CASE: A-237
DATE: 07/12/21

THE HIMALAYAN CATARACT PROJECT

Dr. Geoffrey Tabin, the fourth person in the world to reach the tallest peak on each of the seven continents, first came across ophthalmology after summiting Mount Everest on one of his expeditions.[1] On this trip, he witnessed cataract surgery performed by a Dutch team that restored vision in a woman who had been needlessly blind for three years. He was amazed by the transformative impact of this simple surgical intervention and decided to pursue a career in ophthalmology.

Dr. Sanduk Ruit was born in Olangchung Gola, a remote mountain village located at an elevation of 10,000 feet in the Himalayas in eastern Nepal. Leaving home to study in India at age seven, Ruit went on to study medicine in Delhi, specializing in ophthalmology and microsurgery. He worked as a medical officer on a team at Nepal's northern border and saw the staggering extent of treatable blindness in these remote areas. "In every village, I'd find people blinded by cataracts," he recalls, "stranded in darkness." The experience moved him to restore eyesight to people who were unnecessarily blind.

Through this work, Ruit met Fred Hollows, an Australian eye surgeon who soon became his mentor. While in Australia, Ruit learned an emerging microsurgery technique that uses a much smaller incision than traditional surgery and implantable intraocular lenses for cataract surgery. He wanted to adopt this technique to help his patients back home in Nepal. Dr. Ruit was credited as the first Nepali doctor to perform modern cataract surgery with a sight-restoring lens implant. Together with Tabin, Ruit established the Himalayan Cataract Project (HCP) in 1995 (see Exhibit 1)—with a vow to eliminate all preventable and treatable blindness from the Himalayan

[1] Himalayan Cataract Project website, https://www.cureblindness.org (July 15, 2021).

Summer Hu, Jiayin Xue, Susan Qi and Professor Kevin Schulman prepared this case solely as the basis for class discussion. Stanford GSB cases are not intended to serve as endorsements, sources of primary data, or illustrations of either effective or ineff ective handling of an administrative situation. Funding for this case was provided by the Stanford Graduate School of Business. This case was reviewed and approved before publication by a company designate.

region in their lifetime. Dr. Tabin felt the goal was "more audacious than setting out to make the first ascent of the East Face of Mount Everest."[2]

The HCP soon grew in reach and scale. Initially, Ruit and Tabin led expeditions to conduct high-quality, high-volume, low-cost cataract operations in remote, rural communities. The HCP then established eye care centers where the organization funded and facilitated sustainable training programs for local eye-care professionals across the Himalayas and other remote regions with high rates of cataract blindness in Africa and Asia.

BLINDNESS AS A GLOBAL HEALTH CRISIS

Cataracts result from the clouding of the normally transparent lens of the eye (see Exhibit 2). They can be caused by trauma, diabetes, infection, or other diseases but they most commonly develop due to aging, induced by exposure to UV light. This clouding inside the eye obstructs light and thereby causes decreased color and contrast sensitivity, decreased visual acuity, and can eventually lead to blindness in severe cases. Cataract-induced blindness is most prevalent in low- to middle-income countries where malnutrition, inadequate health and education services, poor water quality, and a lack of sanitation lead to a high incidence of eye diseases. Cataracts also develop earlier and become more severe in people inhabiting places with increased exposure to sunlight, such as Nepal. High altitudes increase exposure to more intense UV which accelerates cataract formation. Globally, an estimated 65.2 million people suffer from moderate to severe distance vision impairment or blindness due to cataracts.[3]

Modern cataract surgery involve making micro-incisions to the eye to remove the cloudy lens (cataract) and to replace it with a new artificial lens fabricated from a specialized plastic polymer (see Exhibit 3). Cataract surgeries are a one-time, low-cost, and relatively simple procedure that can effectively restore vision in patients by removing the mechanical obstruction of light caused by the cataract. However, in remote areas, cataract surgeries are often unavailable due to a lack of access to high-quality ophthalmology services.

"In Nepal, cataracts are accepted and expected," said Tabin. "Your hair turns white, your eyes turn white—it leads to acceptance and depression. Blindness perpetuates poverty, and poverty magnifies the impact of blindness on life." To Tabin, cataract blindness was the low-hanging fruit of global medicine.

TRANSFORMING INCUMBENT PRACTICES

In emerging markets, one of the challenges in developing clinical services is the issue of demand. Prior to the development of the HCP, those living in rural Nepal did not expect vision to be restorable once they had cataracts. Therefore, people did not understand the need for affordable surgery, and did not seek care for their disease. The HCP had to first raise awareness about cataract surgery in this population through education, and through the creation of an entire ecosystem around cataract surgery and general eyecare. This was accomplished in part by treks

[2] Interview with Dr. Geoffrey Tabin, MD, May 21, 2021. Subsequent quotations are from author interviews, unless otherwise indicates.
[3] "World Report on Vision," World Health Organization, 2019, https://www.who.int/publications/i/item/9789241516570 (July 15, 2021).

into remote regions to conduct cataract surgery camps—where the team would perform hundreds of operations for villagers over the course of two or three days. However, the HCP's crown jewel was the development of the Tilganga Institute of Ophthalmology, a full-service eye hospital in Kathmandu, Nepal.

The HCP also disrupted the way cataract surgery was performed. Before the early 1990s, nearly all cataract surgeries in Nepal consisted of a machine-intensive extraction process, which involved removing the entire lens and capsule from the eye. The wound created was large, often leading to infection and complications, and the lens was not replaced. Following this procedure, patients had to wear thick spectacles to make up for the lack of intraocular lens. Post-operative vision was often distorted with peripheral vision impaired by the thickness of the spectacles. These traditional surgeries were long, expensive and created mediocre results.

Ruit quickly realized that the traditional surgery could never be performed at the volume needed to cure blindness in Nepal. He needed a surgical technique that was rapid, low cost, and generated great results to patients. Microsurgery was the answer. Ruit took the microsurgery training he had in Australia and began adapting the technique for use in Nepal. His operation used a surgical microscope, a customized cutting tool he designed, and a tiny, plastic intraocular lens to create a one-time, suture-less cataract surgery procedure. He then iterated this technique until he could achieve the results and speed he desired. This technique, using an intraocular lens to replace the cataract, offered a much better vision than the thick spectacles of traditional surgery. Plus, the surgery took less than ten minutes to perform. The post-op follow-up consisted only of eye drops and a night of bandage before patients had their vision restored the next day and were able to resume their normal pre-blindness life. The simplicity of Ruit's procedure makes it possible to be performed in makeshift settings in remote areas, using low-cost local materials. Most importantly, outcomes were comparable to that seen in Western medicine.

The Tilganga Institute of Ophthalmology

The HCP model in Nepal became a hub and spoke model centered around the Tilganga Institute of Ophthalmology (TIO) in Kathmandu, with mobile teams providing direct services to more rural parts of the country. Since its inauguration in 2009, the TIO served as the main hub for the HCP's operations and had continued to expand its services. Increasing, its physical capacity enabled the HCP to increase the number of patients it treated, but also to devote more space and resources for training programs for ophthalmic personnel at all levels—and provide continuous support to its remote community eye centers and teams. TIO also housed the region's first eye bank, and a new Refractive Surgery Unit that uses new laser technology to affordably treat patients with refractive error.

By 2021, The Tilganga Eye Center at TIO was treating 2,500 patients a week, including patients across the socioeconomic spectrum. For patients unable to pay, the HCP implemented a model of "compassionate capitalism," centered around a cost-recovery model where the elite of Nepal would pay a price for cataract surgery that subsidized eye care for those who would otherwise not be able to afford the care.

Human resources to support the TIO were essential. Ruit and Tabin needed a full, specialized team, and wanted to train the next generation of leaders to lead in their absence. As a result,

training and education became a cornerstone of the HCP in Nepal. It covers the full range of ophthalmic education including both short- and long-term programs for primary eye care workers, ophthalmic assistants, equipment maintenance personnel, optometrists, orthoptists, ophthalmic nurses, ophthalmology residents, ophthalmologists, and ophthalmology sub-specialists. Through these training programs, the HCP was able to expand efficient eye care delivery by increasing the number of trained specialists who could, in turn, themselves train future eye care professionals. TIO graduates went on to lead programs across the world where the need for cataract surgery was greatest.

The HCP also provided programs for mid-level eye care workers. These programs included a six-month course for assistants, covering data entry, visual acuity exams, and pre- and post-operative care such as administering eye drops. The HCP offered a three-year program for ophthalmic technicians: in this program, those who had just graduated from high school learned to provide basic primary health care, check patients' vision, diagnose most minor eye conditions, prescribe glasses, and conduct surgical follow-ups. In the United States, many of these activities are typically conducted by nurses, optometrists, or even physicians. Year one of the program took place in the classroom in Nepal, supplemented by a two-year rotation through stations and hospitals at the HCP or institutions such as Kathmandu University.

These programs focused on maximizing the capabilities of mid-level eye care workers, such as ophthalmic assistants, to be able to deliver and support eye care more efficiently, and at a lower cost. However, even beyond cost optimization, these programs helped create prestigious and respected jobs in the community and bring economic sustainability to remote areas. The cost of these programs could be supported with markups of just a few cents on medications and other supplies.

Technology & Procurement Program

In its process innovation, the HCP faced a significant cost barrier. When Ruit began his work, a single, plastic intraocular lens costed close to $200. This price made cataract surgeries inaccessible to the mostly lower-income communities living in rural Nepal. However, Ruit's research indicated that the raw material needed to make each lens cost only $0.60, while the remaining price of the lens contributed to the profit-driven model of manufacturing companies. In 1995, with the support of the Fred Hollows Foundation, Ruit established a non-profit lens factory in Nepal that manufactured comparably high-quality lenses for only $4 per lens. This factory, housed in TIO, was producing more than 300,000 units of intraocular lenses annually by 2021, with its products made available for distribution to more than 60 countries. This vertically integrated lens production capability allowed the HCP to lower the cost of cataract surgeries in impoverished regions across Nepal.

To provide the equipment for the facilities at TIO, the HCP relied on a specialized procurement program based in the United States. The HCP Technology and Procurement program sourced options for ophthalmic equipment to send to program sites. This program was responsible for the procurement and maintenance of all of the HCP's equipment, supplying several million dollars of specialized equipment, supplies, and furniture each year for the clinics and programs, even for programs beyond the HCP.

Remote Eye Care

Beyond TIO, the HCP worked with mobile care delivery teams to bring a high volume of cataract surgeries to remote areas in the Himalayas, where many cataract patients were physically unable to travel to urban areas to receive care. During these medical expeditions, doctors performed up to hundreds of cataract surgeries daily in makeshift mobile eye clinics set up to serve local communities. The HCP's mobile eye care teams travelled to remote and inaccessible areas by foot, visiting small communities without electricity, potable water, and full sanitation.

Once they arrived, the teams could quickly turn available space, from schoolhouses to other empty buildings, into a medical ward they called outreach microsurgical eye clinics (OMECS). The cataract surgeries delivered in these programs achieved the same results as at TIO and were an important way to bring high-quality care to place that otherwise would lack access. Despite initial skepticism from the ophthalmology field that care could be delivered in these makeshift eye camps, Ruit was able to achieve his goal with his unique surgical technique and his low-cost lenses.

Community Eye Care Facilities

The HCP's hub and spoke model depended on the needs of the region. The HCP provided both financial and administrative support to facilities ranging from OMECs and Community Eye Centers (CECs) in rural areas staffed by ophthalmic assistants, to full specialty eye hospitals in urban centers.

CECs served as the entry points to high-quality eye care for some of the most disadvantaged and remote patients, and as the local base for eye care outreach and education. Administrative tasks, such as recruitment of local residents for training and direction of community health initiatives, were also orchestrated from a community's CEC. These centers were staffed with full-time ophthalmic assistants who provided basic eye care and screenings for infection. Services included diagnosis, treatment, screening, and assistance in pre-screening and surgery during cataract surgical campaigns. In addition, CECs used this information to refer and prepare patients who might need more advanced care. The HCP developed a wide network of CECs across Nepal, including areas such as Bhaktapur, Dolakha, Jiri, Manang, Sindhu, and Rasuwa, among others.

Referrals from a CEC often directed patients to a Community Eye Hospitals, which served as surgical facilities and were staffed with at least one ophthalmologist, supported by a full team of eye care professionals. For example, Hetauda Community Eye Hospital (HCEH), in the Terai region of Nepal, was located five hours from Kathmandu and the main TIO hub. HCEH, in turn, also served as a training hub for the HCP's Cataract Surgery Training Program. HCEH maintained 32 staff on site, including two full-time ophthalmologists. The HCEH staff conducted extensive outreach, increasing surgical volume each year. HCEH performed 3,580 surgeries in 2016, double the number of surgeries in 2009.

Innovating on Cost

Behind the HCP was a model of performance improvement and innovation. Given the enormous clinical and fiscal challenges of providing care to the poor, Dr. Ruit became a surgical pioneer, inventing a technique that could address his challenges.

While the HCP extolled the virtue of their model, sceptics contended that TIO's performance was simply due to the low costs of labor in Nepal. Understanding whether the TIO was really as exceptional as it appeared was critical to attracting donor support for their efforts, and to scaling the model to other global regions with unmet need. Measuring the performance of TIO in a manner that could stand up to scrutiny required careful study of the clinical processes of care, and the cost of services provided in Nepal. The HCP agreed to participate in a novel study to confirm once and for all that their model was as efficient as they suggested.

The study would use an intensive managerial-accounting tool, time-driven activity-based costing (TDABC) to establish the costs of care at TIO. The TDABC study would include on-site observation and analysis of financial records at TIO.

Time-Driven Activity-Based Costing

TDABC offered a bottom-up accounting method that provided the analysis needed by TIO. Implementing TDABC required three core steps: (1) creation of process maps; (2) estimation of unit costs for personnel, equipment, space, and consumables (single-use materials); and 3) calculating the total costs based on the time and resources used at each step of the process map.[4]

Process Maps

Process maps served as documentation of the resources and activities required for an end-to-end service (see Exhibit 4). Activities were mapped through onsite observations of the business process. In healthcare, the framework followed patients as they moved through their care cycle. The process was broken down to individual tasks; physical and human resources were then quantified and attributed to each task. Each resource was assigned a time estimate for each step of the activity, which could be derived through first-hand observation, interviews with stakeholders, and validation of existing care maps. Lastly, all necessary capacity resources and consumable supplies were identified and attributed to each step of the activity. Process maps could help managers understand in detail the steps required to perform a task such as a clinical service.

Cost estimation

The process map accounted for all resources used to provide a service; the costing step then assigned a cost to each of the resources. Estimation of personnel costs required consideration of compensation models and the number of hours attributed to clinical care delivery (practical capacity). For example, if staff were required to attend a training day a week, then this time had to be amortized over the active clinical or revenue-generating time; vacation and sick leaves were also taken into account. Personnel costs were calculated as fully loaded labor rates using employee wage rates, benefits, and the number of hours available.

[4] Robert S. Kaplan and Steven R. Anderson, "Time-Driven Activity-Based Costing," *Harvard Business Review*, November 2004, https://hbr.org/2004/11/time-driven-activity-based-costing (July 21, 2021).

Indirect costs under TDABC were calculated based on the business processes described in the process map. Space cost was estimated from the cost per square footage of the areas occupied for each of the activities and the amount of time spent in each space. Costs related to shared facilities were assigned as a ratio of square footage used by the activities out of the total square footage of available capacity. Security, housekeeping, and utilities are accounted for in space cost. Variable equipment and consumable costs were calculated based on procurement data. All unit costs for personnel, equipment, and space were determined at the minute level.

Total costs

After completion of these two steps, calculation of total costs involved multiplying the unit costs with the time spent on each activity.

The HCP's workflow innovation

Please see Exhibits 4 - 7 for the process maps for cataract surgery at TIO.[5] The process map follows the patient through the entire care process, from the preoperative intake until discharge. Defining the steps in the process can be based on the discrete activities and the type of personnel involved. At TIO, a cataract surgery procedure required 49 different steps (and 10 post-op steps) and took each patient a total of 188 minutes of total clinical care time spent by all providers, from attending surgeons to administrative staff.

Developing resource costs for the personnel involved in cataract care at TIO required input from administrative personnel to help understand the salary and benefit structure, the practical capacity for each level of staff, and the management structure to support the team. Administrative staff were also critical in developing pricing models for consumables and equipment, and in understanding the allocation of space in the facility. The resource costs are presented in Exhibit 8.

Finally, these costs were assessed by combining the process maps and the cost data. The results were that the cost of a cataract surgery with lens insertion at TIO was 9163 Nepalese rupees—the equivalent of $75.[6]

Based on this analysis, Dr. Tabin had some real data to support the economics of cataract care at TIO—but still, how did the data compare to cataract surgery in the United States? This required a TDABC study of a U.S. hospital outpatient clinic (US HOPD), and effort that followed the same study design as at TIO with the development of process maps and a detailed costing effort.

The results were informative for Dr. Tabin. Compared to a U.S hospital-based outpatient department (HOPD), there were key differences in staffing, clinical flow, and timing at TIO. One measure examined by the team was OR time, calculated from when a patient entered the OR to

[5]Adapted from *"A Cost Comparison of Cataract Surgeries in Three Countries: United States, India, and Nepal,"* Jiayin Xue, MD, MPH, John Hinkle, MD, Mary-Grace Reeves, BA, Luo Luo Zheng, MD, Vengadesan Natarajan, MBA, MPhil, Shyam Vyas, MD, Radhika Upreti Oli, MPH Matt Oliva, MD, Robert Kaplan, PhD, Arnold Milstein, MD, MPH, Geoff Tabin, MD, Jeffrey L. Goldberg, MD, PhD, Kevin Schulman, MD, MBA. NEJM Catalyst Innovations in Care Delivery: Vol. 2 Issue 9, September 2021.

[6] Unpublished data from the TIO TDABC working group, Jiayin Xue, John Hinkle, Shyam Vayas, Radhika Upreti.

when the room was ready for another patient to enter. OR time serves as a critical economic measure given the significant expense of the facility. Overall, surgical volume was significantly higher at TIO, with faster operating room (OR) throughput suggesting greater efficiency in the care process. TIO's median OR time was 18 minutes, This result was dramatically shorter than the 48-minute mean OR time at the U.S. HOPD.

Another aspect of the TIO model was that TIO's patients' know to expect extended wait time before they get to the physician. This queueing model means that there is no downtime for the most expensive providers at TIO, the physicians (but at a cost to the patients in the wait in seeking care). The maximization of ophthalmologists' time extended through the care process. Time was saved in transitioning between surgeries by managing two patients concurrently in the same OR. This allowed the preparation of one patient on one operating table, while the surgeon operated on another patient at the adjacent operating table. TIO separated pre-operative and post-operative stations so that the care team at each station could focus on a specific set of assigned tasks as depicted in the process map. This enhanced throughput during the procedure while also allowing training on specific skills to enable deskilling of TIO personnel.

TIO's surgeons did not change masks, caps, gowns, or gloves between patients since these materials never touch the patient's eye. Gloves were sanitized between patients. While these procedures were markedly different than the practice at HOPD. Similarly, medication administration was also designed for efficiency, with the irrigation fluid used during surgery shared between patients rather than having the entire bottle thrown away after each surgery. Since the fluid comes in large bottles, it can be shared among multiple patients at the TIO, with only the opening tip switched out between patients. Even so, that tip was not discarded, but sterilized for reuse. This fluid costs $300 per unit when sourced from the United States, and just $2 when sourced from India, a further saving for TIO.

The U.S. regulatory environment restricts some of the TIO practices in an effort to reduce infections, although there is no evidence of higher post-operative complication rates at TIO. For example, TIO's rate of postoperative infectious endophthalmitis compares favorably to data on U.S. cataract surgeries.

Another major clinical difference in TIO's process and U.S. HOPD was the use of IV anesthesia, which TIO did not use during its surgeries. IV anesthesia has been abandoned in many countries since research had showed no difference in patient outcomes with or without IV anesthesia during simple cataract surgeries.[7] In the U.S. however, IV sedation and monitoring by nurse anesthetists (CRNAs) and anesthesiologists is standard practice since these services are well reimbursed in the US and these services are a profit center for the HOPD.

Deskilling and Top of the License: The Economic Model of TIO

As a design concept, many efforts at process innovation in health care focus on task shifting from more expensive surgical personnel to less expensive highly-trained staff. This was a core part of the TIO strategy. Top of the license suggests that the most expensive personnel should

[7] Ianchulev T, Litoff D, Ellinger D, Stiverson K, Packer M., "Office-Based Cataract Surgery: Population Health Outcomes Study of More than 21 000 Cases in the United States," *Ophthalmology,* 2016 Apr;123(4):723-728. Epub 2016 Jan 22.

only be used to provide services that require their unique expertise. Deskilling is a process of carefully describing individual tasks involved in the process, and assigning these tasks to the least expensive personnel capable of performing the tasks (and training them to perform these tasks).

Overall, the process maps from TIO and HOPD were similar, but the personnel costs were found to be higher in HOPD due to differences in resource types used to perform the tasks. For example, the U.S. site required more nurse time in contrast to the ophthalmic assistants and technicians used extensively at TIO. Though the price differential for labor between the US and Nepal drove much of the difference in personnel cost, skill mix and efficiency from deskilling also accounted for significant differences in cost.

The United States and other countries could benefit from some of TIO's innovative workflow and setup. For example, training lower-cost personnel to perform tasks currently done by nurses or surgeons could be one way to improve workforce efficiency, allowing everyone to "practice at top of their license". However, other practices at TIO, such as having two patients in the same operating room concurrently, would be less applicable due to regulatory barriers and patients' expectation for privacy.

LOOKING TO THE FUTURE

Since its founding, the HCP had raised a generation of surgeons and eye care staff in low- to middle-income countries, bringing their model of high-efficiency, high-quality, and low-cost cataract care to many in need. In the early 2010s, there were more people blind from cataracts in the Himalayas than there were people in the entire state of Wyoming. Nepal, the poorest country in south Asia, went from having 15,000 cataract surgeries performed in 1994 to 300,000 cataract surgeries in 2013. The rate of blindness in Nepal dropped from 1 blind person per 100 to less than 0.2 percent of the population.[8]

Over the years, Ruit and Tabin had also begun to turn their efforts to the next frontiers of treating cataract-induced blindness in the developing world, including sub-Saharan Africa, taking their model to Bhutan, Ethiopia, Rwanda, and Ghana.

They considered which other global markets would be good candidates for scaling this business model, and treating the estimated the 36 million cataract patients who still awaited care. "My role is mentoring doctors," Tabin said. "Nepal worked so well because of Dr. Ruit. Who are the great young doctors who can benefit most, and how can we train them to help develop their care systems for cataract patients?"

[8] The Gift of Sight, Himalayan Cataract Project, https://www.cureblindness.org (July 21, 2021).

DISCUSSION QUESTIONS

1. The literature describes "Focused Factories" in health care as an opportunity to improve clinical outcomes and reduce costs of care for patients. How does the HCP story support this concept?

2. Imagine that TIO has a goal of a 5 percent improvement in efficiency over the next 12 months. How could you use this TDABC study to measure performance improvement at TIO?

3. You are a hospital CEO and read about this TDABC study at TIO. You were very excited by the approach and the findings. You would like to compare the results at TIO with the results at your hospital. Of course, you'd like to compare both the estimates of direct and indirect costs. What would be the response of the Chief Financial Officer to this suggestion? How robust would the estimates be for direct and indirect costs of the procedure?

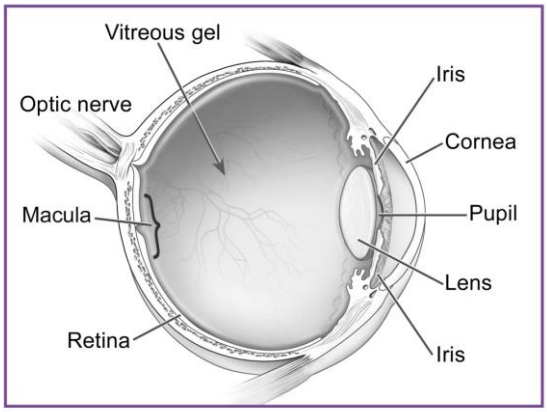
4. You have a meeting with your leadership team—what would you consider key takeaways from this TDABC study of TIO for your team?

5. How does lower cost care translate into lower price care for patients under a fee-for-service payment model? Under a case-rate payment model? Under a capitated payment model?

Exhibit 1
Dr. Sanduk Ruit and Dr. Geoffrey Tabin with patients of the Himalayan Cataract Project

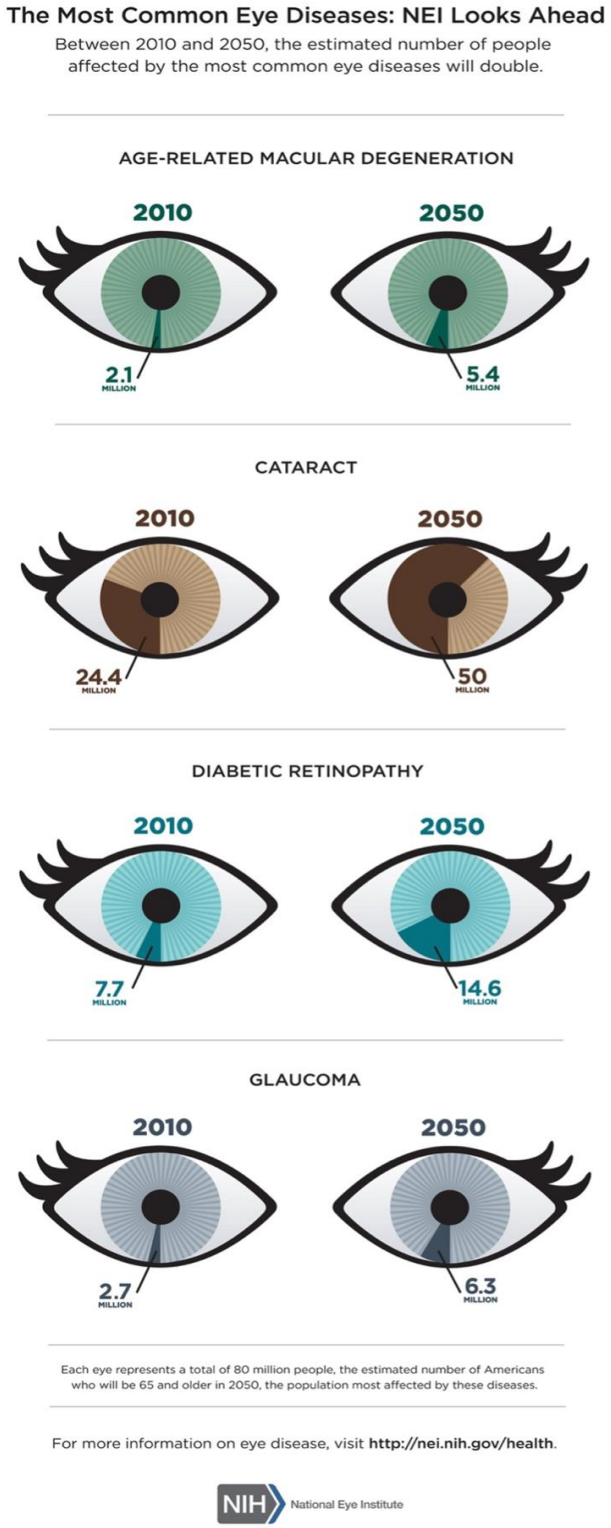
Source: Himalayan Cataract Project 2019 Annual Report.

Exhibit 2
Example of a Cataract



Source: "Cataract: What You Should Know," National Eye Institute – National Institutes of Health, September 2015, p. 5, https://www.nei.nih.gov/sites/default/files/health-pdfs/WYSK_Cataract_English_Sept2015_PRINT.pdf.

Exhibit 2 (continued)
Example of a Cataract

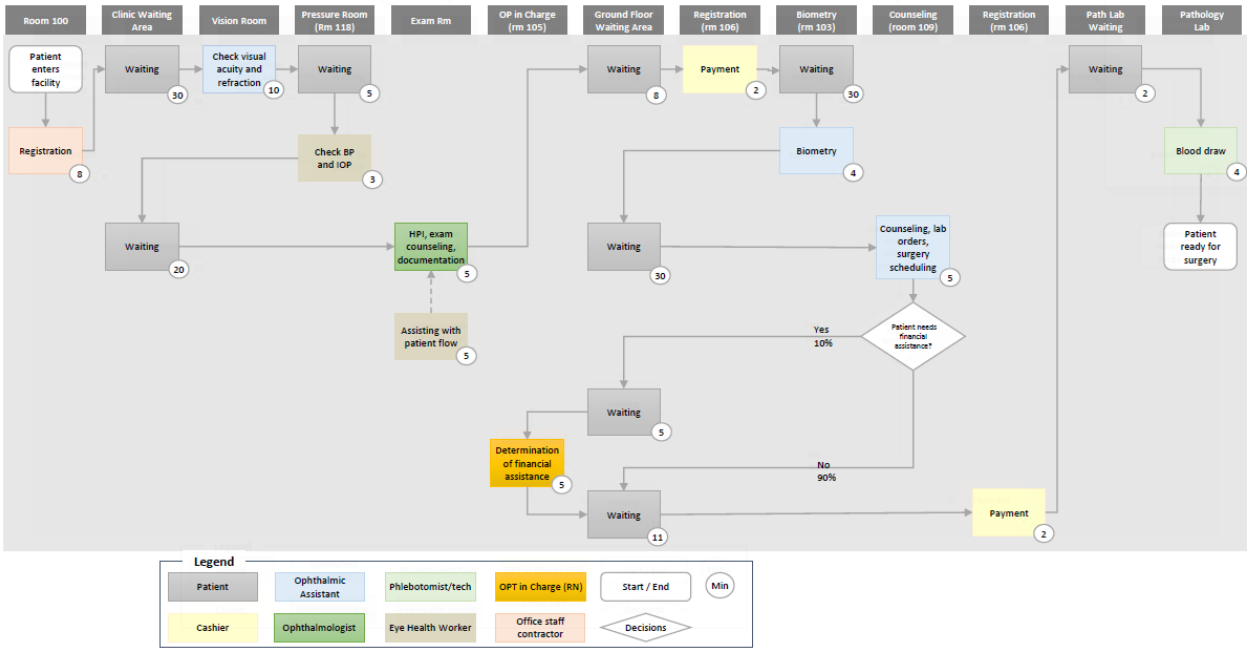


Source: National Eye Institute, Media Library, https://medialibrary.nei.nih.gov/media/1779.

Exhibit 3
Cataract Surgery

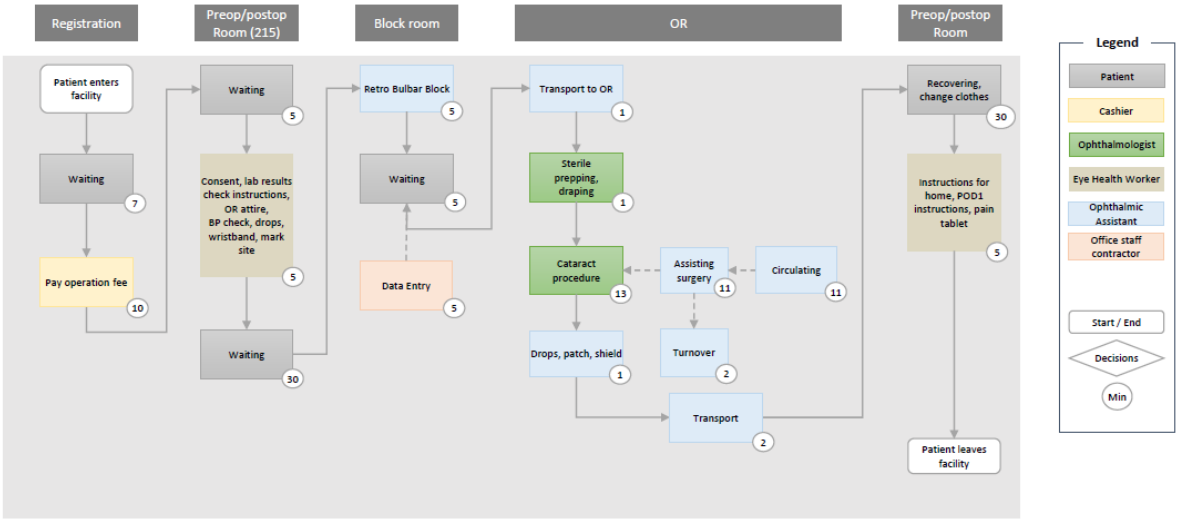
Source: The Himalayan Cataract Program, www.cureblindness.org.

Exhibit 4
TIO Cataract Surgery Pre-op Visit Process Map



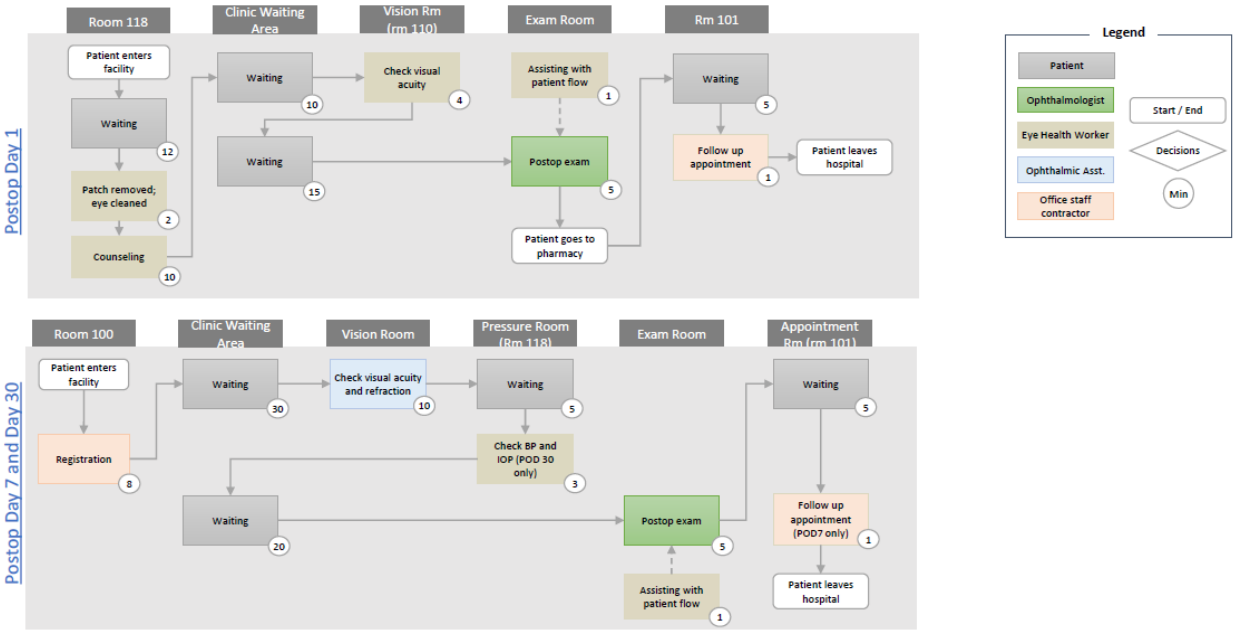
Source: *"A Cost Comparison of Cataract Surgeries in Three Countries: United States, India, and Nepal,"* Jiayin Xue, MD, MPH, John Hinkle, MD, Mary-Grace Reeves, BA, et al. NEJM Catalyst Innovations in Care Delivery: Vol. 2 Issue 9, September 2021.

Exhibit 5
TIO Cataract Day of Surgery Process Map



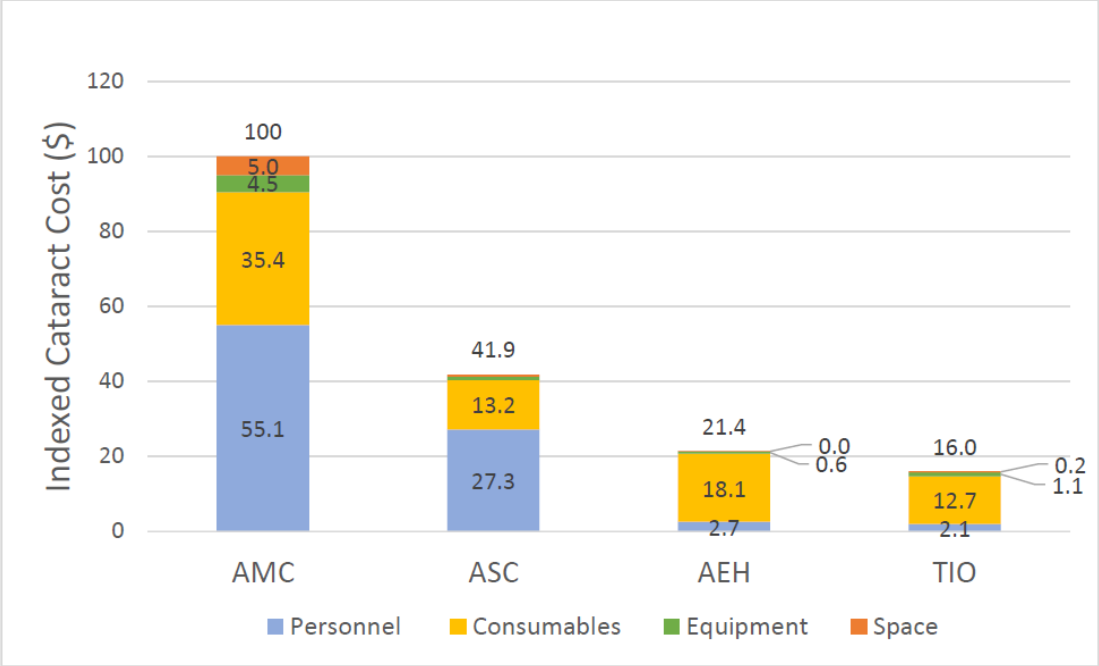
Source: *"A Time-Driven Activity-Based Costing Comparison of Cataract Surgeries Across Distinct Settings in Three Countries: United States, India, and Nepal,"* Jiayin Xue, MD, MPH, John Hinkle, MD, Mary-Grace Reeves, BA, et al. NEJM Catalyst Innovations in Care Delivery: Vol. 2 Issue 9, September 2021.

Exhibit 6
TIO Cataract Surgery Postop Visits Process Maps



Source: *"A Time-Driven Activity-Based Costing Comparison of Cataract Surgeries Across Distinct Settings in Three Countries: United States, India, and Nepal,"* Jiayin Xue, MD, MPH, John Hinkle, MD, Mary-Grace Reeves, BA, et al. NEJM Catalyst Innovations in Care Delivery: Vol. 2 Issue 9, September 2021.

Exhibit 7
Cost Breakdowns for Cataract Phacoemulsification Surgeries at Each of the Eye Centers



Source: *"A Time-Driven Activity-Based Costing Comparison of Cataract Surgeries Across Distinct Settings in Three Countries: United States, India, and Nepal,"* Jiayin Xue, MD, MPH, John Hinkle, MD, Mary-Grace Reeves, BA, et al. NEJM Catalyst Innovations in Care Delivery: Vol. 2 Issue 9, September 2021.

Exhibit 8
Personnel Costs by Resource Type, Including Cost Breakdown per Surgery
(values converted into U.S. dollars)

Personnel Resource	Median annual cost per personnel	Capacity cost (cost per hour)	Average Expected Time per surgery (min)	Total Personnel Cost per surgery
Ophthalmologist	$ 13,850	$ 0.13	34.00	$ 4.43
Ophthalmic assistant	$ 5,301	$ 0.05	72.00	$ 3.59
Eye Health Worker	$ 3,519	$ 0.03	40.00	$ 1.32
Cashier	$ 4,153	$ 0.04	6.00	$ 0.23
Phlebotomist/ tech	$ 4,879	$ 0.05	4.00	$ 0.18
OPT in charge RN	$ 9,272	$ 0.09	0.50	$ 0.04

Source: Unpublished data from the TDABC Tilganga working team - Jiayin Xue, MD, MPH, John Hinkle, MD, Shyam Vyas, MD, Radhika Upreti Oli, MPH.