

This photo was taken after a 2009 guerrilla bombing in the city of Neiva, Colombia. In Neiva, and throughout the country, a dizzying number of trauma patients keep doctors busy. A Pitt partnership has helped Colombian doctors, and some Pitt students, find ways to do clinical research that could help many others in low-resource settings.

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FITTING INTO THE SYSTEM

WHILE THINKING BIG ABOUT TRAUMA CARE IN COLOMBIA | BY ALLA KATSNELSON

The two young men are fixed firmly in Matthew Kesinger's mind. Each was a 25-year-old soldier who had been tracking guerrilla fighters in the jungle of southern Colombia. Each found himself in the emergency room of the University Hospital in Neiva after stepping on a land mine.

The first man was brought in around 7 p.m., his left shin, foot, and ankle hanging by the tendons, and the bones of his lower leg completely severed. Kesinger helped Andrés Rubiano (Fel '09), director of the hospital's trauma department, stabilize the patient in the cramped trauma bay. Working with nurses and a resident, they warmed plastic sacks of platelets in their armpits before setting the bags up to transfuse into the man's body. When Kesinger and Rubiano stopped by the next day to check on him after his surgery, he was sitting up in bed, lucid, eating, and ready for transfer out of the intensive care unit.

The young amputee's doppelganger arrived a few weeks later, also with his left lower leg destroyed. But this second man was less lucky. Before arriving at the ER in Neiva, he had been pumped full of fluids in an effort to control his blood pressure, so he developed a dangerous build-up of fluid in the lungs, pulmonary edema. That, in turn, meant he had to be put on a ventilator. He spent 10 days in the ICU, the doctors unsure whether or not he would live. "This is a simple amputation. There's no reason this guy should die—but he barely made it," says Kesinger, a second-year medical student at the University of Pittsburgh who spent last summer in Neiva working with Rubiano.

The fate of these two patients was linked to the care they received before they arrived at the hospital in Neiva. Although it might be clear in hindsight that a particular intervention—such as administering lots of fluids—created problems, little or no guidance exists in Colombia for the care provided by rescue crews in the field. And the only way to determine what works best for specific types of injuries (or patients) is to take a systematic look by conducting a clinical research study. But despite the fact that about 80 percent of trauma care worldwide is administered in low-income environments, says Rubiano, the vast majority of clinical research on trauma—particularly in specializations such as neurosurgery—takes place in high-income countries. Those findings, he explains, are often not applicable to a setting like Neiva's critical care facility, where miniscule budgets, scant equipment, and a dizzying number of patients make conditions less than ideal. "People are not too motivated or prepared to do clinical research in this kind of environment," he says.

But Rubiano is part of a growing core of Colombian clinicians working to change that, with help from a program launched seven years ago at the University of Pittsburgh. It started with a five-year training grant funded in 2006 by the Fogarty International Center of the National Institutes of Health. The project, dubbed Trauma and Injury Excellence in Education on Research (TraInEER), was designed by Juan Carlos Puyana, an MD associate professor of surgery and critical care medicine at the University of Pittsburgh. The idea was to bring Colombian physicians to Pitt's Clinical Research Training Program and send them home with insight on how to apply for grants and conduct clinical research—and to teach others to do the same. That's how Rubiano found himself at Pitt in the summer of 2007 as one of two fellows chosen to kick off the program.

Rubiano has a round face and a warm, calm demeanor. Medical students at Neiva's South Colombian University consider him one of the school's toughest professors, yet they flock to him because of his reputation as a mentor. Many of them willingly wake up at 4 a.m. on weekends to accompany him on neurosurgery rounds. Neiva is Rubiano's hometown, but he studied medicine at the University of Valle in Cali in the mid-1990s. There the emergency room overflowed with trauma patients—casualties of the decades-old war between drug cartels or of liquor-induced violence and car crashes. He started running with the ambulances in his off hours, witnessing firsthand how strongly patients' outcomes were linked to prehospital care. After medical school, he returned to Neiva to start a program for trauma care in ambulances and then pursued his interest in neurosurgery with a residency in a private hospital in Bogota. The disparity between it and the overcrowded, underresourced public hospitals in Cali and Neiva shocked him and set him on this path.

At Pitt, he and the other fellows were tasked with writing a grant proposal, and Rubiano chose to focus his on a problem that had long bothered him. In high-income environments, patients who arrive with severe TBI are normally monitored in intensive care and sent to surgery only if brain inflammation and swelling swing out of control. But in Neiva,



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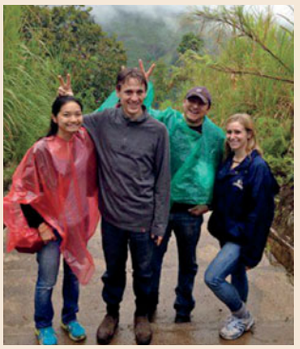
he says, "We do not have enough resources for ICU care." Hospitals like Neiva's generally lack intracranial pressure monitors—standard equipment in high-income settings. So knowing when to intervene becomes guesswork. As a result, death rates from TBI are two to six times higher. Rubiano thought a procedure called decompressive craniectomy, in which a piece of the skull is removed to alleviate pressure, could help in some cases. But the few clinical trials evaluating the procedure also relied on intracranial pressure monitoring. Rubiano wanted to design a trial that would identify other methods and parameters (such as eye, motor, and verbal responses; the presence of other injuries; and clues from CT scans) for deciding whether a TBI patient needs the procedure.

Garnering the experience to conduct such a trial would take some time. "The idea when I returned [to Neiva] was to apply all this knowledge," says Rubiano. "At the beginning, it was really difficult to try to fit that into the system." While at Pitt, Rubiano had dug into the literature on trauma management in military hospitals in Iraq and Afghanistan, which shared some key similarities to the level of resources and the types of patients that existed in his ER. Once home, he conducted a preliminary study with the World Health Organization that examined variations of care administered in the ER. Based on those data, he devised a standard protocol for treating trauma patients in low- and middle-resource countries and started using it at the hospital. In the United States and other high-income countries, surgeons routinely operate with the help of well-established protocols, but Rubiano believes his trauma protocol is a first for Latin America. He has faced some resistance from surgeons at the hospital who don't believe the protocol is necessary. But without data about the bigger picture, says Rubiano, surgeons are working in the dark. "When you don't have this view, you only discuss one case. And you feel like that is the entire reality of the system."

That's where Kesinger entered the picture. The two years he had spent as an emergency medical technician in the poorer neighborhoods of Boston before coming to medical school had fueled his interest in working again in a low-income setting. During his first year in school, he surveyed the options for a research project abroad and found Puyana; he became the first medical student from Pitt to sign on to this side of the exchange with Colombia. Puyana connected him with Rubiano, and the trio worked out a plan: comparing mortality and morbidity in TBI patients before and after August 2011—when the standardized protocol had been instituted. Kesinger recruited two other Pitt students—Lauren Salesi, a second-year Pitt med student, and Sandra Truong, a second-year student in Pitt's Graduate School of Public Health—to conduct summer research projects in Neiva, as well.

The Pitt med students worked with medical students from Neiva, training them to comb through patient medical records to identify the data necessary for their respective studies. It was a tough slog. Kesinger and five Colombian peers pulled data from some 5,000 medical records, mostly handwritten and some 600 to 1,000 pages long. The idea was to retrieve data on 100 parameters: Where was the patient transferred from? Was alcohol implicated? Did the patient develop sepsis? Pneumonia? Meningitis? When he wasn't on service with Rubiano, Kesinger would hike out to a tin-roofed warehouse that held shelves and shelves of brown manila folders; this was the hospital's records room. Kesinger would give the staff long lists of patient names, and they would either pull the physical files or copy an electronic version of them onto a flash drive. Sometimes he would walk over with the jovial director of the records department, and the two would brainstorm about how to raise $5,000 to hire one person for a year to build a comput-







COURTESY S. TRUONG AND L. SALESI



OPPOSITE PAGE: The countryside in southern Colombia, near a coffee plantation. CLOCKWISE, FROM TOP LEFT: Neiva students (shown here) Juan Camilo Barrios Torres and Astrid Ordóñez Muñoz worked with Pitt public health student Sandra Truong. Truong is doing a study on alcoholism, a major source of violence and car wrecks in Neiva. TOP RIGHT: Truong with Matt Kesinger, Andrés Rubiano, and Lauren Salesi in the mountains near San Agustín. Second-year Pitt med student Salesi investigated the epidemiology of pediatric brain trauma for a summer research project in Neiva. ABOVE: Students working in a courtyard behind their Neiva residence. BOTTOM LEFT: The Pitt students with Rubiano and Juan Carlos Puyana.

erized trauma registry with these 100 data points on every trauma patient admitted. "That could revolutionize health care in Colombia: $5,000," he says.

The group is still analyzing data from the study's 5,000 patients, dividing them into subgroups based on diagnoses. After returning from Neiva, Kesinger also trained three Pitt undergraduates to help collect data from the patient charts. The preliminary findings look promising: In patients diagnosed with intracranial trauma, mortality fell from 30 percent to 8 percent. And for all trauma patients, it dropped 26.5 percent (from 3.8 patients per 100 patients to 2.8) in the 10 months after the protocol was initiated. The plan is to publish the findings as soon as possible and also to publish the protocol in English in an open-source format. "We hope that in the coming years the protocol will be used and adapted to low-resource hospitals all around the world," Kesinger says.

Puyana longs to do more. In an urgently worded e-mail, he notes that the level of violence in Colombia has ebbed in the past six years, but in the rest of Central America and Mexico, damaging drug-control policies have ignited violent crime. "These countries are just beginning to live what Colombia has faced over the last 30 years," he writes. "We need to engage in a social revolution that can deal with the real roots of ever-growing violence in Latin America."

Yet the physician can take pride in instigating a smaller revolution of sorts—a clinical research movement that aims to help victims of trauma in Colombia and elsewhere.

Although the original 2007 grant to Pitt that trained Rubiano ran its course, the Fogarty Center recently approved funding for his clinical study on the efficacy of decompressive craniectomy. A larger Fogarty grant, from 2009, aims first to train 10 Colombian researchers in medical informatics at Pitt, then to establish workshops and seminars in clinical training back in Colombia. Ultimately, the hope is to set up a formal medical informatics course in Bogota's Javeriana University, Puyana's alma mater. "The beauty of these programs is that people are learning how to do their own thing," he says. "It began with a small seed, but now it's growing."

Rubiano's cofellow at Pitt that first year, Alvaro Sanchez-Ortiz (MS '10, Fel '13), stayed on to get a master's degree in clinical research and is now a research associate in Pitt's Division of General and Trauma Surgery and finishing his doctorate. He is examining the link between soccer matches, alcohol, and homicides. Another fellow alum, Carlos Ordoñez, now at the University of Valle, in Cali, is publishing often on trauma care. Ordoñez has also created a trauma fellowship program in Cali for surgeons—the first of its kind in Latin America. Rubiano would like to create a second fellowship specifically for neurosurgeons—one that would include extensive clinical research training. "We need to train people here the same way we have been trained," he says.

Kesinger is planning a longer research trip to Neiva. The two land-mine victims gave him an idea. Land mines, tools of destruction in the continuing drug war, wreak more havoc in Colombia than in any other country in the Western world. During his three months in Neiva, he saw about one land-mine injury per week. Inspired by Rubiano's efforts to develop national guidelines for treating TBI, Kesinger decided to try to do the same for land-mine injuries. He has applied for a Fulbright scholarship to fund such work in Neiva for a year. Kesinger has also been spreading the word among medical students interested in doing research on global health, hoping to spark others' interest in traveling to Colombia next summer to conduct projects of their own.

"Matthew has opened the way for other medical students to go down there and do similar work," says Puyana. The recruiting effort seems to be going well, Puyana notes. "I get an e-mail from him every other week that says, 'I told so-and-so about Colombia, and she wants to go.'"