Centralizing Asthma Care to Meet Growing Need

Pudupukkam (PK) Vedanthan, M.D., established International Asthma Services (IAS) in 1987 to meet the growing demand for asthma and allergy care in India and around the world. In November 2015, Dr. Vedanthan’s work was recognized by the Center for Global Health with the “Excellence in Global Health Award”. The ‘Diploma in Allergy and Asthma program’ (DAA), which he established in conjunction with Christian Medical College, Vellore, India celebrated its 10 year anniversary in January 2016. Dr. Vedanthan has improved the lives of thousands of asthmatic patients through a global network of asthma camps and trainings.

The World Health Organization (WHO) estimates that 235 million people suffer from asthma. As a result of increasing urbanization and more particulate matter in the air, it is predicted there will be 100 million more persons with asthma by 2025.¹

The disease is largely under-diagnosed and under-treated, leading to approximately 250,000 deaths annually. It is the number one chronic disease faced by children.

Since asthma is exacerbated by industrialization and urbanization, it is not surprising that prevalence increased throughout the latter half of the 20th century. Asthma can be controlled with medications, but not cured.

Motivated by the challenges of this stubborn, costly disease, Dr. PK Vedanthan has devoted his career to understanding asthma, and providing quality care to those who suffer, especially those in the developing countries where the challenges can be overwhelming.

Dr. Vedanthan completed his medical training at Mysore Medical College in India, which is one of the oldest medical schools in the country, and also his father’s alma mater.

Shortly after receiving his degree in 1969, PK interned under pioneering pulmonologist Myron Stein, M.D., Associate Professor of Medicine at Brown University in Providence, Rhode Island. “Serving under him evoked my interest in respiratory medicine,” reflects Dr. Vedanthan. “This continued during my pediatric residency, when I found that patients with bronchial asthma were some of the most common and challenging cases.”

Dr. Vedanthan completed his pediatric residency at the Rhode Island Hospital, affiliated with Brown University. In 1974, he was selected for a fellowship in allergy and asthma care at Children’s Asthma Research Institute and Hospital, which later merged with National Jewish Health, a premier

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Bolivian Heritage: An experiment of nature to explore determinants of insufficient fetal growth

The University of Colorado has been a large contributor to the education and career of Colleen Glyde Julian, Ph.D., Assistant Professor of Biomedical Informatics and Personalized Medicine in the Department of Medicine at the University of Colorado Anschutz Medical Campus. In fact, she achieved all of her degrees here, earning a B.S. in Biology ’97; M.S., Applied Physiology ’99; and Ph.D., Health and Behavioral Sciences’07.

After receiving her master’s degree from the University of Colorado Boulder, Julian moved to Palo Alto, California where she continued her research related to human physiological responses to high altitude. Through this work Julian met Lorna Moore, Ph.D., Professor of obstetrics and gynecology at the University of Colorado. Moore’s research centered on the effect of high altitude on pregnancy outcomes in Bolivia, and Julian couldn’t resist the opportunity to return to Colorado.

Julian joined the University of Colorado to work with Moore and pursue her Ph.D. from the University of Colorado Denver. This path led to a long-standing collaboration on an important, understudied topic.

Sitting in a geographical bowl surrounded by the Andes Mountains of the Altiplano - the largest high plateau on earth outside of Tibet - La Paz, Bolivia lies between 3,100-3,600 meters (10,500-12,000 feet) where the effective oxygen availability for human consumption is ~40% lower than at sea level, and ~30% lower than Denver, Colorado.

Altitudes of this magnitude pose an extraordinary physiological challenge to the human body; namely, to deliver sufficient oxygen to the tissues despite reduced environmental oxygen availability (hypoxia).

Oxygen deficiency can present as circulation problems, depression, memory loss, respiratory distress, dizziness, sleep disorders, and immune system suppression2.

At 7,000 feet, there is 16% effective oxygen and the beginning stages of anoxia (tissue damage due to oxygen deprivation) appear. At approximately 14,500 feet, there is 12-16% effective oxygen, which causes humans to experience increased breathing and pulse rate, as well as impairment of muscular coordination1.

Amazingly, a healthy body can adapt to counteract the negative effects of moderately hypoxic environments by expanding the number of red blood cells, forming new blood vessels, and increasing ventilation.

During pregnancy, the physiological challenges of environmental hypoxia are magnified because of increasing metabolic and oxygen demands of the mother, as well as those of the developing fetus. When oxygen demands are not met during pregnancy, one potential outcome is insufficient fetal growth, or intrauterine growth restriction (IUGR).

In fact, the incidence of IUGR is approximately three times greater at high altitude than sea level, and is associated with an 8 to 20 fold higher risk of neonatal mortality. IUGR is defined as a birth weight under the 10th percentile for a given sex and gestational age (when comparing 100 normal children of the same sex and age, 90 children would be larger, and 10 would be smaller).

The United Nations Inter-Agency Group for Child Mortality Estimation reported that in 2015, Bolivia had an infant mortality rate of 31 per 1,000 live births. This was a small improvement over the 37 deaths per 1,000 live births in 2010.

However, this rate is still quite high compared to the United States, which had an infant mortality rate of 6 per 1,000 live births in 2015.

For the past eight years, Dr. Julian’s research has focused on the mechanisms underlying altitude-induced IUGR that began with her collaboration with Dr. Moore and, more recently, the impact of impaired oxygenation in early life on the development of pulmonary vascular dysfunction in adulthood.

Julian and Moore have worked together on several projects to investigate the physiological reasons why infants born at high altitudes are smaller than those born at lower altitudes.

Much of their work has taken place in Bolivia, where people live across a wide range of altitudes – from sea level to over 4500 meters/14,700 feet – allowing them to compare the influence of altitude versus socioeconomic factors for IUGR.

For their research, Julian and Moore collaborate predominantly with the Bolivian Institute for High Altitude Biology (IBBA). The research is based in two locations—a high altitude location in La Paz, Bolivia (3,100-4,100 meters/10,000-13,500 feet) and a low altitude location in Santa Cruz de la Sierra, Bolivia (300 meters/1,000 feet).

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respiratory research facility in Denver. He went on to establish a private practice in Fort Collins, Colorado in 1976, becoming the only asthma/allergy specialist between Denver and Billings, Montana for several years.

“I was quite busy, since there wasn’t even a pulmonologist in that region at the time. Eventually, I brought on some associates, which allowed me to go to India more often. After about 10 years, I had four associates,” he explains.

During his yearly visits to India he was shocked by the multitude of asthma cases among his own relatives and friends. This led Dr. Vedanthan to establish International Asthma Services (IAS) in 1992 to address the increasing need for asthma care globally.

“There is incredible interest in this condition because of its huge impact,” states Dr. Vedanthan. “Allergy and asthma are lifetime diseases. As urbanization increases, this disease will become more prevalent. That is what has happened in all these developing countries, especially a country like India, where urbanization has happened remarkably fast.”

PK started IAS programs by focusing on outreach to as many patients as possible. This took the form of Asthma-Allergy Awareness camps.

The first camp was conducted in Bangalore in 1987. PK and a local physician saw roughly 400 patients in three days. The camps are still conducted today, usually with the organizational assistance of local service clubs like Rotary International, hospitals, churches or temples.

The local groups organize space and advertisement. This is especially time consuming in India, where pamphlets, radio announcements, and materials provided during the camp must accommodate the many languages and dialects spoken in the country.

Local health professionals help recruit appropriate patients, and pharmacy representatives donate supplies. “We conduct group education for all participants. There are usually 50-100 people per one-day camp. Then we break into smaller groups for continued education and individual evaluation,” he explains.

So far, approximately 250 such camps have been conducted globally by Dr. Vedanthan and IAS, and nearly 37,000 patients have been evaluated free of charge.

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The educational component of the camps is critical. Dr. Vedanthan states, “An informed patient is generally more compliant and, therefore, easier to treat. A better-educated patient will seek medical care earlier and is more proactive than reactive. This ends in better patient management and reduced healthcare expenses.”

In addition to India, these camps have been held in Kenya, Mauritius, Argentina, Philippines, Russia, Myanmar, and Fiji.

He further describes executing these large-scale camps, “We are working with an extremely small budget, and so advance planning is important. Local physicians use a screening process to refer their own patients to the camp. I am returning to Myanmar in a few weeks, and the doctors are already registering patients. In addition to working with the patients, I will teach the local doctors about Peak Flow Meters and Spirometry, and will leave equipment there for their future use. I usually go to a place three times to reinforce lessons. We have developed India as a hub for training, and we can invite them to train there at a subsidized fee.”

PK understood that advancing asthma/allergy treatment and education would require more than just covering greater territory. “Camps have a limited role. They are helpful, but will not impact the way a disease is treated in the broad sense. Doctors will make the same mistakes in patient care, and the camps will not change their behavior. The best impact is in training the health professionals,” he explains.

PK Vedanthan, M.D., Founder of International Asthma Services

There is incredible interest in this condition because of its huge impact. Allergy and asthma are lifetime diseases. As urbanization increases, this disease will become more prevalent.”
In 1990, after conducting the camps for a few years, he shifted his focus to provide more training to physicians. “This gradually led to more formal activities through medical societies, colleges, and hospitals. We offered continuing medical education (CME) credits for these trainings,” he stated. This evolution led to the establishment of the Diploma in Allergy and Asthma in 2006.

This program centralizes training in India and leverages the faculty and resources at the Christian Medical College (CMC), in Vellore.

The year long distance-learning course includes week long segments of in-person training every quarter. The program has graduated about 350 physicians from India, Sri Lanka, Kenya, Indonesia, Rwanda, Myanmar, the United States, and Canada.

The momentum of the diploma program has been so strong that PK and the IAS organization established the Asthma and Allergy Network of India (AANI), a registered charitable organization dedicated to improving communication and referrals among diploma graduates. The network also provides a platform for clinical discussions and refresher courses.

“We have seen an increase in academic activity, too. There are more CME activities and poster sessions across India,” PK explains.

For those interested in even deeper exposure, Dr. Vedanthan has established a two-year fellowship in Allergy, Asthma and Immunology at the Christian Medical College (CMC) in Vellore. Along with the IAS advisory committee, PK and his colleagues at CMC have developed an immersive curriculum for this program. The program enrolled its first fellow in July 2015.

The expansion of IAS’ educational initiatives doesn’t stop there. 2016 will be the inaugural year for a scholarship with Global Chest Initiatives (GCI). GCI is a joint endeavor between International Asthma Services and Global Cardiology Services.

Two $1000 scholarships will be awarded to deserving health-sciences students at the University of Colorado. “I would like to encourage global medicine early in one’s medical career,” Dr. Vedanthan said.

Dr. Vedanthan’s dream is to establish the “Center of Excellence in Allergy, Asthma and Immunology” at CMC, Vellore. Such an institution would be the primary stage for all asthma activities. He has already started his quest to raise funds for this project, with IAS leading the way.

Student Scholarships in Global Health

If you are a graduate student currently participating or planning to participate in an international project, you may qualify!

**Robinson Durst Scholarship** - Scholarship per project: $2,000
**Rotary Scholarship** - Scholarship per person: $1,000
**Calvin L Wilson Scholarship** - Scholarship per project: $1,000
**Global Chest Initiatives Scholarship** - Scholarship per person: $1,000

Scholarship criteria and how to apply? [Click here!]

**DEADLINE — March 14, 2016**
“The particular relevance of this work for high-altitude Bolivian communities became quite clear the first time I interviewed a research participant and realized the vast discrepancy between the number of times she had been pregnant versus how many surviving children she had. Obviously, there are other social, health, and environmental factors that influence those numbers, but altitude is certainly a large contributor,” said Julian.

HERITAGE: A Protective Mechanism

Through the IBBA and several prenatal clinics, Julian and Moore gained access to pregnant women of native Andean and European ancestry living at sea level and high altitude in Bolivia.

Interestingly, altitude reduces fetal growth in all populations, but the effect is muted in Andeans. “Because Andean and European populations live at an extreme range of altitudes and have different levels of susceptibility to IUGR, we could study physiologic and genetic factors associated with protection against poor fetal growth, as well as factors that increased the risk of low birth weight in a hypoxic environment,” said Julian.

Their work, which was initially funded through a National Institutes of Health (NIH) grant awarded to Dr. Moore, has shown that the maternal vasculature doesn’t respond to pregnancy normally at high altitude.

At low altitude the uterine artery expands during pregnancy to facilitate adequate oxygen and nutrient delivery to the fetus.

In contrast, at high altitude the uterine artery does not expand to the same degree, which limits blood flow, nutrients, and oxygen to the developing baby.

However, there is a threshold for altitude’s effect on fetal development— in healthy pregnancy, altitudes below 2,500 meters/8,500 feet should not affect an infant’s growth. Julian reflected, “We’re currently trying to understand more about the molecular mechanisms by which hypoxia affects the maternal vasculature with the long-term hope of identifying potential avenues for treatment.”

Abnormal maternal vascular adaptation to pregnancy at high altitude is also likely involved in the threefold greater risk of preeclampsia seen at higher altitudes. “According to some of the clinicians we work with, many women who have complicated pregnancies are advised to descend to lower altitudes during the final stages of their pregnancy not only for access to facilities that are better equipped to handle high-risk pregnancies but also to lower the potential for complications such as preeclampsia or IUGR,” states Julian.

This recommendation is given to pregnant women who live in Summit County, Colorado as well. However, relocation from the highland regions of Bolivia is often not possible for many pregnant mothers due to social and economic factors, thus many remain at the extremely high altitudes through the rest of their pregnancy, risking their health, as well as their infant’s.

MOVING FORWARD: Pulmonary Hypertension in High Altitude Environments

With the support of the NIH’s Fogarty International Research Collaboration Award program, Julian recently completed a project demonstrating that perinatal hypoxia increases susceptibility to high-altitude polycythemia, a condition marked by excessive red blood cell production, and attendant pulmonary vascular dysfunction.

“Our work in Bolivia strongly suggests that poor oxygenation during perinatal life sets the stage for the development of pulmonary vascular dysfunction in early adulthood.”

Colleen Glyde Julian, Ph.D., Assistant Professor of Biomedical Informatics and Personalized Medicine

“Our work in Bolivia strongly suggests that poor oxygenation during perinatal life sets the stage for the development of pulmonary vascular dysfunction in early adulthood, and we have gathered additional support for this idea through experimental models here at the University of Colorado. At the moment, we’re trying to get a handle on the mechanisms underlying this link with the hope of identifying therapeutic pathways to not only prevent or treat hypoxia-related pregnancy complications but also their long-term consequences. The overall vision is to improve quality of life for people who are affected by hypoxia-related disorders or pregnancy – whether they live at high altitude or sea level,” stated Julian.

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Bolivian Heritage: An experiment of nature to explore determinants of insufficient fetal growth

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Julian will return to Bolivia in February to give a presentation at the International Congress of High-Altitude Medicine in La Paz.

“The work was truly a collaborative effort between Bolivian physician-scientists and ourselves. Their interest, I believe, stems from the fact that polycythemia and its severe pulmonary complications are a tremendous public health issue in high-altitude regions of Bolivia - it’s not a niche disease in their community,” said Julian.

Her paper was selected for the American Physiological Society’s prestigious APSselect program; a reference for this study can be found here: (http://www.ncbi.nlm.nih.gov/pubmed/26092986).

In 2014, Colleen was awarded the Child and Maternal Health Pilot Program Award from the Colorado Clinical and Translational Sciences Institute (CCTSI) for her work investigating the role of epigenetic marks for hypoxia-induced impairment of fetal growth with Dr. David Schwartz, professor of medicine and immunology at the University of Colorado Anschutz Medical Campus.

This award recognizes cross-disciplinary and collaborative clinical and/or translational research that strives to improve child and maternal health.

Two of Julian’s publications emerged, in part, from this award and can be found by clicking the following links.


Due to her varied and thorough experience, Julian was a highly qualified candidate for this prestigious award and we are excited to follow her work in the future.


Learn more about Dr. Glyde Julian’s work in Bolivia, contact her at colleen.julian@ucdenver.edu.

Picture of the Week

Some pictures do tell a story and the Center for Global Health is sharing a ‘Picture of the Week’ series on Instagram.

Contact Molly at molly.terhune@ucdenver.edu to submit your pictures.

So keep an eye out; one of the pictures may be yours!!

Like us on Facebook and follow us on Instagram at global.coloradosph.
New Center for Human Development
director reinvigorates global health

*Guatemala clinic is expanding rapidly, changing lives*

After years of teaching abroad and working with organizations like the United Nations and Doctors Without Borders, Tony Bolaños felt professionally fulfilled but personally frustrated.

Medicine, he thought, was all about healing patients yet he was seeing very few.

Then he heard about the Center for Human Development (CHD) operated by the Center for Global Health at the Colorado School of Public Health and Children’s Hospital Colorado on a banana plantation in rural Guatemala. Bolaños was working at a hospital in nearby Coatepeque so he came out for a look.

“I happened to find Dr. Edwin Asturias from the Center for Global Health there and we began talking about the project,” said Bolaños during a recent visit to the center which oversees the CHD. “He asked what I was interested in doing and I said I wanted to see patients.”

Not long after, Bolaños was hired as the CHD’s new director and is seeing more patients than he ever imagined.

In fact, thanks to his outreach efforts in the villages surrounding the plantation, the number of CHD patients have spiked from about 50 a month to a high of 354.

“I went personally to the health outposts and met with the leaders of the villages to let them know that we are here and we are ready to help them,” said 47-year-old Bolaños.

The Center for Human Development began three years ago with a $1 million donation from the Bolaños Foundation, run by Fernando and Gustavo Bolaños, owners of AgroAmerica, a major banana grower in Guatemala. The brothers were committed to providing health care to their 3,000 workers and their families.

The money along with funding from Children’s Hospital Colorado, allowed the Center for Global Health to assemble a modern, well-equipped clinic with medical professionals from a variety of disciplines working to bring quality health care to some of the poorest people on earth. The building itself was partly designed by CU Denver architectural students.

As partnerships go, the CHD is highly innovative – a host country, a private business, an American hospital and a university coming together to better the lives of an entire community.

Yet the challenges are staggering.

Child mortality rates in Guatemala – 30 per 1,000 live births – are the highest in Central America. Maternal mortality ratios of 136 per 100,000 live births are also the highest in the region. And those rates increase dramatically in rural areas like the tropical Trifinio region of southwest Guatemala where the clinic is based.

In those steamy coastal lowlands, residents use pit toilets and shallow wells for water. Annual flooding contaminates that water causing gastrointestinal disease and mosquito-borne infections.

Couple all of this with extreme poverty and a paucity of health services and you have one of the most daunting public health challenges on earth.

“If it was easy we wouldn’t need to be there,” said Stephen Berman, MD, director of the Center for Global Health. “Some of the biggest challenges are the most basic – clean water, good education, proper hygiene.”

AgroAmerica built the center, he said, but CU Anschutz and Children’s Hospital are there to ensure the highest quality health care.

“If you look back when we started with an open field and see what we’ve accomplished, it’s really quite impressive,” Berman said. “We have a building, a laboratory, equipment, training programs and now we are building housing for visiting doctors and nurses from CU Anschutz.”

As of September 2015, 18 pediatric residents have rotated through the clinic and during the 2015-16 academic year, 19 other residents have chosen to take part. CU Anschutz public health students and dentists along with family medicine, internal medicine and obstetrics and gynecology residents have also participated. A new birthing center is slated to open in March.

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As the center has grown, so has its mandate. It no longer just services banana farm workers. Now it provides care for the roughly 23,000 people in the villages around the farm with sometimes dramatic results.

Children who once died from treatable illnesses like diarrhea, or women suffering from complicated pregnancies now have a chance they never had before. Bolaños and his colleagues from CU Anschutz and Children’s can make a prompt diagnosis and treat the patients themselves or dispatch them to another hospital before it’s too late.

“The Center for Human Development has entered a new and exciting phase and Tony is a part of that,” said Dr. Asturias, director of Latin American Projects at the Center for Global Health. “We have been officially open for close to two years now and are now seeing pediatric, internal medicine, family medicine and obstetrics residents coming down to get formal training in global health.”

Asturias, a pediatrician instrumental in helping win the initial million dollar donation for the center, said Bolaños is not only from the area but is also a well-respected leader in health care education and health system coordination.

“He has dedicated himself to training our residents and has been successful in engaging the community,” Asturias said. “He is part of our effort to expand the reach of the CHD to the surrounding communities and beyond.”

Bolaños, no relation to the AgroAmerica directors, attended medical school in Guatemala City before working for Doctors Without Borders in northern Guatemala. He focused primarily on the spread of HIV. Later, he studied tropical medicine in Madrid where he was also a professor.

Bolaños eventually went to work for the UN’s Population Fund and taught epidemiology in Coatepeque, about 50 miles from the CHD.

As director, he’s seeking improved collaboration with Guatemala’s public health services to provide vaccines and nutrition programs to local residents. He’s also coordinating with the hospital in Coatepeque to make transferring patients easier.

At the same time, Bolaños is building support for the CHD in the local villages.

“Dr. Jacob Mark treats a patient at the CHD.

“It’s important to give them the correct information,” he said. “It’s frustrating when you hear rumors that are simply not true. And some residents are surprised to find that the services are not free.”

Banana workers pay about $2 per clinic visit while local residents pay roughly $3.50. The cost of getting to the hospital in Coatepeque and seeing a doctor can exceed $20 or more, a sizeable expense in such a poor region.

Despite the challenges, Bolaños finds the work invigorating.

“I love it. It’s a great feeling to be able to provide help to the people who need it most,” he said. “But it’s also sad sometimes.”

Like when he finds himself battling against traditional beliefs that can doom a patient.

“We had a 13-year-old come in very pale with what looked like renal failure,” he recalled.

“The mother didn’t take the child to a doctor because a local pastor said the disease was evil and needed to be cast out. The child died a week later.”

In other cases, the clinic has saved lives.

That happened recently when CHD nurses, who track pregnant women in the community, visited a mother the day after she gave birth. The baby was gravely ill, vomiting blood and refusing to eat. The health care workers swiftly brought the infant to the clinic and gave it an IV and other treatment.

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New Center for Human Development director reinvigorates global health

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“We thought she might have neo-natal sepsis,” Bolaños said. “We talked to the hospital resident and they said ‘Send her to us.’”

After a week of intense antibiotic therapy, the baby was saved.

“That post-partum visit from our center saved her life,” Bolaños said. “And that’s why I love doing this.”

Learn more about the Center for Human Development, click here.

Hundreds of local residents poured in to see the grand opening of the CHD in April 2014.

Jay Lemery, M.D.

He is the co-editor, along with Dr. George Luber of the Centers for Disease Control (CDC), of the textbook — Global Climate Change and Human Health.

The book shows how human health will be - and already has been - effected and how health care practitioners can advocate for change and prepare for the future.

Check it out!

Dr. Jay Lemery is an Assistant Professor of Emergency Medicine and Chief of the Section of Wilderness and Environmental Medicine at the University of Colorado Anschutz Medical Campus.

Human health will continue to be affected by the environment and extreme weather events, but health care practitioners working at the community level can help build human resilience and enhance recovery in the wake of climate-related disasters.

Spring 2016

February 4, 2016
3:30-4:30 | ED2 North 1103
Anschutz Medical Campus

Steve Radelet, Ph.D., Donald F. McHenry Chair in Global Human Development, Georgetown University, Non-Resident Senior Fellow, Brookings Institution

*The Great Surge: the Ascent of the Developing World*

March 16, 2016
12-1 | ED2 North 2106
Anschutz Medical Campus

David Kuwayama, M.D., M.P.A., Assistant Professor of Surgery, University of Colorado School of Medicine

*Evolving Challenges for Health Care Delivery in Conflict Zones: Perspectives of an MSF Surgeon*

April 13, 2016
12-1 | ED2 North 1107
Anschutz Medical Campus

Beth Fischer, M.C.R.P., Senior Technical Advisor for IntraHealth International

*mHealth Supports Community Health Workers in Uttar Pradesh, India*

May 11, 2016
12-1 | ED2 North 1103
Anschutz Medical Campus

Anna Stewart Ibarra, Ph.D., M.P.A., Assistant Professor, Department of Medicine, Latin American Program Director, Center for Global Health and Translational Science, SUNY Upstate Medical University

*Emerging Infectious Diseases in a Hotter, Wetter, More Urban World: Lessons Learned from Ecuador*

Want to watch a lecture you missed? [Click here.](#)