



Bonanza, Nicaragua, is scenic but remote and impoverished. Most residents are involved in some way with artisanal gold-mining—difficult and dangerous work.

An Uphill Battle

By Amos Esty

Benjamin Jastrzembki is searching the streets and shops of Bonanza, a gold-mining town in northeastern Nicaragua, for the perfect piece of scrap metal. He spots a stainless steel bowl on a blanket laid out in front of a small shop. “That might work,” he muses as he pays for the bowl.

Jastrzembki, a 2008 graduate of Dartmouth College, sometimes wonders what local residents think he’s up to when they see him carrying around pots or pans or random bits of metal. Sometimes even he wonders what, exactly, he’s doing. But then he’ll be reminded of the difference that a few dollars’ worth of materials can make in this impoverished rural community.

In Bonanza, as well as many other towns in this part of Nicaragua, thousands of people make their living from small-scale, or artisanal, mining. The work is difficult, to say the least. Miners use picks and shovels, and sometimes dynamite, to extract ore from the hillsides above the town.

Then they load the ore into bags and bring it to local processors, where the ore is ground into a coarse mixture. That mixture is combined with mercury, which binds to gold, creating a mercury-gold amalgam that is much easier to collect than tiny flakes of gold alone. The miners take that amalgam and heat it—often over an open flame or a blowtorch—releasing the mercury as vapor and leaving behind the gold.

Sometimes, Jastrzembki says, the process is car-

Toxic pollution from small-scale gold-mining. Indiscriminate use of an antibiotic that can lead to hearing loss. Scarce or nonexistent health-care resources. Those are a few of the problems that are drawing more and more people with Dartmouth ties down to Nicaragua.

For a **WEB EXTRA** with more photos of Nicaragua, plus several short videos, see dartmed.dartmouth.edu/w09/we08.

Amos Esty is the managing editor of DARTMOUTH MEDICINE. Thanks to financial support from Dartmouth’s Dickey Center for International Understanding, he was able to travel to Nicaragua in July 2009 to do on-site reporting and photography for this article (he took all the photos, unless they are credited otherwise).



By the time Ben Jastrzembksi applied for the Fulbright, during his senior year at Dartmouth, he was already quite familiar with northeastern Nicaragua. He had made his first trip to the region in 2005.

ried out in the presence of children or pregnant women—two populations particularly vulnerable to the neurotoxic effects of mercury (which is both cheap and readily available in Nicaragua, unlike in the U.S., where it is highly regulated). Once, Jastrzembksi even saw a man burning amalgam indoors, over a kitchen stove.

Roughly a quarter of the world's gold production comes from artisanal mining. Mercury is almost always used by artisanal miners to help recover the gold, and most of that mercury ends up in the environment. By one estimate, for every ounce of gold produced by artisanal mining, two to five ounces of mercury are released.

In Nicaragua, that adds up to a lot of mercury contamination. The country is the leading gold-producing nation in Central America, with more than 500,000 ounces—over 15 tons—produced each year. It's hard to know exactly how much of that comes from artisanal mining (rather than from industrial mining, which typically does not involve the use of mercury), but it's a significant portion.

That explains Jastrzembksi's growing collection of scrap metal. He hopes to build a device called a retort that can be used during the heating of the amalgam to trap the mercury vapor, preventing it

Artisanal gold mining starts with extraction of the ore by hand, below. Then the ore is hauled down from the hills to be crushed. Above, Jastrzembksi (left) asks two local miners for feedback on a retort he's built, while they run their crusher—a machine known as a *molino*.



from making its way into the environment and the lungs of local residents. "It's unrealistic to ask people to not do artisanal mining," he says, "and it might even be unrealistic to ask people not to use mercury. The most important thing I think we can do is encourage the use of retorts."

The difficulty is in finding usable materials that are locally available and cheap—conditions that are essential but hard to meet. With a per capita

income of only about \$1,000, Nicaragua is one of the poorest nations in the Western Hemisphere. And Bonanza is isolated geographically, so any items not locally made are expensive. It's about a 12-hour bus ride over bumpy roads from Managua, the nation's capital. It's possible to fly to the more-populated Pacific coast, but at almost \$150, a plane ticket is out of reach for nearly all local residents.

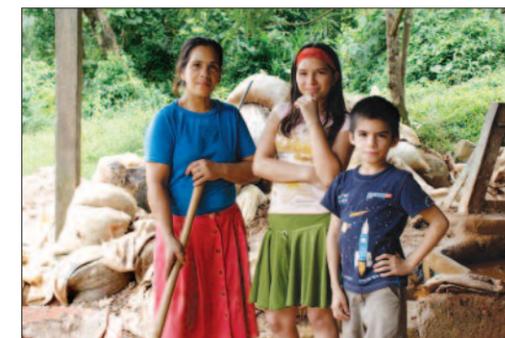
Jastrzembksi's work as an ad-hoc mining engineer was an outcome of his 10-month stay in Nicaragua on a Fulbright grant. From the fall of 2008, just after his graduation from Dartmouth, through the summer of 2009, Jastrzembksi lived in Siuna, a mining town just south of Bonanza. He spent the year interviewing artisanal miners and learning how the process works. Along the way, he identified the need for retorts.

By the time Jastrzembksi applied for the Fulbright, during his senior year, he was already quite familiar with northeastern Nicaragua. He had made his first trip to the region in 2005, when he was a sophomore, as a member of a service trip led every year by Dartmouth's Tucker Foundation. The participants—including undergraduates, medical students, and faculty members from both the Medical School and the College—travel to the rural region to provide medical services, run public-health workshops, and organize various other projects.

Jastrzembksi returned on the Tucker Foundation trip each of the next two years, serving as the student director of the program during his senior year. In 2007, he was awarded the Dean of the College Award for Service for his commitment to Siuna—which included, among other projects, organizing an exchange that brought six Nicaraguan university students to Dartmouth for two weeks.

In the summer of 2008, shortly before starting his Fulbright Fellowship, Jastrzembksi met James Saunders, M.D., a DMS otolaryngologist who, like Jastrzembksi, has a longtime interest in Nicaragua. In 1999, Saunders helped found a nonprofit organization that provides hearing-related health services in the rural town of Jinotega in northwestern Nicaragua. When Saunders heard about Jastrzembksi's upcoming trip, he wondered if the two might be able to collaborate.

With help from other members of the Dartmouth community, Saunders and Jastrzembksi began to plan a research project to investigate the effects of mercury on hearing loss among artisanal miners in Bonanza. Margaret Karagas, Ph.D., a DMS professor of community and family medicine who specializes in studying toxic metals, helped design the project. Several years ago, Karagas and Carol Folt, Ph.D., a professor of biological sciences at



Despite its dangers, mining is often a family business. At left is such a family, and above is their crushing machine, an *arastra*, which uses a different technology than a *molino*.

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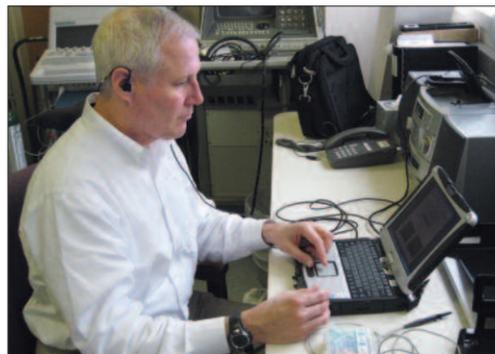
Dartmouth as well as dean of the faculty and acting provost, advised another Dartmouth student, Joel Wickre '03, who was doing a study of mercury exposure in Siuna. The current project, Karagas says, "is sort of the natural follow-up."

The most dangerous form of mercury is methylmercury, which is created when elemental mercury is released into the environment and taken up by bacteria or by animal species low on the food chain. As methylmercury makes its way up the food chain, it becomes increasingly concentrated—and increasingly dangerous.

In many countries, including the U.S., the main source of methylmercury exposure is through the consumption of fish. But Bonanza residents, even though they eat little fish, may suffer from the effects of chronic exposure to low levels of elemental mercury in the environment. Karagas explains that it's hard to know exactly what the effects of such exposures might be. "There are lots of questions we do not have answers to, especially at low levels," she says. "That's why we're doing the research."



Above, James Saunders (left) chats with a colleague between cases at DHMC, shortly after his return from Nicaragua. Below, Jay Buckley demonstrates a laptop-based program that he helped to develop and that has been used to test the hearing of Nicaraguan miners.



ent tests: one that measures the functioning of the inner ear; a second that gets an overall assessment of hearing; and a third that gauges the brain's ability to process sound. Using the three tests, Buckley says, provides a fairly comprehensive picture of a person's hearing.

On this recent trip, Jastrzembki also took fingernail samples that will be used to test mercury

The Dartmouth team hopes the fingernail samples and the results of the hearing tests will help them determine how widespread hearing loss is among miners in Bonanza, and whether exposure to mercury might be a contributing factor.

Mercury is known to be a powerful neurotoxin, and in a study of artisanal gold mining in Venezuela, the United Nations found that about a quarter of miners and their family members in one rural region exhibited signs of neurological damage from mercury exposure. Such damage often takes the form of impaired cognitive function, including problems with vision, memory, and muscle coordination. And although the effects of mercury on hearing loss in humans remain undetermined, a study in monkeys found that animals exposed *in utero* to methylmercury exhibited more hearing loss as they aged than did unexposed monkeys.

To examine the possible effects of mercury on miners' hearing, Jastrzembki returned to Bonanza in October. On this trip, he brought with him a computer program developed several years ago by Jay Buckley, M.D., a DMS professor of medicine and a former astronaut. Jastrzembki used the program, which was designed to assess astronauts' hearing during space expeditions, to test the hearing of miners in and around Bonanza.

The program is as well suited for use in rural Nicaragua as in outer space. It runs on a laptop and requires only a small probe fitted with speakers plus a microphone. The program includes three differ-

levels among the miners. The testing is now under way in the DMS Trace Elements Lab, and the results will show whether the mercury used in mining has made its way into the miners' bodies.

Eventually, the Dartmouth team hopes these samples and the results of the hearing tests will help them determine how widespread hearing loss is among miners in Bonanza, and whether exposure to mercury might be a contributing factor.

This project is just one of many that Saunders is working on, in an effort to unravel the causes of hearing loss in Nicaragua—and to do something to help those with impaired hearing. He made his first trip to Nicaragua in 1998 on a medical mission organized by a woman who attended his church. At the time, he lived in Oklahoma City and was on the faculty at the University of Oklahoma. He and the other volunteers on that trip spent time in several towns, but Saunders found himself particularly taken by Jinotega, a city of about 50,000 that sits in the mountains north of Managua. Unlike in much of Nicaragua, temperatures in Jinotega remain relatively mild, often climbing only into the 70s during the day and cooling down into the 50s at night. The lush green hills surrounding the town made a deep impression on Saunders. "It's one of the most beautiful places I've ever been," he says.

After that trip, Saunders began talking with fellow volunteer Mark Falk about establishing a permanent project in Jinotega. They returned to the area the next year and spent a week there. Saunders brought an audiometer with him to measure hearing loss in the patients he would see.

"I was expecting to see a lot of ear infections—but there are a lot of ear infections—but what I was surprised by was how many kids had hearing loss [but] didn't really have ear infections," he says. The finding concerned and intrigued Saunders and launched him on a quest to figure out the causes of such widespread hearing loss.

To start with, he and Falk set up a nonprofit called Mayflower Medical Outreach to provide otolaryngology clinics in Jinotega. In the years since, the organization has stretched the scope of its original mission in order to tackle problems underlying the need for hearing-related health services. "We went in thinking we were going to treat ear infections, so we got the things we needed . . . to treat ear infections," Saunders says. "Then we realized, 'Gosh, there's a lot of hearing loss here, so we need hearing aids.' . . . Then we realized, 'Well, wait a minute, these kids with hearing aids, we're sending them home with hearing aids and they've got no educational support, so we need to look at the



David Molter (left), a surgeon at Washington University who has joined several of Saunders's trips, operates here with assistance from a Nicaraguan surgery resident.

school. What do we need to do to support the schools?" Over time, he says, "you just keep getting deeper and deeper into the problem."

Every summer, the organization brings a number of volunteers to Nicaragua. In July 2009, 26 volunteers joined the trip, including surgeons, medical students, and nurses, plus a number of nonmedical volunteers. Together, they provide services that would otherwise be totally inaccessible to many Nicaraguans.

The 2009 trip illustrates how deeply Saunders has become involved in Nicaragua. On the day the Mayflower team flies into Managua, a Saturday, Saunders spends part of the afternoon talking to Daisy Enriquez, M.D., a Nicaraguan otolaryngologist who has worked with Mayflower for several years, about how to divide up the volunteers among the various projects.

Most spend the week in Jinotega, providing hearing aids, performing surgeries, or finishing up renovating and painting a boarding school that is home to a number of deaf children. Some head for Chinandega, a town west of Jinotega, to perform surgeries. And a few of the volunteers stay in Managua for the first few days, working in a temporary audiology clinic and performing surgeries.

While Saunders escorts the group that heads for Jinotega on Saturday evening, the volunteers staying in Managua set up shop at the city's Lenin Fonseca Hospital. The team—which includes physicians, a medical student, a nurse, and a technician—spends several days operating on patients with the help of Nicaraguan nurses and physicians. One volunteer, David Molter, M.D., is a veteran of

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DHMC audiologist Kerry Gudlewski (center) has just fitted this man for a hearing aid using a material that takes an instant impression, and she's now explaining to the patient and his wife how the device works.

In the past, Gudlewski says, some patients have not shown up to get their hearing aids. Using the instant materials allows her to ensure that people get the help they need.

a number of Mayflower trips. He knows Saunders from their days as residents together at Duke University Medical Center; Saunders asked Molter to join Mayflower's efforts several years ago. A pediatric otolaryngologist at Washington University in St. Louis, Molter spends part of Tuesday afternoon operating on a woman with a hole in her eardrum. A second-year Nicaraguan resident assists him, as other residents observe. Molter works confidently and steadily, explaining to the residents what he's doing as he proceeds.

With a long list of patients to see, the operating teams plan to work well into the evening. But at 6:30 p.m., as they wait for their instruments to be sterilized so they can start the next procedure, a Nicaraguan doctor tells Molter that the autoclave—the sterilization device—isn't working. He doesn't think the teams will be able to operate again until the next day. It's a frustrating delay for the visitors, but one that's clearly nothing unusual for the Nicaraguan doctor.

With the surgeries at an end for the day, Molter visits earlier patients now recovering in the wards. In the cool, almost cold, operating rooms, it's easy to forget the stifling heat and humidity of Managua in mid-July. The walk to the patient rooms offers a

quick reminder. Six or seven patients, and perhaps twice as many family members, are crowded into each room. Fans blow the hot air from one side of the room to the other.

Molter sits down near one of the day's first patients—a teenage girl. Through a translator, he explains to her family that the girl will soon recover fully. But the girl isn't listening—clearly she's already doing well, since she's talking away on her cell phone.

While Molter and other volunteers provide surgical solutions to Managuans' hearing problems, DHMC audiologist Kerry Gudlewski, Au.D., puts her diagnostic skills to use in a small 10-foot-by-10-foot office. A quarter of the space is taken up by a testing booth. The booth, which in the United States would be soundproofed, here offers only minimal buffering from the ambient noise. And the dim lights on the audiometer, which Gudlewski uses to chart patients' responses, require her to turn off the overhead lights so she can read the machine.

This is Gudlewski's second trip to Nicaragua with Mayflower; her first was in 2008. Nicaragua is badly in need of audiology services. During this trip,

she and another Mayflower volunteer, Debra Fried, Au.D., an audiologist from New York City, double the number of practicing audiologists in the entire country.

One of Gudlewski's first patients is a nine-year-old girl who is blind in addition to suffering from chronic ear infections that are causing hearing loss. When Gudlewski begins the examination, the girl starts to scream. Her mother explains that a local provider had tried to fit the girl for a hearing aid, but the process had been intensely painful; obviously, the girl remembers the earlier encounter.

The problem, Gudlewski later explains, was probably with the use of the material used to make a mold for a hearing aid. In order to make a mold of a patient's ear, Gudlewski uses a material that looks like Silly Putty. It is inserted into the ear, where it hardens to the exact shape of that individual's ear canal. "When you're doing an ear mold impression, you want to make sure that it doesn't stick to the eardrum because that is painful," Gudlewski says. "So you put in what's called an otoblock. That makes sure the material doesn't get to the eardrum." She thinks what probably happened to the girl is that some of the material seeped around the otoblock and hardened against her eardrum. When the impression was pulled out, it stuck to her eardrum, causing intense pain.

This year, Gudlewski says, the Mayflower team is equipped with materials that allow her to make instant hearing aids. Previously, she would have taken an impression, which would be brought back to the U.S., where the hearing aid would actually be made. But then the hearing aid had to be sent back to Nicaragua, requiring the patient to return to the clinic to pick it up. In the past, Gudlewski says, some patients have not shown up to get their hearing aids. Using the instant materials allows her to ensure that people get the help they need.

Before long, Gudlewski has an instant hearing aid ready for the young girl. When she's done, she asks the mother to bring her daughter back later in the week so that Gudlewski can make sure the hearing aid is set properly.

By Wednesday, when they return for the check-up, the girl's mood is dramatically improved. Gudlewski has her sit in the sound booth for a hearing test. When she is sure she has heard a signal, the girl shoots her arm into the air. When she is less sure, she lifts it slowly and waves her hand. Either way, she smiles as she responds.

When the test is over, Gudlewski gives the girl a lollipop. "Thank you," the girl says in English. Her mother thanks Gudlewski repeatedly, hugging her before they depart. "*Hasta pronto*," the girl says as she goes out the door. "See you soon."



Meanwhile, Saunders has spent several days in Jinotega, performing surgeries to fix chronic ear problems and continuing to study the underlying causes of hearing loss in the region. He has spent a lot of time since his first visit a decade ago trying to piece together the mystery of the widespread hearing loss he has found there.

Gudlewski is all smiles after she has been able to help this nine-year-old Nicaraguan girl, who is blind as well as hearing-impaired.

Gudlewski has the girl sit in the sound booth for a hearing test. When she is sure she has heard a signal, the girl shoots her arm into the air. When she is less sure, she lifts it slowly and waves her hand. Either way, she smiles as she responds.

Several years ago, Saunders put some numbers behind what he knew was a significant problem. In a study of schoolchildren in and around Jinotega, he found that 18% of them exhibited significant but previously undiagnosed hearing loss. In the U.S., by comparison, only about 3% of children have hearing loss. And Saunders believes the prevalence of the problem in Nicaragua may be even higher than 18%, because children who have severe to profound hearing loss may not attend school.

He also determined that many of these children came from families with a history of hearing loss. But in genetic tests, Saunders found that the mutations usually responsible for hearing loss in the United States were not to blame in Nicaragua. Not a single child had either of two mutations common in the U.S. among people with hearing loss.

During this year's visit to Jinotega, Saunders met with members of a local family that he hopes may help tease out other genetic factors. Many of the members of this family have hearing loss, indicating that there might be a hereditary factor in play. Saunders plans to continue to take genetic samples from family members and have them screened for other genetic mutations that may be responsible.



This is one of the special-needs classrooms in the Jinotega public schools; note the sign language alphabet. The girl on the left lives at the new home for deaf children.

Some of the deaf children were abused or abandoned by their families before being brought to the home. When they arrive, many have little or no ability to communicate but they pick up sign language very quickly.

But Saunders notes that there are other possible explanations for hearing loss in Nicaragua. One is the easy access Nicaraguans have to a class of antibiotics called aminoglycosides, which are known to have ototoxic side effects. Pharmacies in Jinotega sell such antibiotics for just a dollar or two—no prescription needed.

Then there's the ubiquitous environmental noise. Gudlewski says the lack of awareness about the danger of exposure to loud noise in Nicaragua is similar to the situation in the United States 50 years ago. She often sees patients in the U.S. in their 60s or 70s with significant hearing loss because they worked in noisy environments without ear protection. Now, she says, things have improved dramatically in terms of recognizing the need to avoid constant exposure to loud noise; she hopes the same will eventually be true in Nicaragua. "For a lot of these people, prevention is the only treatment you can give them," she says.

It's also possible that the high rate of hearing loss is the result of some combination of genetics, environmental influences, and the use of ototoxic antibiotics, with each factor exacerbating the others. Recent research has found that the combination of aminoglycosides and exposure to loud noise

can cause greater hearing damage than either alone.

While Saunders continues to try to unravel the causes of hearing loss in Nicaragua, all of the Mayflower volunteers work to ameliorate its effects. Just last year, Mayflower opened a home for deaf children that now houses about 15 youngsters between the ages of 6 and 13. Jinotega also has a public school that offers special classes for deaf children, a service that is not available in the isolated mountain villages outside the town.

For some of the children who live at the home, their hearing loss is so severe that it would be impossible for them to attend school otherwise. For others, it gives them a place where they are more accepted than they were among their families.

Sara Wernicke, a Mayflower volunteer who knows sign language and works with the children, says that some were abused or abandoned by their families before being brought to the home. When they first arrive, many of the children have little or no ability to communicate. But given a chance to be around other children with hearing loss and to attend school, they start to pick up sign language and other communication skills very quickly.

During the day, the children attend classes at a Jinotega public school, wearing the uniform required of all the school's pupils—white shirts, with blue pants for boys and blue skirts for girls. They return to the home after school.

In July, many of the Mayflower volunteers worked at the home, painting rooms and finishing work on a bakery attached to the facility. When it opens, the bakery will provide sustainable funding for the home. The work progresses steadily during the day while the children are in class. But in the late afternoon, after they return, work slows as some of the volunteers put down their paintbrushes to play with the children.

Later in the week, Saunders returns to Managua, where he and Fried, the audiologist from New York, are meeting with officials from a public university. They hope to set up a program that will train Nicaraguans to become audiology technicians. That way, some services that are now available only when Mayflower volunteers are in the country can be provided year-round.

Fried says there is no program in all of Central America as rigorous as the one they're planning; it will be a nine-month course. Their long-term goal is to establish permanent clinics in different parts of Nicaragua so residents will not have to wait for Mayflower's trips to have access to basic audiology services. Another long-term goal is to establish a nationwide screening program so that children with hearing loss can be identified and helped as early as possible.

Saunders and Fried hope to have the training program off the ground soon. They already have three potential students—including two of the nurses who worked with Gudlewski in Managua during her visit this year. Fried says it can be daunting to think about setting up such a program in a foreign country, but it's worth the effort. "People come here desperate for hearing services," she says. "You just have to follow through."

Saunders did not expect when he first went to Nicaragua that his involvement there would become so consuming. He reflects on his ever-deeper ties to the area several weeks after his return from this year's trip. "It can be overwhelming," he says. "You hang on to those little bits of progress that you make. I look at where we are now and compare it to where we were 10 years ago."

Over the course of that decade, Saunders's interest in Jinotega has grown into a broader engagement with global health problems generally. "That has been very rewarding for me," he says. "This has become, I would say, the major focus of my professional life. . . . Everything that I do these days in some way has something to do with global health."



Above is a street scene in Jinotega; the trip that Saunders's team made there this year fell right in the middle of the region's rainy season.

And after just two trips to Nicaragua, Gudlewski is already as enthusiastic as Saunders. "It really just makes me so happy," she says. "I love doing it."

On her last day in Jinotega, Gudlewski tests a 10-year-old boy. He has profound hearing loss in his right ear; his left ear is not quite as bad. Gudlewski explains to his mother that there is nothing that can be done for his right ear, and the mother's face falls.

But, Gudlewski quickly adds, his left ear can be helped. She takes an impression of his ear canal and says that a hearing aid will be ready soon. The mother smiles, but nervously, and asks how much it will cost. It's free, Gudlewski explains. The mother's face lights up.

When Gudlewski is done, she explains that the mother will be contacted when the hearing aid is ready to be picked up. The mother asks if Gudlewski will be there to put it on—she wants to bring Gudlewski a souvenir to help her remember Nicaragua. Gudlewski smiles. It's a nice gesture, but it's clear she won't need a souvenir to make the trip stick in her mind. "I can't wait to go back," Gudlewski says later, after her return to DHMC. "I'd go back next week if I could."

Like Saunders and Gudlewski, Jastrzembki is certain he'll get back to Nicaragua, too, even if he doesn't yet know in what capacity he'll do so. "I've invested a lot of energy and time in getting to know this area," he says. "It has a lot of interesting aspects, and it has a lot of need."

"I can't imagine myself not being involved in this part of Nicaragua for the rest of my life." ■

Saunders did not expect when he first went to Nicaragua that his involvement there would become so consuming. "It can be overwhelming," he says. But, he adds, it "has been very rewarding for me."

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The Longest Run

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whole hospital. "Write about this," he said.

So what is there to say? I felt frustrated by the occasional misunderstanding of—and, rarer, disregard of—the real me. But my doctors and nurses were focused on treating my illness. When they interacted with me, they aimed their words, understandably, somewhere between the delusional me and the rational me—never quite connecting with the real me.

But how could they? Even I couldn't see myself as I truly was. At one point, for example, I believed I would be discharged at the end of my third week in the hospital and would be able to run a few light miles that weekend. In fact, it was four months later, in December, before that was possible.

In the time that has passed since my illness, now years rather than months, I have come to understand that my essential self, the real me, began to emerge the minute I awoke from my coma. Beneath the delusions, the dreams, the infirmity, the stubble,

was someone fighting to stand on his own, to help his caregivers bring him back to good health. I have come to believe that this real me is something like the soul. It is what remains when an illness suddenly strips away good health and personal history. But it's invisible to those treating the illness unless they look carefully, and it's often obscured even from the patient himself.

There were moments in the hospital when I recognized only a faint flicker of this soul, so how could I expect the doctors and nurses to see it? Nonetheless, no matter how wasted a patient is, there remains an essential self he desperately needs to hang onto. And if he is to recover in a timely and effective way, he needs to believe that others see that essential self, too.

I now think that looking for this is key to healing the very sick. It will never supplant medicine's therapeutic arsenal. I could not have survived without the brilliant, aggressive care I received. I know I was lucky to have so many important pieces in place when I fell ill. That cannot be the case for every patient.

At one point near the end of my third week in the hospital, internist Ed Merrens explained to me, "When you came to the hospital, we took control of your body. Now, we are going to give it back to you."

Only by relinquishing myself to the experts was I able to survive. But once I did survive, I needed to be seen and understood so I could begin to really recover.

My recovery has been nearly total. There was a little permanent damage to my lungs, so I have to be careful if I get a chest cold. But through running and weightlifting, I have regained the body I lost during all those weeks in bed. In the fall of 2008, Dr. Walter O'Donnell, the Mass General pulmonologist who has monitored my return to health, looked up with a warm smile from the results of a breathing test I'd taken an hour earlier and said, "We just don't see results like this."

Even so, I don't run many races these days. But I did mark my recovery by doing the grueling Mount Washington Road Race again the next year, in June 2007. The 7.6-mile course has been called "sadistic" for its vertical rise of nearly 5,000 feet. I finished further back than I ever had. But it may have been the most satisfying race I've ever run. ■

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