Harnessing the Power of Digital Technology for ROP Care in Developing Nations



The Global Education Network for Retinopathy of Prematurity is using digital technology in several ongoing programs.

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Telemedicine and digital imaging are changing the playing field for global ophthalmology and improving access to care for patients with retinal disease. Technological advances often bring about efficient solutions and result in operational improvements that need not be restricted to use in developed, high-technology countries.

Developed countries progressed through fixed-line connectivity in the 20th century before mobile technologies superseded the established land-based networks in many areas. Many developing nations, however, are proceeding directly to more efficient mobile and clean energy technologies, leapfrogging the effective but imperfect solutions of the past.

Likewise, many technologies in medicine are transferable to developing countries. Telemedicine has been studied as a modality that may improve access and delivery of care to infants at risk of conditions such as retinopathy of prematurity (ROP).[1] Shortage of expertise and workforce—a problem experienced by both developed and developing countries—has been the driving force behind the adoption of telemedicine for ROP screening in many countries. Consolidation of critical clinical decision-making processes to a centralized reading center allows efficient concentration of expert consultations.

These potential advantages of telemedicine for ROP screening can be transferred to developing nations. Over the past decade, the Global Education Network for ROP (GEN-ROP) has been collaborating with international partners and nongovernmental organizations such as Orbis International; Helen Keller International; the Tilganga Institute of Ophthalmology in Kathmandu, Nepal; and the Aravind Eye Hospital in Coimbatore, India, to improve capacity for ROP care by using digital imaging technology and telemedicine. Several collaborations are ongoing.

AT A GLANCE

- The potential advantages of telemedicine for ROP screening can be transferred to developing nations.
- The Global Education Network for ROP has helped establish several ongoing programs using ROP telemedicine screening in resource-limited regions.
- These types of programs may provide channels for continued communication with local care providers over the long term.

GEN-ROP COLLABORATIONS

Mongolia

In 2011, through a collaboration between the National Center for Maternal and Child Health, Orbis International, and GEN-ROP, children with ROP were identified during a flying eye hospital program in Ulaanbaatar, Mongolia.[2] Subsequently, an ROP training and screening program was launched using the Retcam Shuttle (Clarity Medical Systems) camera for image-based screening along with examinations by a local pediatric ophthalmologist using indirect ophthalmoscopy.

Additional training was provided for the local partners through fellowships for ROP screening and treatment. During this program, many challenges had to be addressed, including acquiring the needed equipment (eg, a laser for treatment), assuring support from neonatology and pediatrics, and developing caregivers' awareness that certain neonatal intensive care unit (NICU) practices can play a role in the development of ROP.

A multidisciplinary approach was established to support the ROP screening and management program. We used a team that included neonatologists, NICU nurses, ophthalmic photographers, and ophthalmologists, with the understanding that a team led exclusively by ophthalmic professionals may be less effective in the long term.

Through the utilization of imaging and a cloud-based data management system, we have been able to establish evidence-based screening guidelines for this region. In addition, through telementoring, we have been able to educate local Mongolian physicians in the diagnosis and management of ROP.

Nepal

Helen Keller International, the Tilganga Institute of Ophthalmology, and GEN-ROP, with support from the USAID Child Blindness Program, have collaborated to develop an ROP screening program using telemedicine and digital imaging. Participants have taken a team approach, with input from neonatology, nursing, and ophthalmology. The goals are to help improve overall neonatal care and to reduce the incidence of ROP and childhood blindness secondary to ROP. The program uses the 3nethra neo (Forus Health) camera for ROP imaging. The iTeleGEN cloud-based data management system we developed is being used to maintain clinical records for all patients who have been identified as at risk for developing ROP.

India

In India, the Aravind Retinopathy of Prematurity Eradication - Save Our Sight (ROPE-SOS) program was launched in 2015.[3,4] This program was funded by USAID and a grant from Mr. Subroto Bagchi.

ROPE-SOS is a mobile ROP tele-screening program. The program covers a resource-limited geographic area of more than 18,000 square miles (larger than the state of Maryland), harboring a population of 51 million individuals (approximately the populations of California and Georgia combined) in the southern Indian states of Tamil Nadu and Kerala.

The ROPE-SOS team includes two technicians, one manager, one midlevel ophthalmic assistant, and a driver who together cover 56 NICUs in 18 cities. The technicians have been trained to capture digital fundus images in preterm babies using the Retcam Shuttle.

Once a baby is screened, the images are uploaded and transmitted to a reading center, where a retina specialist skilled in ROP reads the images and immediately sends a report back to the team in the NICU. A 4G broadband network—a level of technology that is now available in most parts of even rural India—is used for transfer of the images.

Overall, the whole process of screening babies and counseling parents takes about 12 to 15 minutes per case. If a baby requires treatment and is stable systemically, he or she is transferred to Aravind Eye Hospital in Coimbatore for management. If a baby who needs treatment is not sufficiently stable for distant travel, an ROP expert visits the NICU within 3 days to provide treatment.

ROPE-SOS has been reported to effectively identify infants

with ROP requiring treatment. Between August 2015 and February 2018, a total of 11,912 babies were screened by teams in this program.

FUTURE DEVELOPMENTS

Development of sustainable health care facilities and systems in resource-limited regions often depends on the education and development of local individuals to equip them with the skills they need to locally develop a framework for provision of care. Web-based digital learning programs have been shown to be effective in the remote education of trainees in the United States and around the world.[5-7] These types of programs may be particularly useful for the development of standardized ROP education and training. They may additionally provide channels for continued communication with local care providers over the long term.

As the ability to collect digitized high-resolution fundus images becomes available in resource-limited regions, it will become possible to use advanced computational techniques, such as computer-based image analysis and deep learning,[8] in these regions. In this way, low- and middle-income countries may gain access to the same advanced technologies now being used in developed countries for high-throughput management of clinical disease. Understandably, many aspects of such developments still must be validated before they can be adopted as mainstream clinical practices.

Financial support is crucial for the application of digital technology in global ophthalmology programs. Funds for these efforts are frequently sourced from philanthropic groups and from organizations such as the USAID Child Blindness Program. USAID is a US federal organization whose stated aim is "to support partners to become self-reliant and capable of leading their own developmental journeys."[9] In accord with this mission, global ophthalmology programs should endeavor to use effective technologies to enhance the stability, maturity, and resilience of health care systems in resource-limited regions.

SO MUCH POTENTIAL

The use of digital technology, imaging, telemedicine, computer-based image analysis and deep learning is applicable to many global ophthalmology programs and is not exclusively limited to the clinical provision of care in developed countries. We look forward to further deployment of these technologies to improve not only the eye health care of premature babies, but also health care more generally in resource-limited countries and regions. ■

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