Lessons Learned from the Creation of a Center of Excellence in Low Vision and Vision Rehabilitation in Wenzhou, China

Rebecca Marinoff and Michael H. Heiberger

Abstract: A model Center of Excellence in Low Vision and Vision Rehabilitation was created in a health care setting in China utilizing an inter-institutional relationship with a United States optometric institution. Accomplishments of, limitations to, and stimuli to the provision of low vision and vision rehabilitation services are shared.

Visual impairment affects society in many ways, including by making it difficult for young children to reach developmental milestones and attain educational and employment opportunities; it often results in increased dependence on public assistance, and there are also growing numbers of older adults with visual im-

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pairments who are at risk for serious injury caused by falls necessitating hospital stays or residence in nursing homes. In 2010, it was estimated that there were 8.2 million blind individuals in China, and 67.3 million people with low vision (Mariotti, 2012). Beginning with China's 11th five-year plan in 2006, the need for low vision care was included (Fan, 2006). The estimated economic consequences in the United States from medical, nonmedical, and lost quality of life costs related to visual impairment were \$138.9 billion in 2007 (Wittenborn & Rein, 2013). Since China has a population that is at least four times that of the United States, the economic cost there would likely be significantly greater.

Selection of the site in Wenzhou for a collaborative project

The relationship between the State University of New York College of Optometry (SUNYCO) and the Wenzhou Medical College (now Wenzhou Medical University [WMU]) began in 2008 with

an agreement that established student and faculty exchanges, collaborative research, and cosponsorship of the Confucius Institute for Health Care in New York City. With the assistance of a three-year grant from the Lavelle Fund for the Blind, SUNYCO agreed to work with WMU to create the Center of Excellence in Low Vision and Vision Rehabilitation (the Center). The grant was renewed for an additional three years, making it a six-year project.

WMU is the largest health care facility in Zheijang Province, China; with 19 affiliated hospitals and 18,000 students, it serves more than 20 million patients. WMU's Eye Hospital provides a broad range of specialty care to more than 270,000 individuals per year. Many of these patients have reduced vision due to congenital or acquired eye conditions and can benefit from low vision services.

WMU was one of the first institutions in China to introduce programs of optometry within its medical school. Unlike in the United States, where optometry is a separate profession with separate educational institutions, it is treated in China as a subspecialty for ophthalmologists who wish to specialize in the treatment of functional vision problems. There are three levels of optometric education at the WMU School of Optometry and Ophthalmology. The three-year undergraduate degree with optometry technology certification aims to train the student to become a technician and to perform refraction, ophthalmic lens dispensing, contact lens fitting, and orthoptics. The five-year undergraduate program provides graduating students with a medical-based bachelor's degree. In the seven-year program, graduates earn a medical-based bachelor's degree as well as a master's degree. The optometry curriculum in 2008 did not include any low vision clinical experience and thus only rudimentary low vision services were available at WMU as well as elsewhere in China. There was also no provision for vision rehabilitation services for the purpose of enabling people who are visually impaired to perform work or leisure activities.

The Center was established as a separately identified unit at the Eye Hospital of WMU to specifically address the need for diagnosis and management of patients with low vision. Since the WMU Eye Hospital is the only such specialty hospital in a region with approximately 10 million people, such a center would be situated in a location where most of the population goes for secondary and tertiary eye and vision care.

Another important factor in choosing WMU's Eve Hospital was its existing affiliation with the Wenzhou School for the Blind as well as two other schools for children who are blind in the region. Prior to the establishment of the Center, children at those facilities were being treated as blind even though a number of them had residual vision. There were no on-site facilities for eye care or low vision care at the schools. Once the Center was established, children were brought there for evaluation, and a number of them were provided with devices such as hand magnifiers, stand magnifiers, or closed-circuit televisions (CCTVs) that enabled them to function visually. Some even progressed from braille reading to the reading of text utilizing the devices noted above. This progression to print has since led to the construction of a new school for students who are blind in Wenzhou that uses

Box 1			
Time line of	project	by	vear.

Year 1 2008–09	 Grant is received from the Lavelle Fund for the Blind Advisory Board is appointed (three low vision professionals, one vision rehab educator, and one administrator of a blind services agency) SUNY staff visits Wenzhou to assess facility design and staffing issues Leadership team is established at Wenzhou Curriculum is developed for doctors, nurses, and students
Year 2 2009–10	 Advisory Board meets once Official opening of Center on May 10, 2010 Low vision curriculum materials are introduced in optometry training programs Low vision services at the Center are expanded and enhanced Planning begins for 2011 Summit Forum on Low Vision and Vision Rehabilitation Additional low vision equipment and devices are supplied to WMU through Lavelle grant funds
Year 3 2010-11	 (1) Advisory Board meets twice (2) Continuing education courses are developed by WMU staff and delivered both in person and via online presentations (3) The Summit Forum on Low Vision and Vision Rehabilitation is held
Year 4 2011–12	 The grant is renewed; another three-year grant is received from the Lavelle Fund to further develop the current Center Advisory Board meets twice There is additional outreach to WMU Eye Hospital staff and staff at other hospitals that treat stroke and diabetic patients to identify possible low vision patients Low vision services are initiated at the Hangzhou clinic
Year 5 2012–2013	 Advisory Board meets once Additional staff is added at the Center: two additional doctors and four nurses trained at SUNY; ongoing training is also provided by previously trained staff at WMU \$10,000 grant is received from the Wenzhou government for the purchase of low vision devices for needy patients
Year 6 2013–2015	 Final year of project is extended into 2015 due to initial grant funding being delayed until the middle of year one. The Lavelle Fund agrees to this extension Advisory Board meets twice One additional doctor and four additional nurses are trained at SUNY and at WMU as the Center approaches full capacity A new school for blind students is opened in Wenzhou A low vision display is established in the Retina Service of the Eye Hospital Two nurses receive limited mobility training A supply of inexpensive low vision devices is provided by SUNY, utilizing grant funds Several team members from SUNY and WMU are invited to participate in the 15th International Forum on Vision Health in Chengdu, China. A separate symposium on low vision and vision rehabilitation is held as part of the conference

state-of-the-art equipment for students' visual learning.

Designing, equipping, opening, staffing, and promoting the Center

The Center, a state-of-the-art facility for the provision of low vision and vision rehabilitation services, is prominently located on the downtown campus of WMU alongside the Eye Hospital and the School of Optometry and Ophthalmology. The official opening ceremony was on May 31, 2010 (see Box 1 for a time line of the project).

The Center occupies 6,240 square feet and is equipped with four low vision examination rooms, a special testing room, an assistive technology room, a dispensing area, and a classroom. There is a range of optical, nonoptical, and electronic low vision devices to demonstrate to patients. There is also a vision rehabilitation room for training patients to perform activities of daily living in adaptive ways. This room includes kitchen space, shower space, and laundry space. It demonstrates environmental changes such as task lighting, contrasting colors, and tactile cues.

Three optometrists from WMU spent six weeks in New York in 2010, both receiving training and visiting sites that provide low vision clinical care. Since vision rehabilitation was a relatively new concept to eye care providers in China, it was necessary for the WMU team to have this exposure so they could educate their colleagues in the Eye Hospital about the new patient services and determine which of these services could most feasibly be delivered at the Center. More time than was originally anticipated was spent on promotional activities. Since the Center was designed to serve as a model for other such facilities in China, time was spent building relationships with other hospitals and service providers in Wenzhou. In addition, a campaign was initiated to promote the new facility and its rehabilitative model. Over the six-year project, promotion of the Center and its low vision rehabilitation took place through a total of 37 educational programs for doctors, nurses, and community volunteers from service organizations such as the local and regional Lions Clubs in the province.

The team at the Center currently includes six doctors (two full-time and four part-time) and three nurses who provide support to the doctors and rehabilitative care to the patients. There is a minimum

staffing of two doctors and two nurses each day. Since opening, the Center has provided care to over 11,000 patients and has hosted over 260 visitors from other hospitals and government agencies across China.

The clinical team at Wenzhou is functioning effectively both in the provision of patient care and by participating in programs to educate other practitioners about the types of low vision and vision rehabilitation services that they have learned to provide and implemented at the Center. In addition, they have been orienting practitioners from other specialties within the Eye Hospital at Wenzhou and elsewhere about the necessity to refer patients for low vision evaluations if they have visual disabilities that cannot be corrected by traditional spectacles, contact lenses, or cataract surgery.

The first half of the six-year project culminated in the 2011 Summit Forum on Low Vision and Vision Rehabilitation, which was held on the campus of the School of Optometry and Ophthalmology in Wenzhou. Over 150 practitioners from throughout China plus 30 faculty members from WMU attended the event, which was the largest low vision meeting ever held in China.

The low vision educational model at WMU

The low vision curriculum was significantly modified in order to prepare students with an expanded scope of low vision services. Modifications included adding clinically relevant lectures and laboratory sessions to the current curriculum (see Table 1). Curriculum materials that addressed vision rehabilitation topics were provided by the SUNYCO low vision faculty, Lighthouse

Table 1 Curriculum modifications.

Former topics	How modified
Introduction to low vision and blindness	No change
Pathology causing low vision	Added functional impact of disease
Low vision examination	Modified to include: low vision exam part 1: case history, acuity testing, charts, and notation; and low vision exam part 2: objective and subjective refraction, contrast sensitivity testing, central and peripheral visual field testing. (For both parts, clinical emphasis on performing tests and interpreting results.)
Contrast sensitivity and low vision (theory)	No change
Visual acuity, visual field, and low vision (theory)	No change
Low vision aids (theory)	Added clinical applications of distance, near, and nonoptical devices; added case examples
Low vision rehabilitation (how to use low vision aids)	Added concept of rehabilitation plan; role of rehabilitation providers; need for rehabilitation training; addressing contrast, lighting, glare issues; added case examples
Psychosocial factors	No change
Four labs, three hours each: distance acuity, near acuity, distance low vision aids, near low vision aids	Four labs, three hours each: case history and acuity, low vision refraction and contrast testing, distance low vision devices and nonoptical devices, near low vision devices

Guild International (LGI), and VISIONS/ Services for the Blind and Visually Impaired (VISIONS). The team members at WMU were all fluent in English and were able to utilize these materials and also to create translations to Chinese when needed. In addition, two new curricula were designed for training in China, one as a continuing education track for doctors and the second to train staff in how to provide rehabilitation services. The curricular changes have been well received and, since the modification of the optometry curriculum at WMU, at least two recent graduates of the optometry program have obtained positions at other institutions in China as low vision providers.

In October 2010, a grant was received from the Chinese Ministry of Education under the National Project on Teaching Resources to develop new curriculum materials for the optometry program. It is anticipated that this grant will be expanded to provide such materials for teachers at all 60 optometry programs in China. Beginning in December 2010, two low vision courses were developed by Wenzhou staff and made available for existing practitioners on the Chinese National Medical Continuing Education website. One course is a one-day training program designed to familiarize eye doctors with the areas of low vision and with how to make an appropriate referral for a low vision evaluation. The other course is a two-and-one-half-day training program for optometrists who wish to begin offering low vision care. The curriculum at WMU for ophthalmology students who are not specializing in optometry has been further expanded to include a course in low vision taught by one staff member from the Center.

Two textbooks have been developed. One, Low Vision in Optometry, is designed for optometry students who are

Table 2 Summary of training for doctors.

Date	Location	Emphasis
October to November 2010	New York	Training for doctors on diagnostic testing, examination techniques, selecting appropriate low vision devices, management options, and visit to sites
January 2011	Wenzhou	SUNY team observes and critiques patient care to evaluate effectiveness of training
November 2013, May 2014, October 2014	Wenzhou, Hangzhou	Advanced low vision examination and prescribing, quality assessment, nonoptical devices

in the five-year undergraduate degree program. The second, *Low Vision Techniques in Optometry*, is designed for optometry students who are in the three-year undergraduate degree program. Forty other universities in China are using these text-books.

As part of each visit between SUNYCO staff and the team at the Center, teaching materials prepared by the WMU team were reviewed. These included curricular material in low vision for the optometry and ophthalmology students at WMU, as well as patient-education materials. The curricular materials introduce new Center staff to the provision of low vision and vision rehabilitation services and have also been shared with 38 other hospitals in China.

A training video was produced by the WMU team. It includes depictions of how to conduct a low vision examination, utilize optical and nonoptical devices in rehabilitation, and use electronic devices. This video is available for purchase by hospitals through the China Medical Association.

Identification and training of staff

Doctors who had interest or skill in vision rehabilitation were selected to see low vision patients at the Center, and SUNYCO staff selected nurses to fill the role of providing vision rehabilitation services. Based on their level of education and training, organizers felt that the nurses could be trained to provide additional, specific services (Jiang, Li, Ma, & Gu, 2015; Ungos & Thomas, 2008). In the United States, there are certified professionals with specific roles, such as vision rehabilitation therapists or occupational therapists (Ponchilla & Ponchilla, 1996; Warren & Barstow, 2007), but there are no such training programs in China. Initially, nurses at the Center were trained to instruct patients in both how to use optical, nonoptical, and electronic low vision devices, and to perform a range of daily activities, therefore providing services that in the United States would be provided by separate certified professionals.

Training for doctors and staff utilized the "train-the-trainer" approach, in which participants were given the materials and skills needed to train others. A group of doctors and nurses were trained by SUNYCO staff and they then went on to train additional doctors and nurses from WMU. The training for doctors was mostly clinical, since they had already received didactic training in the theory of low vision (see Table 2).

Nurses began their training with distance learning published by LGI and seminars by SUNYCO faculty in order to gain background knowledge. This training was

Table 3 Summary of training for nurses.

Date	Location	Emphasis
October to November 2010	New York	Distance learning and seminars on low vision, optics, and rehabilitation topics; hands-on training in optical and nonoptical low vision devices, and rehabilitation techniques. Includes weeklong course in activities of daily living training and half-day program on O&M, environmental design, and mental health
January 2011	Wenzhou	SUNY team observes and critiques vision rehabilitation to evaluate effectiveness of training; SUNY staff presents full-day program to nurses
December 2013	New York	SUNY team observes and critiques patient care
April to May 2014	New York	SUNY team observes and critiques patient care, reviews patient data collection
May 2015	New York	Three-week program on O&M at VISIONS

followed by hands-on training sessions held in New York City, which took place at SUNYCO, LGI, and VISIONS (see Table 3).

Due to safety concerns and the need for extended training, for much of the project there was hesitation in training nurses at the Center in the provision of orientation and mobility (O&M). The nurses indicated a strong need for these services, and SUNYCO contracted with VISIONS for two nurses to receive training and to shadow certified orientation and mobility specialists (COMS). This program was not expected to qualify the nurses as COMS. The goal was to expose the staff to how O&M instruction is offered in New York City. The program limited instruction to indoor mobility, including human guide, trailing, and protective techniques. The nurses were taught basic cane skills, so that they could evaluate whether patients required such training and attempt to refer them elsewhere.

Patient care services at the Center

Prior to the implementation of the project, low vision care at the WMU Eye Hospital

consisted primarily of an evaluation of the patient's visual acuity followed by a determination of the magnification that was required for best acuity at distance and near. Often, the patient received a low vision device with little or no instruction on its use. There was no follow-up to determine how well the patient was functioning with the device. Moreover, there was little or no attention paid to eliciting whether patients had difficulty with activities of daily living.

The low vision examination at WMU has been expanded in several ways. A nurse conducts a functional assessment, a questionnaire, to determine if and how the patient's reduced vision affects his or her ability to perform everyday tasks. This assessment is conducted to determine the patient's functional visual goals. Examples of functional visual goals are to read the newspaper or thread a needle. The doctor reviews this information prior to examination. Evaluation of visual capabilities now includes a more in-depth refraction testing, contrast sensitivity testing, and testing of the patient's central and peripheral visual field. The examining doctor makes recommendations for

optical and nonoptical low vision devices in order to meet the patient's individual functional needs, and the examination is followed by vision rehabilitation services with a nurse. The nurse trains the patient to use the recommended devices effectively and efficiently, and to perform household tasks using adaptive methods. The nurses mostly train patients to perform instrumental activities of daily living, skills that help the patient maintain independence in the community such as kitchen skills (including pouring, measuring, slicing, and kitchen safety), clothing management (including threading a needle and washing laundry), telling time, identifying money, telephoning, and handwriting. The nurses also train patients to perform grooming and hygiene tasks in adaptive ways, which are considered fundamental self-care tasks. In the final year of the project, the training also included the indoor mobility training described previously.

In 2010, WMU established a smaller satellite eye hospital in Hangzhou, the capital of Zhejiang Province and, in 2012, a low vision clinic was established there. Doctors and nurses from WMU rotated there to conduct training. Low vision examinations as well as vision rehabilitation services are conducted at the facility.

Barriers to referral for low vision services in the United States are documented in the literature (Keefe, Lovie-Kitchen, & Taylor, 1996; Lovie-Kitchen, Keefe, & Taylor, 1996; Marinoff, 2012). In the early years of the project, publicity from the opening of the Center led to self-referrals, and only about 20% of patients were referred by other departments in the WMU Eye Hospital. This number grew to 62% in 2014 and rose to 76% by the end

of 2015. Increased referrals were accomplished in several different ways. One was to conduct in-house education about low vision for doctors and nurses from other departments. A low vision display was set up in the Retina Clinic. This display serves as a daily reminder to the staff in that department, and it also attracts the attention of patients and their families who may not otherwise be aware of possible nonmedical or nonsurgical methods for improving visual function. Referrals also increased as affiliation with additional special schools for students who are blind increased. Patients also reach the Center by identification at screenings.

During the second half of the project, the Center began to work with other hospitals in the WMU system to identify stroke and cardiac patients with visual impairments. These patients might not be referred for low vision care, and if referrals are made they usually go to the main part of the Eye Hospital rather than directly to the Center. In order to remediate this situation, a room within the main Eye Hospital has been established where these patients can be screened by triage nurses to determine if they are appropriate candidates for a low vision evaluation. This approach has yielded an increase in patient referrals.

Provision of low vision devices

Prior to this project, the array and quality of low vision devices available at WMU was limited, and many of the available magnification devices were not properly labeled as to their magnifying powers. There were virtually no nonoptical devices available.

The Center, through purchases, loans of equipment by manufacturers, and

Box 2 Devices available at the Center.

Optical or electronic devices

Prism half-eye spectacles (4D-12D)

Hand magnifiers (5D-28D)

Stand magnifiers (4D-28D)

Handheld monocular telescopes (2x-10x)

Binocular spectacle-mounted full field telescopes (2x, 3x, 4x)

Desktop closed-circuit televisions

Portable closed-circuit televisions

Nonoptical aids

Lap desks

Black-and-white cutting boards

Bump dots

Large print pill box

Liquid level indicator

Needle threader

Large print kitchen timers

Filters (range of colors and frame sizes)

Talking watches

Long oven mitts

Magnifying mirror

Typoscopes, writing and signature guides,

bold-lined paper, bold pens

government assistance, has been able to vastly improve the array of low vision devices to demonstrate to patients (see Box 2). Some patients can afford to purchase the recommended devices, while others require that all or part of the cost be subsidized. WMU, in 2010, received a government grant of ¥100,000 renminbi (approximately \$15,700 U.S. dollars) to help subsidize these devices. In addition, philanthropic support has been building from such nongovernmental entities as the new Lions Club in Zhejiang Province.

The government now funds some devices for use in schools such as the school for students who are blind in Wenzhou. As a result of this project, SUNYCO has been able to assist WMU in the purchase of better-quality devices at a modest cost by locating sources in the United States, Australia, and Taiwan, as well as by exploring ways to minimize import duties and expedite delivery.

There was concern that the number of low vision devices dispensed during the early years of the project was low compared to the percentage of patients examined who received such devices. The number ranged from 18.5% to 26.7% between 2012 and 2014. Several reasons were found for these low percentages of low vision device prescriptions. First, staff were not initially counting highpowered reading glasses as low vision devices. Second, many patients were not ready to commit to the purchase of a device at the time of the exam. It is possible that these patients purchased the device elsewhere, but we could not confirm whether or not such purchases were made. Some patients came to the Center solely for vision rehabilitation services. Regrettably, many patients were not able to afford needed devices. Some patients hoped for a medical or surgical cure and were not ready to accept their level of impairment and the need for low vision devices. Finally, many patients at the Center were children, and their devices were often supplied by the school that the child attended.

As a solution to some of the above problems, an initial supply of low-cost

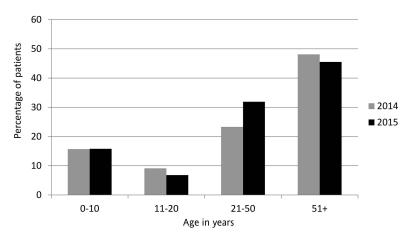


Figure 1. Age of patients as percentage.

optical and nonoptical devices were stocked by the Center and were to be given at little or no cost to patients. These items were lower-cost alternatives to devices initially stocked by the Center. Once it was determined which items were dispensed most frequently, a plan was developed for ensuring the Center had an adequate supply of these devices.

Cultural differences affecting the provision of care

At the Center, a significant portion of the patients are children (see Figure 1), which may be attributed to the Center's relationship with the three schools for students who are blind in the region. Overall, in China, there is an emphasis on care for the young, since most older adult patients live with relatives who can perform visually related tasks for them. Another factor is that the Chinese government, in addressing a great need with limited resources, puts a priority on providing health care to the young. A study of the patient population at a low vision clinic in Shanghai found that 63.88% of the patients were under age 30 years (Gao et al., 2015).

Another example of cultural differences concerns remaining independent. Older adult patients in America may request assistance with tasks that they are not able to do because of vision impairment, but usually they would rather remain independent. It is the authors' experience in China that older adult patients are quite comfortable relying on their relatives to take care of them. In addition, many patients were still seeking a medical or surgical cure and, therefore, were not receptive to low vision rehabilitation services. It must also be recognized that the culture in China is evolving, and it required a good deal of thought as to how to optimize the delivery of care while also considering tradition and modern concepts.

One of the greatest differences in providing outpatient care in China, and particularly in Wenzhou, is that patients often travel long distances to come to the Eye Hospital. They will stay for as many hours as necessary, but it is often difficult if not impossible for them to return for follow-up appointments. It became necessary to perform as many of the diagnostic procedures as possible in one visit, which sometimes required frequent breaks

due to patient fatigue. Likewise, vision rehabilitation services that were normally taught in a series of visits often needed to be condensed and, at times, presented in a small group environment rather than individually.

Project funding

For the duration of the project, costs were shared by SUNYCO, WMU, and the Lavelle Fund for the Blind. SUNYCO provided a portion of the support for project administration and SUNYCO faculty. WMU bore the full cost of building, equipping, and maintaining the Center facility, as well as staffing it and providing educational materials for patients. Lavelle funds were utilized to support travel expenses related to staff training and to partially offset salaries for faculty, a vision rehabilitation consultant, and the project director. A relatively small portion of the Lavelle funding was used to support travel expenses related to the advisory board and to provide an initial supply of inexpensive low vision devices for the Center.

Funding of patient care

The actual cost of delivering low vision and vision rehabilitative care at WMU was difficult to determine because the Eye Hospital does not assign staff or other costs by unit. Government reimbursement for a low vision evaluation is at the same very low rate that is paid for a general eye examination even though much more time is required for a low vision evaluation. This lack of additional compensation for low vision evaluations was not a problem, however, since the Eye Hospital provided staff and other support as needed. Funding for low vision devices was a

challenge, and government grants and support from local Lions Clubs have provided support.

Sustainability of the Center

WMU was committed to providing care to low vision patients. The doctors and nurses at the Center were dedicated and willing to educate their patients, their patient's families, and other staff at the Eye Hospital. There was governmental support at local, provincial, and national levels. The Zhejiang Lions Club, individual donors, and community volunteers offered philanthropic support. All these ingredients combined led to the Center being a success.

Sustainability of the Center depends upon the factors cited above. The most important one is continued institutional commitment to low vision and vision rehabilitation. Philanthropic support from service clubs such as the Lions Club, individual donors, and community volunteers is a relatively new phenomenon in China that is expected to grow in size and importance in supporting the work of the Center.

Lu Fan, current President of WMU, in her July 2015 presentation to the Vision China conference in Chengdu, described a number of efforts that will be continued by WMU with regard to the Center, including expanded low vision services within the Eye Hospital and expansion of the training of doctors and nurses in the provision of low vision and vision rehabilitation services. These efforts will be supplemented by an increased awareness of the Center within the primary eye care clinics. A new electronic medical record system will be used to

identify prospective patients for referral to the Center.

According to Dr. Lu, there are plans for the expansion of training programs for doctors from other facilities in China, as well as an increased effort to attract support from charities for patients who cannot afford the services. Many of the plans for the future are based on what was learned during the six years of this Lavellesponsored project with SUNYCO. Dr. Lu looks forward to continued international cooperation with partner institutions in the United States and elsewhere.

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Rebecca Marinoff, O.D., clinical professor, State University of New York College of Optometry, 33 West 42nd Street, New York, NY 10036; e-mail: rmarinoff@sunyopt.edu. Michael H. Heiberger, O.D., associate clinical professor director emeritus, China Center of Excellence Project, State University of New York College of Optometry, 7 Burbank Court, Greenlawn, NY 11740; e-mail: heiberg@sunyopt.edu.