

Curing Disparity

Donald Burke, MD; Thomas Cook, PhD; Patricia Garcia, MD, MPH



Courtesy of Thomas Cook, PhD

Trainees from eight countries in Central and Eastern Europe who are involved in a University of Iowa project funded by the Fogarty International Training and Research Program in Environmental and Occupational Health gather at a meeting in Slovakia.

To eliminate health disparities worldwide, the U.S. National Institutes of Health John E. Fogarty International Center for Advanced Study in the Health Sciences fosters partnerships between U.S. scientists and foreign counterparts through grants, fellowships, exchange awards, and international agreements that support a range of activities. The stories that follow—about teaching epidemiologists in Thailand how to develop and run computer models of infectious diseases, helping developing democracies in Central and Eastern Europe build capacity in environmental and occupational health, and enhancing the contribution and participation of researchers in Peru to the global health agenda—are told by Fogarty-funded researchers who share their knowledge worldwide.

Curing Disparity: Epidemiology in Silicon

DONALD BURKE, MD

Dean and Jonas Salk Chair of Global Health in the Graduate School of Public Health at the University of Pittsburgh



Donald Burke

For two years I have been principal investigator on a grant from the U.S. National Institutes of Health to develop computer models of infectious disease epidemics that may be important to national security. My group decided influenza was a top priority, so we did two types of influenza modeling. For one part of the modeling effort, we worked with collaborators in Thailand to develop simulations of a hypothetical epidemic in Southeast Asia. Then we used the model to determine if intervention strategies could stop an early-stage epidemic in its tracks—what we call “quenching” an epidemic—in Asia before it spread worldwide.

To do that, we created a simulated population for Southeast Asia, focusing on Thailand. Our simulation distributed 85 million individuals onto a map according to population densities. We put them in households, schools, and workplaces—basically creating an artificial society in the computer. We computationally released an influenza virus into the

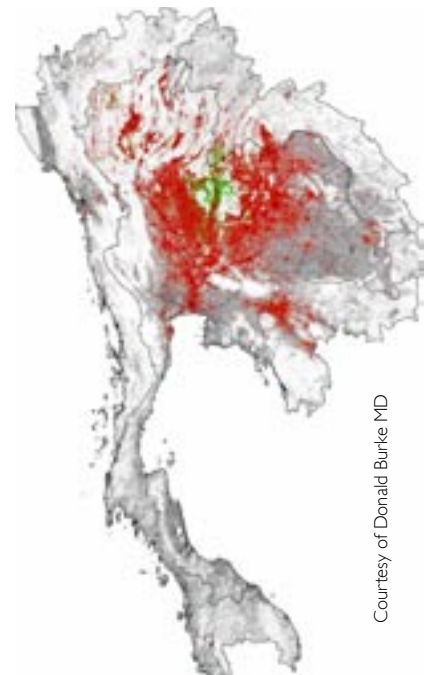
population and studied the transmission patterns that ensued. Then we evaluated what would happen if Thailand treated cases, treated families, closed the schools, or geographically restricted people’s movements. We are testing policies—plans, procedures, and actions designed to bring about a desired governmental goal, in this case epidemic control—in the simulation, and we call it “epidemiology in silicon.”

It isn’t possible to rigorously test policies before an epidemic explodes, but by doing it with a simulation that has some fidelity to natural patterns, you can ask if certain combinations of policies are likely to be more effective under certain circumstances. We published our findings in *Nature* magazine (September 7, 2005). The main conclusion was that if you responded to a nascent epidemic at a reasonably early stage—fewer than 50 cases—and used an aggressive strategy of treating the cases and everyone in the geographic area with antiviral drugs, it would be possible to contain or quench the outbreak before it became an epidemic.

The second part of our modeling effort, published in *Nature* on July 26, 2006, was to do the same thing for the United States—create a simulation of population density, movement patterns, households, workplaces, schools, distributed airline travel, and local travel. The difference in the United States is that we don’t expect to be able to completely stop an epidemic. At the height of a global pandemic, such a high percentage of potential travelers would be incubating or ill with influenza that stopping even 99 percent of air travel into the United States would still allow a large number of infected persons into the country by airplane.

These computer models are computationally intensive. We run the models thousands of times because every time we run them, just as chance influences reality, we get somewhat different results. To assess a policy, we have to run a simulation multiple times to see, on average, what effect an intervention-strategy policy option will have on the epidemic. Depending on the simulation, each run can take half an hour on a supercomputer.

In mid-2005, we were just finishing the Southeast Asia quenching modeling work when an opportunity came through the Fogarty International Center to



Courtesy of Donald Burke MD

Computer simulation of an outbreak of transmissible avian flu in Thailand. Red indicates new cases; green indicates areas where the epidemic has ended.

increase Thai involvement. The Thais were very expert from the policy side, but they didn't have modeling sophistication because most epidemiologists in Thailand don't have a background in computational modeling and simulation. With Fogarty's support, we worked with the Thai epidemiology training program through the Ministry of Health and provided training opportunities in modeling. The key collaborator there is Dr. Kumnuan Ungchusak, director of the Bureau of Epidemiology in the Department of Disease Control at the Ministry of Public Health.

Our group is working with the Thais on three levels. First, we worked directly with them as research colleagues to develop models. They were wonderfully helpful in this—we could not have completed our first modeling effort without our Thai colleagues. Second, we have worked on more classroom-oriented types of interactions, where larger groups learn the technology but are also exposed to computational approaches to modeling epidemiology. In June 2006, the Thai students completed a course for field epidemiologists. In addition to a regular epidemiology course, my junior colleague, Dr. Derek Cummings, gave a series of classes on modeling opportunities for 25 or 30 students in the class. Third, which isn't yet accomplished because we're still early in the program, we will identify degree candidates to work on projects that are in part related to modeling and simulation.

Curing Disparity: Environmental and Occupational Health for Developing Democracies

THOMAS COOK, PHD

Professor of Occupational and Environmental Health at the Center for International Rural and Environmental Health in the College of Public Health at the University of Iowa



Thomas Cook

Courtesy of Thomas Cook, PhD

At the University of Iowa, we began working with health professionals from Central and Eastern Europe in 1996 to help these low- and middle-income countries build their capacity to improve occupational and environmental health. Today, professionals from Hungary, Poland, Slovakia, and Romania work with us as part of the Fogarty International Training and Research Program in Environmental and Occupational Health, and program activities have included health professionals from as many as 13 countries throughout the region.

Environmental health issues can include water quality and the health effects of poor water quality, air and industrial pollution, and soil pollution by fertilizers, pesticides, heavy metals, and other contaminants. Occupational health issues include injuries and trauma in the workplace, industrial and agricultural injuries, and work-related chemical exposures.

There's a close link between occupational and environmental health issues, particularly in rural areas. Our focus at the University of Iowa is rural health. In the 1950s, we had one of the first centers for agricultural medicine in the United States, so we're very interested in rural health issues and have a fair amount of experience and expertise in issues like pesticide poisonings and water contamination in rural areas.

Some people believe living in the countryside is healthy and wonderful, but the data worldwide tell you differently—a large number of serious health issues are related to rural and remote populations. These include the lack of preventive health and emergency services for people who live long distances from medical facilities, and water contamination by pesticides and fertilizers. In several Central/Eastern European countries, as many as 80 percent of the rural villages have water supplies with chemical or biological contamination.

We help people in Central/Eastern Europe deal with environmental and occupational problems by training physicians and public health professionals in a wide range of specialties—people who know how to test well water, how to recognize health problems, and how to collect data so policies and regulations and laws can be changed. We've trained nurses, engineers, physicians, epidemiologists, and public health media specialists.



Courtesy of Thomas Cook, PhD

A Fogarty International Center/University of Iowa occupational health trainee conducts a survey related to well-water safety in Romania.

In each country, we identify at least one institution that is responsible for rural and environmental health and work with them to select and train the people they need. For example, the Nofer Institute for Occupational Medicine in Lodz, Poland, is that country's leading occupational health institution. We will soon welcome the seventh health professional from that institution to our training program on the University of Iowa campus. The model we use is what Fogarty International Center calls intermediate-term training, meaning the students come to the University of Iowa for a 15-week semester. We and our collaborators jointly identify a student, who travels to the United States and takes graduate-level courses in the College of Public Health or a related college. The student is also matched with a faculty mentor who has expertise in the student's field.

While they are at the University of Iowa, students formulate a small research project that will be funded and that they will work on when they return home. Within a year after they return home, their faculty mentor travels to the country and together they present a continuing education program for the student's colleagues and other professionals from the region. It gives the trainees recognition as experts, and they are able to share what they have learned. We think it's a great program.

It takes a few years for the training to pay off—to get a critical mass of experts in each country. In northwestern Romania, for example, the country's third largest city, Cluj-Napoca (population 350,000), is in a very rural area. To date, we've had five trainees from Cluj, young, energetic physicians who are working hard to expand the scope and impact of public health in their country. We've found resources to fly experts there to conduct seminars and workshops, and we've significantly expanded our use of Internet-based education programs to help in capacity-building efforts throughout the region.

Curing Disparity: Global Health Peru

PATRICIA GARCIA, MD, MPH

Principal Professor in the School of Public Health at the Universidad Peruana Cayetano Heredia in Peru and Chief of the Peruvian National Institute of Health



Patricia Garcia

Courtesy of Patricia Garcia, MD

At my university we are working to develop a global health framework and train a new generation of health scholars and investigators, doing so with the support of the Global Health Initiative of Fogarty International Center.

My colleagues—Dr. Eduardo Gotuzzo, Dr. Hector Garcia, and Dr. Bob Gillmann—and I at Cayetano Heredia are designing a multidisciplinary program related to global health and infectious diseases that includes people from the schools of medicine, public health, science (biology, chemistry, and mathematics), and mental health. We are also involving colleagues from other fields who have much to contribute to the study of the broad social and economic issues that relate to health. Specialists in social science, education, veterinary science, and dentistry are involved in our program, as are economists, sociologists, lawyers, and health communicators.

We aim to offer a master's degree in global health for our undergraduate students, and we invite people from other countries to come and learn about public health issues in global health in the particular environment that surrounds our institution.



Courtesy of Universidad Peruana Cayetano Heredia

Students participate in fieldwork for a Basic Concepts in Global Health course at the Universidad Peruana Cayetano Heredia in Peru.

Our Global Health Demonstration Program here in Peru was the only program outside the United States that Fogarty fully funded for three years.

In training a new generation of health scholars at Cayetano Heredia University, we want to strengthen the translation of research into health policies and practices, and enhance the contribution and participation of developing-country researchers to the global health agenda. We basically propose to develop a multidisciplinary global health curriculum for undergraduate and graduate students and create a master's degree in global health, initially with emphasis on infectious diseases but also on other areas we consider important, such as chronic diseases.

We also want to design and implement distance-learning programs, expand international faculty exchanges, and develop global health expertise at our university that is not currently available in Peru.

We have almost finished the first year of the program. The idea was to develop an administrative system that would allow different schools within our university to work together—which is usually very complicated in one institution—and have curricula that allow students from different schools to take courses together to promote multidisciplinary approaches.

This year we also launched our Web page (<http://www.globalhealthperu.org>) and two pilot courses—Foundations in Global Health and Basic Concepts in Global Health. In July 2006, we finished Basic Concepts in Global Health, a weeklong course for undergraduate students that includes the participation of different professionals. It's a broad approach to global health that covers economic aspects, social aspects, different diseases of global importance, and

fieldwork. We go up to the Andes Mountains for a day so students can put together issues of health and the environment. Next year we plan to extend the course to two weeks and open it to international students.

Another project completed in our first year was an international conference, the First International Conference on Health Problems With Global Impact and Relevance, held in August 2006 in Lima, Peru, for health sciences students and professionals.

For our second year, which started in September 2006, our goal is to organize our master's degree in global health and promote research in global health as part of the program. That will also be part of the third year. Both years will have international students—the interaction between international students and national students is key for the issue of global health.

The Taiwan government provided funding to launch the Peruvian health portal (<http://portal.globalhealthperu.org>). It is for people who are interested in coming to Peru or learning about diseases located geographically in Peru. Right now we describe only infectious diseases, but our idea is to eventually include mental disorders and other issues. We have health recommendations for travelers and are creating a database of studies of different diseases in Peru by Peruvian researchers.

The course on Foundations in Global Health is an open course for graduate students and has about 80 students. The idea of this course is to evaluate interest in these topics and create a forum for discussion of global health issues. At the end of the course, the students will present monographs on global health issues, and we will publish the best papers in a book that will be out in January 2007.

It's a great opportunity that we are able to promote the development of global health, interaction between researchers from other nations and Peruvian researchers, and the interests of undergraduate and graduate students in global health.

I would like to invite students from other countries who are interested in the program to visit our Web site and learn about how to participate in these courses and, eventually, in the research that will be done through this program. ■

The opinions expressed in the preceding articles do not necessarily reflect the views or policies of the U.S. government.