began Aurolab which

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manufactured high-quality lenses for 5 dollars in Madurai. Aurolab then expanded to produce excellent low cost sutures for eye surgery, pharmaceuticals, and disposables for surgery. They now sell full surgery packs with everything needed for one cataract surgery for 10 dollars. Again, with an enormous volume and a high-quality product Aravind's compassionate capitalism has allowed care to extend beyond their own bases in Tamil Nadu.

Doctors, nurses, and ophthalmic assistants from all over the world now come to Aravind for training. Meanwhile they have developed a great local network of outreach vision centers to screen patients. They perform outreach eye camps in the poorest areas of Tamil Nadu and bus patients who are blind to Aravind for their surgery. A combination of trained patient and family counselors, and attention to details such as feeding the family members who accompany the blind person back to Aravind for surgery, have led to a marked increase in cataract surgery volume. Like McDonalds, Aravind has become the brand name even the poorest of India's poor can trust.

Aravind has also served as an inspiration and starting point for other systems. The Tilganga Eye Care Hospital in Kathmandu Nepal, in conjunction with the Himalayan Cataract Project of the USA and Fred Hollows Foundation of Australia has achieved similar success. Led by Dr. Sanduk Ruit, who is one of the most brilliant innovators in ophthalmology, he is a master at delivering state of the art, Western standard-care, at a low cost and providing the best possible care to the poor. Dr. Ruit spent time at Aravind and brought many of their ideas to Nepal, including starting a factory to produce low-cost lens implants. Similarly, many of his surgical innovations have found their way back to Aravind and are now standard procedure.

However, the topography of Nepal is different from India. It is difficult to bus poor patients into Kathmandu due to the lack of roads and isolation of many of Nepal's poorest villages. Moreover, there is not a sufficient population density to support an ophthalmologist in the hilly regions. The strategy Tilganga adopted is to train ophthalmic assistants to be based in the mountains providing primary eye care, giving spectacles, and screening for eye disease. When a sufficient number of people in any given region is blind from cataracts a mobile team comes to the patients. Dr Ruit has perfected the art of setting up a sterile operation theater in the most remote settings and providing outreach microsurgery with the same quality as hospital-based surgery. Like Aravind, Tilganga has also emerged as an international training center for high-quality eye care. The Tilganga model is now being exported to many parts of Africa where similar geographic challenges prevent patients from reaching care. Meanwhile the Aravind system is spreading throughout India and extending into China.

Not long ago in Nepal and most of India it was an expectation that as people grew older their hair would turn white, their eyes would turn white, and then they would die. Although death is still inevitable, thanks to Aravind Eye Care blindness in old age is no longer a certain outcome of a long life in Southern India. The challenge today is to extend that success to other regions of the world.