



Mystery in the Fields

A rare form of kidney disease is killing laborers and crippling communities in three different regions, from Central America to Sri Lanka to India. As death tolls mount, researchers remain puzzled, unable to definitively uncover the disease's causes.



THE INTERNATIONAL CONSORTIUM
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COVER: Mihintale Dhammarakkita Thero, a monk in Sri Lanka, donated his kidney to a high school principal with a rare form of kidney disease. "Mystery in the Fields" explores how this disease is killing laborers in three different regions, from Central America to Sri Lanka to India.

Photo: Anna Barry-Jester

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Go online for more about this epidemic of chronic kidney disease, including video, interactive graphics and related stories:
www.publicintegrity.org/health/mystery-fields

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Society of Environmental Journalists:

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MYSTERY in the Fields explores how a rare form of kidney disease is killing laborers and crippling communities in three different regions, from Central America to Sri Lanka to India. As death tolls mount, researchers remain puzzled, unable to definitively uncover the disease's causes.

This project is an outgrowth of an earlier investigation, "Island of the Widows," published in December 2011 by the Center for Public Integrity and its International Consortium of Investigative Journalists. In that piece, reporter Sasha Chavkin exposed how chronic kidney disease was so prevalent in some regions of Central America it left communities filled with widows and scientists searching for answers.

Building from that research, Chavkin discovered that the disease had also developed in clusters in India and Sri Lanka. Over several months this year, he and video journalist Anna Barry-Jester traveled to the countries to tell the story from the ground, and pressed governments and leaders of the medical community for answers.

Their report is also being published or aired in news outlets including PRI's *The World*, the BBC, *The Sunday Times of Sri Lanka* and *The Week in India*. ■

Center for Public Integrity Wins October Sidney Award for “Mystery in the Fields” Investigation



Sasha Chavkin



Anna Barry-Jester



Ronnie Greene

Sasha Chavkin, Anna Barry-Jester and Ronnie Greene of the Center for Public Integrity won the Sidney Hillman Foundation’s October [2012] Sidney Award for its “Mystery in the Fields” investigation.

Sasha Chavkin is an investigative reporter based in New York City. He recently covered political advertising in the 2012 elections in “The Ad Wars,” a regular column for the *Columbia Journalism Review*. He has previously written for ProPublica and *The New York World*.

Anna Maria Barry-Jester is a multimedia journalist based in New Delhi, India. She previously worked as a producer for an award-winning global health series at ABC News. She holds a Master of Public Health from Columbia University. She has been researching and documenting chronic kidney disease since 2008.

Ronnie Greene is a senior investigative reporter and editor with The Center for Public Integrity. Also in October 2012, he received an Emmy Award for his

investigation, produced in partnership with ABC News, into the U.S. government's green energy spending. Before joining the Center, he was *The Miami Herald's* investigations and government editor; his last *Herald* project, "Neglected to Death," was a Pulitzer Prize Finalist for Public Service.

Sidney judge Lindsay Beyerstein interviewed the reporters about their story:

How did you become aware that a mysterious kidney disease was killing agricultural workers?

We first found out about this disease affecting one sugar plantation in Nicaragua. A large number of the workers were dying of kidney failure and no one could find its cause. A lawyer who was representing the workers told me about their situation — in one community so many men had died of kidney disease that instead of being called La Isla, The Island, it was referred to as the Island of Widows. From reporting on that story it became clear that this wasn't just

happening in one place. It was occurring all along the Pacific Coast of Central America, and as we learned later, the same kind of disease was affecting eastern India and Sri Lanka as well.

This was a wide-reaching investigation across multiple countries. Can you describe your strategy for reporting this piece?

There were two main challenges in this story: trying to figure out the mystery of what is causing the disease, and telling the stories of the people who are suffering from the disease. The difficulty in investigating the cause is that there are a lot of theories out there, which are backed up by varying amounts of evidence. We spoke to many scientists with different perspectives on this disease, and tried to assess which theories were the most plausible and had the best research to back them up.

We also travelled to the places that were hardest hit by the epidemic and followed the individuals who were suffering from it, who do not speak English and

often don't express emotion or talk about personal thoughts the way that many Americans do. These were mostly young and middle aged men who had been breadwinners for most of their lives, sometimes from shockingly young ages. All of sudden they were terribly ill, unable to work, and often didn't have long to live — and they had responses that varied from anger to resignation to one man who didn't even tell his wife and children the seriousness of the disease because he didn't want them to share in his suffering.

This is a medical mystery with political dimensions. Describe the vested interests shaping the response to the CKDu epidemic.

In two of the affected areas — Central America and Sri Lanka — this disease posed a threat to major agribusinesses that didn't want to see people rocking the boat about their practices. In Central America, the disease has largely affected sugarcane workers, and scientists have found that extreme heat and

the exertion of their jobs causes dehydration that damages the kidneys. The sugar industry has fought fiercely to prevent this from being classified as an occupational disease, and insists that it has nothing to do with their labor practices.

In every place the disease is occurring, the evidence suggests that an unknown toxic exposure is also a crucial factor. In Sri Lanka, the health ministry and World Health Organization recently said their research had found that the heavy metals cadmium and arsenic were key culprits, but they have yet to provide evidence to back that up. The likeliest sources of cadmium and arsenic are fertilizers and pesticides. The agribusiness industry in Sri Lanka insists that their agrochemicals are safe and abide by regulations, and have strongly criticized scientists who said otherwise.

The disease strikes in sharply defined pockets or belts, leaving farmworkers doing similar jobs in nearby areas unaffected. Why do you think that is?

The evidence suggests that a toxic exposure is causing this disease — which would mean that the areas where the toxin is present are at risk. The key piece of evidence for this is that everywhere the epidemic is occurring, workers are suffering from a rare type of kidney damage called tubulo-interstitial disease. Tubulo-interstitial disease is consistent with toxic poisoning and severe dehydration, and not with diabetes or hypertension, which are the most common causes of chronic kidney disease.

CPI used Kickstarter to help fund the project. Can you say a bit about that process? Was this your first foray into this kind of fundraising?

It was the first time using Kickstarter both for me and for CPI. We thought this would be a good project to work with because we had already done a story about this disease in Central America, and felt that gave us added credibility to fundraise for this project. Both Anna Barry-Jester and I have been report-

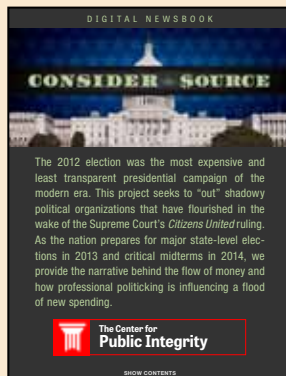
ing on this problem for several years. We felt that if we could communicate how urgent and how neglected this epidemic is, that we hopefully could get people to invest in our project and more broadly in informing the world about this problem.

Was there anything you wanted to include in the story that you had to leave out?

One issue that I wished we could have mentioned is the future outlook for this disease, particularly as it relates to climate change. The best evidence we have to date suggests that some combination of a toxic exposure and chronic dehydration from working in extreme heat are key causes of this illness. If the climate is getting hotter, that means that more people could be at risk in the same kinds of areas we've seen affected so far — rural communities where a large part of the population is engaged in manual labor in the fields. ■



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Introduction

As kidney disease kills thousands across continents, scientists scramble for answers

By Sasha Chavkin

Published Online: September 17, 2012

IN THE TINY Sri Lankan village of Sandamalgama, rice farmer Wimal Rajaratna sits cross-legged on a wooden bed, peering out toward lush palm trees that surround his home. Listless and weak, the 46-year old father of two anxiously awaits word on whether his body can accept a kidney donation that offers his only chance of survival.

In Uddanam, India, a reed-thin farmer named Laxmi Narayna prepares for the grueling two-day journey he takes twice every week. For most of his 46 years, his job involved shimmying up palm trees to harvest coconuts at the top. He now spends most



A woman bathes outside a well in the village of Sandamalgama, Sri Lanka.

Photo: Anna Barry-Jester

of his time negotiating the more than 100-mile bus trips he takes to receive the dialysis treatments that keep him alive.



A man holds his young sleeping children in La Isla, a community near Chichigalpa, Nicaragua, which has been hit hard by an epidemic of chronic kidney disease.
Photo: Anna Barry-Jester

Ten thousand miles away, in the Nicaraguan community of La Isla, Maudiel Martinez dreads returning to the rolling sugarcane fields where he spent most of his teenage years at work with a machete. Blood tests by the sugar company that employed him found that his kidneys were seriously damaged — and exertion beneath the tropical sun could

tip the 20-year-old's health into a lethal spiral.

In three countries on opposite ends of the world, these men face the same deadly mystery: their kidneys are failing, and no one knows why.

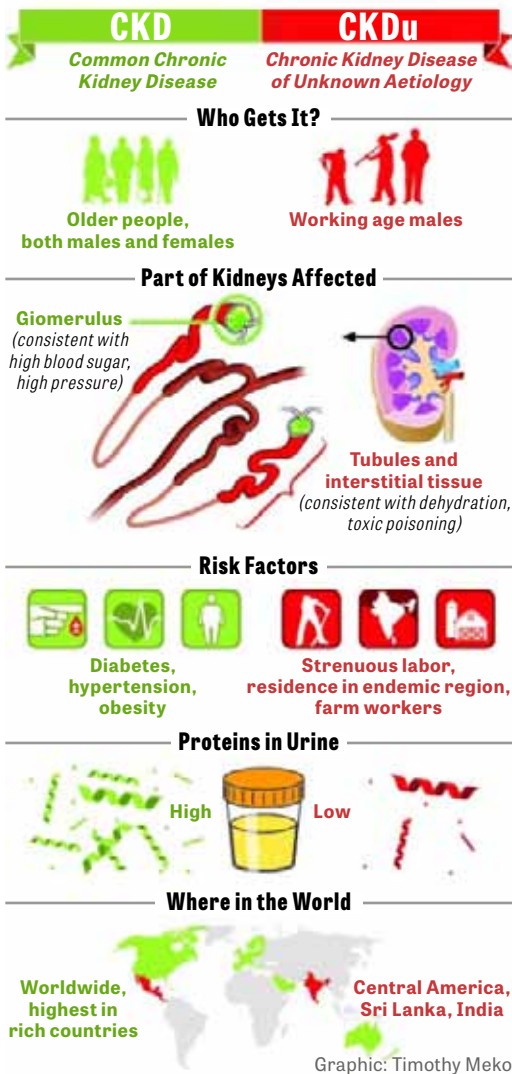
A mysterious form of chronic kidney disease — CKD — is afflicting thousands of people in rural,

agricultural communities in Sri Lanka, India and Central America. The struggle to identify its causes is baffling researchers across multiple continents and posing a lethal puzzle worthy of Sherlock Holmes.

The three epidemics have crucial threads in common. The victims are relatively young and mostly farm workers, and few suffer from diabetes and high blood pressure, the usual risk factors for renal disease. They experience a rare form of kidney damage, known as tubulointerstitial disease, consistent with severe dehydration and toxic poisoning.

Other common links offer clues to a possible cause. The epidemics affect sharply defined geographic areas that are stunningly fertile and swelteringly hot. The victims mostly perform heavy manual labor, have little formal education and lack easy access to medical care. Pesticides are used heavily, and communities drink local groundwater. In each case, the disease began surging in the 1990s.

What's the Difference?



Graphic: Timothy Meko

Despite a decade of research in each affected region — and a potentially noteworthy discovery this year in Sri Lanka — scientists have yet to prove a chemical at fault or a means of exposure. Researchers are convinced that if they could identify the culprit, the outbreaks could be stopped and the death toll reversed.

“I absolutely think that it’s preventable,” said Daniel Brooks, an epidemiologist at Boston University who is leading a study in Nicaragua of the new form of CKD. “I’m very convinced that what is happening to individuals is from some sort of exposure.”

In a sense, researchers are waging a race against three parallel epidemics occurring across multiple continents. Yet the search for clues was slow to begin, with governments including the United States moving with little urgency despite warnings of the disease’s toll. And separate groups of researchers — each chasing clues to kidney epidemics across the globe — have not fully explored whether they are linked together.

The new form of CKD is not officially recognized in the Americas even though kidney disease has killed more people in El Salvador and Nicaragua than diabetes, HIV/AIDS and leukemia combined in the

last five years on record, the Center for Public Integrity found.

In a disease not yet formally recognized, researchers cannot say how many have fallen ill. But the death toll reaches tens of thousands.

More than 16,000 men died of kidney failure in Central America from 2005 to 2009, with annual deaths increasing more than three-fold since 1990, according to an analysis of World Health Organization data. In Sri Lanka, the WHO says at least 8,000 people suffer from chronic kidney disease of unknown cause, though other sources put the number more than double that. In the Indian state of Andhra Pradesh, more than 1,500 have been treated for the ailment since 2007.

“There’s a need to connect all the dots between these different outbreaks,” said Dr. Ajay Singh, a nephrologist at Harvard Medical School who is leading a study of the epidemic in India. “Our premise should be to first look for common causes.”

The response has been fragmented in part because wealthy countries and international institutions have been reluctant to recognize the problem. Most CKD is caused by diabetes, obesity or hypertension, all fast-growing problems in the developing world. Health of

ficials have sometimes blamed the usual suspects of unhealthy diet and lifestyles for any increase in CKD in poor countries — a diagnosis that neglects the possibility of environmental exposure.

“Nephrologists and public health professionals from wealthy countries are mostly either unfamiliar with the problem or skeptical whether it even exists,” said Dr. Catharina Wesseling, the regional director for the Program on Work and Health (SALTRA) in Central America, which pioneered the initial studies of the region’s unsolved outbreak. “The response from the North and from international agencies must be much stronger.”

In the meantime, thousands of villagers are dying each year from an ailment triggering as many questions as answers. Are tainted agrochemicals to blame? Dehydration in the fields, aggravated by dangerous working conditions? Or could multiple culprits exist, with different causes in each region?

From Sri Lanka to India to Central America, all the victims know is that something in their lush, hauntingly beautiful surroundings is wasting away their lives. In one patch of rural Nicaragua, so many men have died the community is called “The

Island of the Widows.” In the Indian region of Uddanam, a reverse trend has taken hold: Couples decline to marry at all.

In Sri Lanka, a Suspect Emerges

Wimal Rajaratna has worked in the rice paddies since he was 20. He enjoyed good health until December 2011, when he began suffering an alarming array of pains. His head pounded, his knees ached at the joints, and his appetite deserted him.

He traveled from his home in Sandamalgama — a village of 27 families — to the doctor in the nearby town of Horowpathana. Tests revealed that his levels of creatinine, a chemical in the blood that indicates kidney function, were an astronomical 9.45 mg/dL — more than seven times higher than normal. He had chronic kidney disease, advanced into its late stages.

Rajaratna’s illness is part of an epidemic sweeping northern Sri Lanka. The disease affects three provinces in the north central region of the country, and estimates of the number of patients range from 8,000 by the World Health Organization to nearly 19,000 in a tally based on



Wimal Rajarathna receives dialysis treatment at Anuradhapura General Hospital.

Photo: Anna Barry-Jester

hospital records compiled by independent researchers. Prevalence in the affected region is 15 percent, according to unpublished results from a three-year study by the Sri Lankan health ministry and WHO.

The government has even come up with a name for it: CKDu, chronic kidney disease of unknown etiology.

Since 2009, the health ministry and WHO have embarked on the world's largest and most comprehensive study of CKDu. They have sampled patients' blood and urine,

tested the soil, water and food, and surveyed and mapped the population of the affected region. "We need to do full-blown research on this and then find out the causative agents," said Dr. Palitha Mahipala, additional secretary of health for Sri Lanka and the leader of the official study.

Still, despite growing public pressure and repeated promises of definitive answers just months away from release, the official program maintained complete silence about its findings for three years.

Finally, in June 2012, the health ministry and WHO publicly identified chemicals they said were an essential cause of the disease. The culprits: The heavy metals cadmium and arsenic, through low-level exposure likely occurring through the food chain. “It’s not a mystery,” said Dr. Shanthi Mendis, the Coordinator and Senior Adviser of the WHO non-communicable disease program and the lead adviser of its efforts in Sri Lanka.

Cadmium and arsenic are both toxins with an array of human health effects that include kidney damage. Cadmium is often present in phosphate-based fertilizers, while arsenic has been detected in several Sri Lankan pesticides and also occurs naturally in some parts of South Asia.

The official findings in Sri Lanka represent a potential breakthrough, with implications in Central America and India. But the scientific program has not yet released any of its data behind its findings — leaving questions unanswered and lingering doubts about its conclusions.

In sufficient quantities, cadmium and arsenic cause the same rare type of kidney damage found in the disease’s victims. However, researchers Mahipala and Mendis said most of

their patients’ tests and environmental samples showed these chemicals at levels below the exposure limits set by United Nations agencies.

“It has not exceeded the limits,” Mahipala said. “But now we are just thinking when somebody is exposed to these heavy metals over a long period of time,” damage to the kidney tissue could result.

Mahipala acknowledged that “we can’t really come to a conclusion” about the effects of specific exposures that remain within international limits. Neither he nor Mendis offered evidence to explain how these metals had entered the food chain or the bodies of victims at levels sufficient to cause CKD.

The WHO says it will release official study results in late October that will include hard data. The program is also embarking on research of dietary patterns in the affected region to better understand exposure levels.

Chemicals in Question: Big Business in Sri Lanka

Some evidence suggests that cadmium and arsenic have been disseminated through fertilizers and pesticides, whose import is financed by the Sri Lankan government. So, any

definitive link between agrochemicals and public health failings would carry significant consequences.

Sri Lanka's agrochemical industry disputes the notion that its products are at fault. "We can guarantee that pesticides produced by many multinationals and international companies, they follow all the WHO and FAO [Food and Agriculture Organization] guidelines," said Rohitha Nanayakkara, secretary of Sri Lanka's National Agribusiness Council. "We believe that those are not in harmful levels."

In June 2011, Sri Lanka's Registrar of Pesticides briefly banned several leading pesticides such as glyphosate and carbofuran after tests found they were contaminated with small amounts of arsenic. A few months later, it reversed the ban after concluding that the arsenic levels were too low to pose a serious threat.

The ban was overturned even as the WHO's internal meeting notes in June 2011 called for stronger regulation of "nephrotoxic agrochemicals" — and warned that any delay would cause "further accumulation of toxic agents in the environment and result in cumulative damage to the health of the people living in these areas."

As the fuller details of research remain undisclosed, Sri Lanka's well-regarded health service struggles to meet the massive need in the affected area. Local doctors say that as few as one of every five patients that need dialysis are approved to receive it. Public hospitals offer kidney transplants if patients can find their own donors and pay a substantial portion of the costs of necessary medications.

In Rajaratna's case, a friend of his family has offered to donate a kidney. As Rajaratna awaits the result of blood tests to determine if he is a match, he travels more than 60 miles twice a week to get dialysis, sleeping on the concrete floor of the hospital when his treatment goes too late for him to take the last bus home. He has no idea how he became so sick.

"That's what I need to know," he said. "What happened to me?"

In India, the Trouble in Uddanam

Laxmi Narayna's village, Gonaputuga, is part of a verdant rural belt along India's eastern coast called Uddanam. Spanning less than 100 miles, this stretch of villages near the northern border of the Andhra Pradesh state has been suffering



Laxmi Narayna undergoes dialysis treatment at Seven Hills Hospital in Visakhapatnam, India. The coconut farmer travels hours to and from the city each week for treatment, but according to his doctor, “on dialysis people don’t do well. Holding on for a year would be just about it.

Photo: Anna Barry-Jester

for two decades from a mysterious strain of CKD.

Healthy throughout his 46 years, Narayna began experiencing a painful series of ailments in late 2011. His body began to swell, he had difficulty urinating and he found blood in his stool. He visited a doctor in the closest major city, Visakhapatnam,

where he learned he had CKD.

Unable to work after decades spent harvesting coconuts from the top of palm trees, Narayna spends his days resting and traveling back and forth from dialysis in Visakhapatnam. “Now, I do nothing,” he said. “I take medicines and be.”

India’s wave of CKD is smaller

than the other outbreaks — but highly concentrated. Unpublished results from a study by Harvard Medical School found that 37% of the population in the hardest hit village, Akkupalli, had the disease. From 2007 to 2012, 1,520 patients from Uddanam received care for CKD from a state health insurance program for the poor. But this number significantly understates the burden of a disease that is latent until it reaches its advanced, deadly stages.

Unlike Sri Lanka and Central America, the illness affects men and women roughly equally, according to separate findings by researchers from Harvard and Stony Brook University. The gender equality and geographic concentration of the illness have focused concentration on potential contamination, particularly in the drinking water.

“This seemed to be an exposure to the community as a whole,” said Singh, of Harvard. Dr. Ravi Raju Tatapudi, a leading nephrologist in Andhra Pradesh and the other study director, said heavy metals and pesticides running off from the fields into the groundwater were the group’s primary suspects.

Despite years of attention to the disease, not one study has been pub-

lished about Uddanam CKD. The Harvard group has conducted extensive tests of the groundwater and soil in the area, but the results have been delayed for months at a laboratory in Hyderabad.

For Laxmi Narayna, time is running out. At the Seven Hills Hospital, he smiles bravely and says he feels no pain, but his thin frame is dwarfed by the wide cot he rests on and the hulking hemodialysis machine attached by tubes to his arm.

“On dialysis people don’t do well,” said Narayna’s doctor, Ravi Shankar Machiraju. “Holding on for a year would be just about it.”

In Central America, the Science of Sweat

Maudiel Martinez started working in the cane fields at 14. His father had died of CKD two years before, and his family was struggling. After three years of work at the Ingenio San Antonio plantation, he was diagnosed with CKD at 17.

He continued to work — providing false identification to contractors who looked past the fact that his permit carried a woman’s name.

The epidemic in Central America spans six countries along a nearly 700-mile stretch of the Pacific coast.

Across the region, kidney failure has killed more than 2,800 men each year from 2005 to 2009, according to an analysis of data from the WHO. In El Salvador, the kidney disease has become the second leading cause of death among adult men.

Groups of sick workers picket the gates of powerful sugar companies, demanding that the ailment be compensated as an occupational illness.

The Ingenio San Antonio sugar plantation is the epicenter of the fight. There, workers have been protesting for nearly a decade, alleging that the company's pesticides and labor practices caused the disease. After the World Bank provided the Ingenio San Antonio with a \$55 million loan in 2006, workers complained to the Bank's ombudsman — leading to an agreement that the company fund the ongoing Boston University study.



Luis Asavedo, 37, hours before he died from chronic kidney disease in Nicaragua. His wife and 9-month-old sat with him in the final hours.

Photo: Anna Barry-Jester

The BU team has pinpointed evidence suggesting that heat stress and dehydration are key contributing factors. Workers who performed strenuous labor in the sun, such as cane cutters, suffered significantly more kidney damage over the course of a single harvest season than those with less arduous job responsibili-

ties, the researchers found.

However, recent tests of adolescents found that many had markers of kidney damage without ever having entered the fields — suggesting a pre-existing exposure as well.

Brooks, the leader of the Boston University team, hypothesizes that a toxic exposure may render the population vulnerable but is not enough to trigger the disease by itself. “It doesn’t actually go to chronic kidney disease until you get what I would call the second hit, which would be the strenuous labor and the dehydration that may come from this difficult work,” he said.

Researchers in El Salvador have also uncovered intriguing clues. A study published in April found that low-lying, coastal communities that grew sugarcane and cotton were both swamped by the disease, while a sugarcane community at a higher altitude was barely affected — illustrating the vital role of geography. In Costa Rica, the government has launched a study that will seek to officially determine whether the illness is an occupational disease.

Workers like Martinez continue to place themselves at risk to support their families. At 20 years old, he is recently married and his wife is expecting a baby. “I feel like every

day I work I’m taking away a little part of my life,” Martinez said.

“We work there because the company is the only option we have.”

Missed Opportunities

As the economic and human costs mount, governments have begun to fund studies and treatment programs. El Salvador has launched an initiative called NefroLempa that targets chronic kidney disease, the state of Andhra Pradesh has created a health insurance system for the poor and built new dialysis facilities, and Sri Lanka has worked closely with the WHO on research.

But international institutions and wealthy nations have repeatedly failed to connect the dots, let alone invest on a scale some experts say is necessary.

At a 2011 health summit in Mexico City, the United States beat back a proposal by Central American nations that would have listed CKD as a top priority for the Americas and adopted an official consensus that the Central American epidemic had distinct causes from most CKD.

“The idea was that to keep the focus on the key big risk factors that we could control and the major causes of death: heart disease, cancer and

diabetes,” said David McQueen, a U.S. delegate from the

Centers for Disease Control and Prevention who has since retired from the agency. “And we felt, the position we were taking, that CKD was included.”

McQueen’s comments reflect the widely held view that any CKD in developing countries stems from diabetes and other diet-related risk factors rather than a new form of illness.

For its part, the WHO has not made any connections between the studies it is supporting in El Salvador and in Sri Lanka. In Central America, it has neither adopted a formal name for the disease nor considered whether it is related to the illness that it recognizes as “CKDu” in Sri Lanka.

The WHO has not kept a record of outbreaks similar to CKDu — there have also been comparable reports in Egypt — and believes that it is premature to extrapolate findings from Sri Lanka onto other regions.

CKD researchers are beginning to study each other’s work independently. Scientists from Boston University, the Central American NGO SALTRA, and Sri Lanka have shared notes, and many will convene at a SALTRA-organized con-

ference in Costa Rica in November. “We definitely need to see this as a global epidemic, but we must not forget that there may be important local causes and drivers,” said Wesseling, the SALTRA director in Central America.

But so far, none of the scientists have systematically compared the epidemics or joined forces across regions to explore the broader phenomenon. The teams from Harvard and Boston University, based half an hour apart, have never met.

The medical mystery is so difficult to solve in part because the pieces do not fit together easily. It is possible that each epidemic has a different cause: pesticides in one place, hard labor in another and an unexamined risk factor such as genetics in the third.

Yet most on-the-ground researchers believe they are connected.

“We’re talking about these outbreaks that are happening among poor agrarian residents of these countries, mainly among men ... and that do not seem to be explained by diabetes or hypertension or any of the typical risk factors,” said Boston University’s Brooks. “So those things lead me to really think there’s a good chance they are in fact connected.” ■



For more than a decade, a rash of chronic kidney disease has been striking down the villagers of this remote agricultural belt along the northern coast of Andhra Pradesh, India.

Photo: Anna Barry-Jester

India

Verdant terrain conceals clues to the cause of a fatal kidney disease

By Sasha Chavkin

Published Online: September 19, 2012

A TANGLE of green blankets the land amid thick tropical heat. Shady groves of cashew trees strew the ground with juicy, perfume-scented fruits. Men

can be seen climbing coconut palms to tap into the trunks for wine. The region's name, Uddanam, comes from a word in Sanskrit that means "Beautiful Garden" or "Paradise."

Uddanam's rich terrain seems an unlikely place for the mysterious strain of illness tormenting the area. For more than a decade, a rash of chronic kidney disease has been striking down the villagers of this remote agricultural belt in the state of Andhra Pradesh, India. In some villages, the disease has impacted from 24 to 37 percent of the population, two to three times higher than elsewhere in the district, according to unpublished results from a study by Harvard Medical School.

As the death toll mounts, the seemingly idyllic region has become stigmatized. In contrast to Nicaragua's "Island of the Widows," which is named for the alarming rate of chronic kidney deaths among the community's husbands, residents of Uddanam say they now have trouble getting married at all.

"Other people, they don't want to come for marriage," said Dr. Priya Prathibha, the state medical officer in the hard-hit village of Varaka. "They are not giving any bride or bridegroom to this area, this Uddanam area."

Uddanam's victims have much in common with those of the unexplained epidemics in Sri Lanka and Central America. They come from farming communities and are

mostly poor. Few suffer from diabetes or hypertension. The climate is sweltering, toxic pesticides are used liberally, and biopsies show the rare pattern of tubulo-interstitial kidney damage. This type of damage accounts for less than 4 percent of end-stage renal disease in the United States, and is consistent with severe dehydration and toxic poisoning.

Yet in other ways Uddanam is different. The research to date suggests the disease is confined to a single belt of villages that spans less than 100 miles. Despite men's traditional role in the fields, both sexes are affected almost equally, teams from Harvard and Stony Brook University found. Farmers of several different types of crops — coconuts, cashews and rice — are all affected.

The known impact is also smaller: from 2007 to 2012, a total of 1,520 people required treatment for kidney disease through the state health program. Even if several times as many are in the latent early stages of the disease, its geographic and humanitarian scope is more contained than in Central America or Sri Lanka.

"Our hypothesis is that an exposure to something in the environment, whether it's in the soil

or in the water or both, is responsible for this,” said Dr. Ajay Singh, a nephrologist at Harvard Medical School and the co-leader of the Harvard study.

The research has yet to offer definitive answers. Not a single study has been published on Uddanam CKD, nor do any official statistics measure its scale or reach. Among the scientists and the villagers, confusion and frustration reign.

“They come to you and they don’t understand what’s happening to them,” Singh said of Uddanam’s residents. “But they do understand that they’re dying from the disease and there are no resources to help them out and something needs to happen there.”

A Family Tragedy

Hyamavathi and Pameela Bendalam have lived the tragedy that has left many Uddanam families frightened of consenting to marriages. Both were in their early twenties when they married and moved to a village in the region called Varaka. Hyamavathi was about 23 when she married her husband, a coconut and rice farmer named Venkataramana Bendalam, in 1990. Pameela was about 20

when she married Venkataramana’s brother Rama Rao, also a rice farmer.

The marriages made the women “co-sisters,” and they began living together in the Bendalam family compound. For more than a decade, their husbands worked the five acres of rice paddy and coconut fields owned by the family.

In 2005, their husbands began to experience difficulty urinating. Both were initially diagnosed with urinary tract infections before traveling to visit doctors in Visakhapatnam, also known as “Vizag,” a city more than 100 miles away.

“They were unwell, but we didn’t know a disease had hit,” Pameela said. “Then we found out that they had kidney condition, when we went to Vizag.”

The illness left the two brothers feverish and nauseous, and eventually too sick to work. Both took medicines to relieve the disease’s symptoms, but the family could not afford dialysis. Pameela said the cost of the treatment her husband did receive was more than 60,000 rupees, close to \$1,100 at the current exchange rate.

The family had to take out loans, and then to gradually sell off their land. Pameela and Hyamavathi



Ramarao Laxminaraina, a 25-year-old rice farmer, receives dialysis treatment.

Photo: Anna Barry-Jester

took care of the two terminally ill brothers. “The both of us were in a lot of pain and misery,” Prameela said.

In 2007, Venkataramana and Rama Rao died less than a month apart — on November 25 and December 23, respectively.

Prameela and Hyamavathi remain in the compound, and now work the single acre that remains of the land cultivated by their hus-

bands. This labor provides their only income beside the thousand rupees (roughly \$18) each month that Prameela’s son Siva earns as a teacher in a private institute.

“I borrowed money thinking that he would survive,” Prameela said of her husband. “But he died, and now the loans have to be paid back as well. This is bad karma, full of suffering.”

Since their deaths, the state gov-

ernment of Andhra Pradesh has established new programs that assist Uddanam's victims. A statewide health insurance program for the poor now covers the costs of dialysis. State-of-the-art dialysis centers have been established in several cities through a public-private initiative led by Dr. Ravi Raju Tatapudi, a leading nephrologist who served three years as Andhra Pradesh's director of medical education.

But almost all of the area's nephrology and dialysis services are in Vizag. The costs of travel and of medicines that are not covered by the insurance program are still prohibitive for many families in Uddanam.

"They have dialysis but they are 200 kilometers away," said Sham Sundar Puriya, the village head in Patha-Varaka, a sub-community in Varaka village. The residents "cannot go to that place because of lack of money, so they are staying here and dying here."

Uddanam lacks doctors. There are no full time nephrologists stationed within 100 miles of the region, and local medical officers must refer their patients to distant urban facilities. Dr. Prathibha, the medical officer who lives in Varaka, says the fear surrounding the dis-

ease has left "even doctors" scared to live in Uddanam.

"If they are not coming," she asked, "who will?"

Frustration and Fear

Since the 1990s, when Tatapudi and other nephrologists began noticing the unusual strain of CKD in Uddanam, various theories of the disease's origins have emerged. Most have centered on toxic exposure. An unpublished study by a team of researchers from Uddanam and Stony Brook University concluded that the disease is "most likely to be the result of a chronic exposure to an environmental agent."

Dehydration, another possible factor, has received less attention. The Uddanam area is brutally hot, and farmers spend long hours in the fields.

Dr. Goru Krishna Babu, a researcher who conducted door-to-door surveys in Uddanam for the Harvard study and grew up nearby in Andhra Pradesh, said the heat was so overwhelming one day, he had to stop and lie down while carrying out the surveys. "One of the things I took pride in was that whatever the temperature was I could sustain myself," he said. "But one of



Siva Bendalam feeds a cow in his village of Varaka, Andhra Pradesh. “So many people are leaving,” said Siva, who helps support his family since the death of his father and uncle in 2007. “If the disease continues, no one will be here.

Photo: Anna Barry-Jester

the days I literally had to lie down on the bed.”

So far, the efforts of the Stony Brook, Harvard and state government researchers remain tied up in delay. None have published studies that point toward specific suspects. A lab test by Stony Brook that tested local water for contamination by any of 42 toxic chemicals, including heavy metals such as arsenic and cadmium, revealed nothing out of the ordinary, said Kate Dickman, a pharmacolo-

gist with the Stony Brook team.

The most visible sentiment in Udandanam is frustration: that the years of research and promises haven't brought results. As the deaths continue, many residents have become fearful of living in a land so beautiful it was named after “Paradise.”

“So many people are leaving,” said Siva Bendalam, Prameela's 20-year-old son who helps support his family. “If the disease continues, no one will be here.” ■



In Sri Lanka, people with CKDu are predominantly male agricultural workers living in an area known as the “rice bowl.”

Photo: Anna Barry-Jester

Sri Lanka

Breakthroughs, setbacks and a spiritual touch

By Sasha Chavkin and Anna Barry-Jester

Published Online: September 18, 2012

FOR TWO decades, chronic kidney disease has been a mystery and death sentence in Sri Lanka, striking 15 percent of the residents of its north central region.

This summer, after years of secretive official research, a glimmer of scientific hope emerged. The government and World Health Organization announced in June that they identified a key cause of the disease



21-year-old Sampath Kumarasinghe relaxes with family outside his home near Kebitigllewa, Sri Lanka. Sampath has the most advanced form of CKDu, end-stage renal disease.

Photo: Anna Barry-Jester

in Sri Lanka: chronic exposure to arsenic and cadmium, likely consumed in food.

Yet in a disease that has confounded experts across continents, even potential breakthroughs come with asterisks. The new report left huge questions unanswered — including where in the country the toxins were found, how they entered the food and what foods were contaminated. The key unsolved question: the extent fertilizers and pesticides contributed to the outbreak.

In Sri Lanka's lush northern farmlands, the mystery and the death sentences continue. Lacking firm answers from the scientific community, some victims' best hope for survival comes through the spiritual community — and offers of kidney transplants from Buddhist monks and those they inspire to make extraordinary sacrifices for strangers.

At 21, Sampath Kumarasinghe is among the victims awaiting that miracle.

The soft-spoken farmer was diag-

nosed last September with kidney damage so severe it had reached its terminal phase: end stage renal disease. Healthy his entire life, he suddenly became feverish and too sick to work in the rice paddies. His mother mortgaged their land to pay for his medical care, and they began the search for a kidney donor. One day, like a vision, a man appeared in his hospital offering to donate his kidney.

“I am only thinking of ways to save my son’s life,” said Sampath’s mother, Punchirilalage Dingiri Manike. “That is what I think of day and night.”

Sampath is among the youngest victims of a broad epidemic of chronic kidney disease sweeping north central Sri Lanka. Its victims are mostly male agricultural workers who do not suffer from diabetes or hypertension, the usual causes of the illness. The government and WHO call it CKDu: chronic kidney disease of unknown etiology.

Winding Path to Answers

CKDu emerged in Sri Lanka’s north central farmlands, known as the “rice bowl,” in the 1990s. Physicians began noticing clusters of kidney failure in which four or five members of a single household had the disease. Rezvi

Sheriff, who began practicing in the 1970s as Sri Lanka’s first nephrologist and is the unofficial dean of the country’s kidney doctors, calls it a recent phenomenon.

“In the last 20 years or so,” Sheriff said, “we have noticed it.”

Researchers developed a succession of theories to try to explain the outbreak, from cyanobacteria to fluoride to aluminum pots and pans, but none settled the debate. The conflicting alarms spread fear and confusion among villagers.

The unsolved mystery became an embarrassment to the Sri Lankan government, whose leaders take pride in the health system despite the country’s per capita GDP of roughly \$5,600 — less than one-eighth that of the United States. The country points to infant and maternal mortality rates approaching those in the U.S. and Europe.

In 2008, Sri Lanka’s Health Ministry invited the World Health Organization to join a comprehensive study to unravel the disease’s roots.

For more than three years, no results were announced publicly. “Releasing information piecemeal is not the solution for the problem,” said Dr. Shanthi Mendis, Coordinator and Senior Adviser of the WHO non-communicable disease pro-

gram and the lead adviser of its efforts in Sri Lanka.

Scientific alarms sounded elsewhere. A group of researchers from Sri Lanka's University of Kelaniya released studies citing widespread arsenic contamination in drinking water, food and soil — and blaming pesticides. In June 2011, several common pesticides were found by the government to have small amounts of arsenic, and briefly banned from importation.

The Kelaniya group's findings provoked a storm of condemnation: some scientists questioned their methods, and government officials and Sri Lanka's agribusinesses sector accused them of harming the country.

“Loose tongues and irresponsible reporting could lead to irrevocable repercussions in the export sector and thereby adversely affect the whole economy of Sri Lanka,” Dr. Anura Wijesekara, Sri Lanka's registrar of pesticides, wrote in a column in *The Island* newspaper. “One interested group has already termed this as As [arsenic] terrorism.”

Two months later, Wijesekara lifted the ban on the pesticide imports. He did so, he said in an interview, because the amount of arsenic they contained was too small to pose

danger. “It's not a big deal to have so little amount of arsenic in a pesticide because arsenic is a natural element,” Wijesekara said.

Yet in the months before the ban was lifted, the official CKDu study group was internally warning of the “imperative” of stronger regulations for “nephrotoxic agrochemicals.” A WHO meeting report from June 2011, obtained by the Center for Public Integrity, cautioned that failure to act quickly could “result in cumulative damage to the health of the people living in these areas.”

A full year later, in June 2012, the government and WHO released partial findings, concluding that exposure to low concentrations of cadmium and arsenic is a key cause of the epidemic.

“The data that we have got up until now show that it's a combination of nephrotoxic heavy metals,” said Mendis of the WHO. “For the moment all we know is that these heavy metals have entered the food chain.”

Still, much remains unknown. The government and WHO said that lab results found small amounts of heavy metals in CKDu patients' blood and urine, but did not specify how much. Researchers said the metals got there through the food chain — and not through the widely

suspected vector of drinking water — but will not say which foods were contaminated. Mendis said a technical report to be released in late October will lay out the details.

Agneta Åkesson, a toxicologist at the Karolinska Institute who specializes in cadmium poisoning, reviewed three WHO meeting reports describing Sri Lanka's findings through February 2012. These notes, obtained by the Center for Public Integrity and described as "administrative" by the WHO, include the results of many of the biological and environmental tests.

"Based on what's written here, you cannot conclude anything," Åkesson said. In the absence of any newer evidence, she said, the exposure levels described were "not enough to cause chronic kidney failure."

The results also offered no explanation of how the heavy metals entered the food.

A leading suspect is agrochemicals, which are heavily used in the affected area's rice paddies. Cadmium is frequently present in phosphate fertilizers and can accumulate in soil; several pesticides in Sri



Sampath Kumarasinghe talks to Ajantha, a potential kidney donor, while undergoing dialysis treatment at Anuradhapura Hospital, Sri Lanka. Photo: Anna Barry-Jester

Lanka contain small quantities of arsenic. Some regions of the world also have low levels of arsenic that naturally occur in the environment.

The official study's research of pesticides and fertilizers remains incomplete.

To some, the government and WHO's reticence to release more information raises the possibility that the undisclosed evidence points toward the agrochemicals and rice

crops that form the economic backbone of Sri Lanka's long-suffering northern countryside.

Dr. Channa Jayasumana, one of the Kelaniya scientists, said that in a private meeting with his group in August the health ministry acknowledged the role of fertilizers and pesticides. A primary culprit, he said, is a fertilizer called triple superphosphate, which will be targeted for reduction in the next growing season.

"They have narrowed down the problem to heavy metals and realized the importance of fertilizers and pesticides," Jayasumana said.

The health ministry and WHO did not respond to inquiries as to whether they had identified rice, pesticides or fertilizers such as triple superphosphate as leading sources of heavy metal exposure.

The agribusiness industry says it's possible heavy metals contribute to the disease — but that the theory remains unproven, and dangerous levels of heavy metals could not have come from their products.

The cause could be "cadmium or arsenic," said Rohitha Nanayakkara, Secretary of the National Agrobusiness Council. "But what we say is it can't be from pesticides, because the quantities included in pesticides are minimal."

Meantime, the government continues to import — and farmers continue to apply — thousands of tons of agrochemicals to the fertile paddies blanketing the farmlands of Sri Lanka.

Kidneys for Strangers

As officials debate their next steps, another movement is bringing hope to Sampath and others suffering from CKDu.

As Sampath was falling ill, a man in a distant village, W.B. Ajantha, made an unusual vow. When his wife became pregnant, Ajantha promised to Buddha that he would donate his kidney to one of the many young men who needed one. After his daughter was born, he went to the hospital to find a patient.

One day as Sampath lay in the dialysis ward, the stranger approached and offered to donate his kidney. Ajantha is one of hundreds of Buddhists, most of them monks, donating their kidneys to strangers due to their spiritual beliefs.

In Sri Lanka's devout North Central province, where CKDu has become the leading cause of death, these orange and red-robed priests are revered by the population and supported by its alms. A nephrolo-

gist at a hospital in central Sri Lanka estimated that about one of the three transplants his unit performs each week relies on an altruistic donor.

“He said he is not doing it for money,” Sampath’s mother, Manike, said of Ajantha, who is Buddhist but not a monk. “I can only bless him as I have nothing to give.”

Tests confirmed that her son and Ajantha were a match. Sampath’s transplant is set to be one of the first performed at Anuradhapura General Hospital, a public hospital whose nephrology unit serves the entire northern region affected by the disease.

The operation will expand a growing program to provide patients with the only real solution to advanced CKD: kidney transplants.

Mehinthe Dhammarakkita gave his kidney when he was 28. As a boy, he had seen his ailing uncle receive a kidney transplant, and then go on to survive for more than 20 years. The monk was moved to donate his own kidney after visiting a village where he met sick patients who would die without a transplant.

“I thought about the imperma-



Mehinthe Dhammarakkita Thero, a Buddhist monk, and high school principal G Gunasena sit outside the educator’s home near Kebithigollewa, Sri Lanka. The monk donated a kidney to the principal, who suffers from CKDu.

Photo: Anna Barry-Jester

nence of life and how our bodies will anyway be absorbed to the soil one day,” Dhammarakkita said. “If one can make a sacrifice when we are alive, one can gain some spiritual happiness.”

Dhammarakkita seeks to inspire villagers with his example and then connect them with patients in need. It was Dhammarakkita who provided the unseen link in Sampath’s ap-

parent miracle — informing Ajantha of his plight. “If we can donate a part of our body to someone, there are no words to describe the happiness it gives,” Dhammarakkita said.

Although kidney donations in Sri Lanka are growing, they are provided to only a fraction of patients. The disease still overwhelms the health system, and the vast majority of eligible patients cannot receive dialysis, let alone transplants.

As he awaits his operation, Sampath continues to make the 8-hour

journey to and from Anuradhapura Hospital twice a week. On a warm day in July, nurses dote on the young patient as they insert needles into his neck for his four-hour dialysis session. He flashes a smile, his teeth stained red with the juice of the betel nuts he frequently chews.

“I am happy,” he said, “but I do have some fear as well.” ■

RELATED: Listen to “Sri Lanka: Kidney Ailment Linked to Farm Chemicals” from PRI’s “The World.”

FOLLOW-UP

Steps proposed to tighten control of agrochemicals

By *Sasha Chavkin*

Published Online: December 28, 2012

THE SRI LANKAN government is vowing to impose tighter controls on pesticides and fertilizers amid growing concern the chemicals are helping fuel a mysterious epidemic of chronic kidney disease devastating its north central region.

In September, the Center for

Public Integrity explored how this disease is killing agricultural workers in Sri Lanka, India and Central America. Scientists in each region are struggling to identify the cause of these parallel epidemics, which have led to tens of thousands of deaths worldwide and are suspected to

be linked to a toxic exposure.

In a November 2012 speech laying out a national budget proposal, Sri Lankan President Mahinda Rajapaksa pledged to take action to crack down on contaminated agrochemicals.

“There is a theory that pesticides and chemical fertilizer contribute to increase non-communicable diseases,” Rajapaksa said, referring in oblique terms to the politically controversial kidney epidemic. “Therefore, regulations will be formulated to require suppliers and distributors of all agrochemicals to comply with quality standards.”

A committee of government ministers is meeting with scientific experts and interest groups and will submit a report to the cabinet with recommendations for the regulations, said Sri Lanka’s Registrar of Pesticides, Dr. Anura Wijesekera.

Wijesekera, whose office oversees imports and permitting of agrochemicals, said Sri Lanka had already taken a significant step earlier this year: establishing limits of detection for nine toxins including cadmium and arsenic.

Pesticides and fertilizers containing more than the permitted amounts of these chemicals are prohibited from distribution.

The country has not always moved swiftly to restrict pesticides.

Following years of official research, the Sri Lankan health ministry and World Health Organization declared in June that low level exposures to the heavy metals cadmium and arsenic were “causative factors” for the ailment — which they have named CKDu, chronic kidney disease of unknown etiology. Despite prior warnings from the WHO to reduce farmers’ exposure to agrochemicals, the Sri Lankan government in 2011 lifted a temporary ban on pesticides it had found to be contaminated with small amounts of arsenic, the Center reported.

Wijesekera said he lifted the ban because the levels of arsenic contained in the pesticides were too low to pose a threat.

Now, Wijesekera said his office is acting to curb marketing by fertilizer and pesticide producers, which he said encouraged farmers to use excessive amounts of

agrochemicals. “They had been trying to advertise pesticides as fast-moving consumer goods,” Wijesekara said of the pesticide industry.

Yet even as it tightens controls, the Sri Lankan government has not released the scientific reports it says provide the basis for its policies.

In June, when the WHO and Sri Lanka’s health ministry cited cadmium and arsenic exposure as a possible cause for CKDu, they did not publicly release their supporting evidence. WHO officials said a technical report detailing the lab results would be released in late September. That deadline shifted to late October, and was pushed back again as the report was submitted to the Sri Lankan health ministry for review. On December 20, Sri Lanka’s Director General of Health Services, Dr. Palitha Mahipala, told a CPI reporter he would share the technical report, but the WHO then indicated it would not be ready until mid-January.

Some experts question whether the government truly has evidence to back up its assertions.

Wijesekara said he attended closed-door sessions earlier this year in which the WHO presented its scientific findings to government officials and leading researchers. He said the WHO indicated the culprit was cadmium rather than arsenic, but did not share detailed evidence linking the exposure to agrochemicals. “I don’t have any scientific evidence to accept that they cause CKDu,” Wijesekara said.

Protections for kidney recipients

As the official study remains sealed, Sri Lanka is acting to improve treatment for the flood of CKDu patients in its hard-hit northern farmlands. This fall, the government hospital in the city of Anuradhapura, the capital of Sri Lanka’s North Central Province, performed its first kidney transplants, which offer the only chance at long-term survival for patients with advanced cases of the disease.

Among the seven patients receiving transplants in Anuradhapura was 21-year-old Sampath

Kumarasinghe — an ailing rice farmer the Center profiled in September. Sampath had his transplant on Sept. 25 and is recovering successfully, said Dr. Rajeeva Dassanayake, the head of the nephrology unit at the Anuradhapura hospital.

Yet his path to a new kidney came after a twist involving a potential donor.

In September, the Center reported that Sampath was expecting a kidney donation from a stranger named W. B. Ajantha, who said he was following the example set by Buddhist monks and donating his kidney for free.

Dr. Dassanayake said the hospital has since discovered that Ajantha had been offering his kidney to various patients — taking small payments and requesting lodging for his family in advance. “He pretends he’s going to give his kidney, asks for a couple of hundred rupees,” Dassanayake said of Ajantha.

Dassanayake and Sampath said Ajantha had lived with Sampath’s family and relied on them for support for weeks before the operation. Sampath ended up getting

his kidney from a cadaver. A few days after the surgery, Ajantha left the area. He could not be reached for comment.

Of late, Dassanayake said, some individuals and groups have emerged seeking to exploit the epidemic. To prevent problems, Dassanayake said his hospital only accepts kidney donations from Buddhist monks and relatives of patients, and prohibits donors from selling kidneys for a fee. He said he has seen people falsely claiming to be brothers in order for one to sell their kidney to the other, and other instances in which money changed hands between family members in exchange for a kidney donation.

“When people don’t have a donor they get really frustrated and pluck at straws,” Dassanayake said. “There are various people and organizations who pretend to help people find a kidney as well, but I don’t know a single patient who has found a kidney through one of these organizations.” ■

Anna Barry-Jester contributed to this report.

Central America

New urgency to combat this “disease of poor people”

By Sasha Chavkin

Published Online: April 29, 2013

BRINGING new urgency to a mysterious kidney disease afflicting the region’s agricultural laborers, Central America’s health ministries signed a declaration Friday [April 26] citing the ailment as a top public health priority and committing to a series of steps to combat its reach.

Over the last two years, the Center for Public Integrity has examined how a rare type of chronic kidney disease (CKD) is killing thousands of agricultural workers along Central America’s Pacific Coast, as well as in Sri Lanka and India. Scientists have yet to definitively uncover the cause of the malady, al-



Maria Isabel Rodriquez, center, El Salvador's Minister of Health, with Nelson Arboleda and Reina Turcios-Ruiz of the U.S. Centers for Disease Control. Photo: Anna Barry-Jester

though emerging evidence points to toxic heavy metals contained in pesticides as a potential culprit.

Following years of official inaction in the U.S. and beyond, Friday's San Salvador declaration — for the first time — formally recognized the disease and its unique characteristics.

“This disease fundamentally affects socially vulnerable groups of agricultural communities along the Pacific Coast of Central America, predominates among young men, and has been associated with conditions including toxic environmental and occupational risk factors, dehydration, and habits that are damaging to renal health,” said the declaration adopted by the Council of Health Ministers of Central America.

The ministers pledged potentially meaningful new steps, including more detailed statistical tracking of CKD, the development of national and regional plans to investigate and treat the disease, and promotion of stronger regulation of agrochemicals.

The declaration represented a major victory for El Salvador and its health minister, Dr. Maria Isabel Rodriguez. Ninety years old and barely five feet tall, peering from behind enormous eyeglasses, Rodriguez has

been a driving force behind catapulting the ailment from obscurity to formal recognition as a leading regional threat.

“This is a disease of poor people,” Rodriguez said. “This is a disease of people who work in the fields and have very bad living conditions.”

The outcome signaled a turnaround by the U.S. Centers for Disease Control and Prevention, which in 2011 helped beat back an effort by El Salvador to declare the malady a top priority for the Americas. The CDC now says it has devoted “several hundred thousand” dollars to support research of the disease, created a multidisciplinary internal task force on chronic kidney disease in Central America, and pledged to help fund a national survey by El Salvador to measure the prevalence of chronic ailments including CKD.

“We have that commitment to provide the support to follow and strengthen their investigations in the ministries of health,” said Dr. Nelson Arboleda, the CDC's director for Central American Region.

The San Salvador conference also marked a threshold in international cooperation in combating the mysterious disease. Following years in which researchers battling parallel epidemics in Central America,

Sri Lanka and India failed to compare results, Sri Lanka sent an official delegation to El Salvador and urged Central America to consider its research findings and policy responses as a model for future action.

“We are having enough clinical, biochemical and histopathological evidence to say this is the same disease,” said Channa Jayasumana, Sri Lanka’s delegate in El Salvador.

The disease has felled thousands. In Sri Lanka, more than 8,000 patients are receiving treatment for CKD of unknown cause, an official report found, a figure representing just a fraction of those affected by a disease that remains latent until its advanced stages. More than 16,000 men died of kidney failure in Central America from 2005 to 2009, with annual deaths increasing more than threefold since 1990, according to an analysis of World Health Organization data. In El Salvador, CKD has become the leading cause of hospital deaths among adult men.

The Debate over Pesticides

Although the declaration reflected broad agreement to take action, the two-day conference that preceded its signing was dominated by a forceful debate. The central ques-

tion: whether there was adequate evidence to declare the disease is linked to agrochemicals and respond by restricting their use.

At the conference, El Salvador presented findings from an ongoing official study, conducted jointly with the Pan American Health Organization, suggesting that pesticides and fertilizers containing heavy metals may be to blame. Environmental tests of soil and water samples in a village heavily affected by CKD, Ciudad Romero, found the presence of high levels of cadmium and arsenic, heavy metals toxic to the kidneys. Among a sample of 42 residents of Ciudad Romero who suffer from CKD, all reported applying pesticides without any protective equipment.

A national sample of 46 CKD patients found that 96% reported using pesticides, and medical tests of these patients revealed additional symptoms such as impaired reflexes and damage to arteries in the lower limbs that suggest toxic poisoning.

El Salvador’s findings echo those in Sri Lanka. An official study there, conducted by the Sri Lankan health ministry in partnership with the World Health Organization, documented elevated levels of cadmium and arsenic contained in agrochem-



A woman holds a photograph of her husband and men who worked with him in the sugar cane fields near Chichigalpa, Nicaragua. The man died from chronic kidney disease; four of his sons currently have the disease.

Photo: Anna Barry-Jester

icals and within environmental samples from the endemic region — and found the same heavy metals in samples of urine, hair and nails of patients. Sri Lanka also found residues of several pesticides in the urine of many of the affected patients.

Since publication of its report, the Sri Lankan government has

imposed a ban on four common pesticides from use in the endemic region. Rodriguez, El Salvador's health minister, said she also hopes to ban pesticides that are potentially linked to the epidemic.

Yet other researchers questioned the weight of evidence pointing to pesticides. El Salvador found arsenic above permitted levels in one

location in Ciudad Romero and cadmium above permitted levels in another location in the same village — hardly proof of widespread contamination, critics say. The nation also has yet to complete toxicology tests that will determine whether the heavy metals came from pesticides, or whether heavy metals and pesticide residues appeared in blood, urine, or tissue samples of CKD patients.

Basic questions about the pesticide hypothesis remain unanswered in both El Salvador and Sri Lanka's reports, including evidence of how the agrochemicals are entering victims' bodies or what products are at fault. Despite the dramatic parallel findings from the recently released reports, no peer-reviewed studies in more than a decade of research have established a definitive link to agrochemicals.

"There is still no direct causal connection," said Dr. Ramon Trabano, a Salvadorean nephrologist who published two of the first studies demonstrating the presence of the disease. "I think all of this is political. They want something to blame."

The controversy came to head in the final portion of the scientific conference. The argument pitted skeptics

of the evidence against conference organizers who argued that the Sri Lankan and Salvadorean results were clear enough to create a moral obligation to take precautionary action. The debate was concluded by Rodriguez, who delivered a forceful defense of El Salvador's findings.

"What has been presented here is scientific fact, and I will defend it with my nails," she said, holding up bright red-painted fingernails and reducing the room to laughter.

Chemicals in the Spotlight

Two chemicals in particular have come into investigators' crosshairs in both El Salvador and Sri Lanka: 2,4-D and glyphosate. 2,4-D is a common herbicide used to control weeds, and glyphosate is the active ingredient in the world's most popular herbicide, Roundup. Both are used worldwide, including in countless areas not affected by this distinctive form of chronic kidney disease.

The El Salvador sample of CKD patients from Ciudad Romero — the community shown to be contaminated by heavy metals — found that 100 percent and 75 percent of the patients, respectively, reported using 2,4-D and glyphosate. In Sri

Lanka, both are used heavily and were found in urine samples of some sick patients.

Glyphosate was developed by Monsanto, but the patent has expired so numerous companies now sell glyphosate products. Monsanto said it currently sells glyphosate products in Sri Lanka but did not confirm whether it sells such products in Central America.

Dr. Daniel Goldstein, a Senior Science Fellow at Monsanto, said “glyphosate does not cause renal failure.” He said he was aware of the official findings from Sri Lanka, and that glyphosate contains phosphorus, an element whose molecular similarity to arsenic can result in small amounts of arsenic byproduct in quantities not threatening to human health. But the “plausibility of relationship is virtually nil” between glyphosate and the Sri Lankan kidney disease epidemic, Goldstein said.

Dow Chemicals, which developed 2,4-D, did not respond to requests for comment. Like glyphosate, the patent on production has expired and other companies also produce pesticides containing 2,4-D.

According to the Environmental Protection Agency, excessive quantities of glyphosate and 2,4-D in drinking water can cause damage to

the kidneys. But little research has been conducted into other types of exposures, and particularly on long-term health effects on humans.

“I’m appalled at how little [research] there is on humans,” said Dr. Stephanie Seneff, a Senior Research Scientist at the Massachusetts Institute of Technology. Seneff published a study last week raising concerns about a variety of potential health effects from long-term exposure to glyphosate.

Scientists from the Salvadorean and Sri Lankan research teams also suspect that toxic additives to pesticides, or dangerous combinations of chemicals, may pose health risks additional to those presented by the products themselves.

In an interview in San Salvador, Rodriguez reacted with surprise to Monsanto’s position that glyphosate does not threaten the kidneys.

“Ah, Monsanto!” she said, a look of consternation crossing her face. “They are the ones that will be fighting us.” ■

Anna Barry-Jester contributed to this report.

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Updates

Countries are cracking down on pesticides as suspected link to rare kidney disease

By Sasha Chavkin

Published Online: September 20, 2013

ON OPPOSITE ends of the world, governments are cracking down on pesticides as a potential cause of a mysterious form of kidney disease killing agricultural workers.

In El Salvador, the congress approved a ban earlier this month on 53 agrochemicals. If the law is signed by Salvadorean president Mauricio Funes, the country will join Sri Lanka as the second nation to ban top-selling pesticides for a potential link to kidney disease.

Meanwhile, in India, new research from Harvard University and the state of Andhra Pradesh found



The mysterious form of chronic kidney disease in India mostly affects farmers in the region, where cashews, rice and coconut are the main crops. Photo: Anna Barry-Jester

local drinking water to be contaminated with high levels of silica — a mineral used in pesticides that has

been linked by previous studies to kidney failure.

For more than two years, the International Consortium of Investigative Journalists has examined how a rare type of chronic kidney disease, CKD, is afflicting agricultural workers along Central America's Pacific Coast, and in Sri Lanka and India. A recent study estimated that the ailment has killed more than 20,000 people in Central America alone, but scientists have yet to definitively uncover the cause of the parallel epidemics.

Following its emergence in the 1990s, the disease was widely ignored by authorities even as it devastated impoverished rural communities. Only now, bolstered by a growing body of scientific research, have governments begun to vigorously search for causes and solutions.

Yet the push to target pesticides is triggering fierce opposition from agribusiness — and concern from some researchers who fear the dramatic pesticide bans could be a distraction from other, potentially stronger scientific evidence linking the malady to the effects of heat stress and dehydration.

The most sweeping measure contemplated so far: The ban on 53 agrochemicals approved on Septem-

Money, research target mystery kidney disease in Americas

By *Sasha Chavkin*

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PLEDGING \$1.7 million to combat a mysterious kidney disease killing agricultural laborers by the thousands, health ministers from across the Americas passed a resolution last week formally recognizing the disease as a serious threat to public health.

Last week's declaration from the Directing Council of the Pan American Health Organization (PAHO) called on member states to conduct research and surveillance of the disease, and to strengthen their occupational and environmental health programs. It designated several Central American groups, including governments and NGOs, to collaborate.

The policy marks a significant turnaround for PAHO, which in 2011 rejected a proposal by El Sal-

ber 5 by El Salvador's Legislative Assembly, including leading products such as glyphosate, the active ingredient in Monsanto's Roundup, and 2-4,D, produced by Dow Chemicals.

The proposed law would prohibit various chemicals that have long been banned in most of the world, but also includes widely used pesticides glyphosate, 2-4,D, paraquat and endosulfan. Salvadorean health officials believe agrochemicals containing toxic heavy metals are the primary cause of the disease.

The move to prohibit major commercial brands has sparked resistance from El Salvador's Chamber of Agriculture and Agribusiness (CAMAGRO), along with politicians in opposition parties. "As the law is written, the President should veto it," congress member Mario Ponce, who sought to remove the previously cited four pesticides from the list, told a Salvadorean newspaper. "We would be giving a very severe blow to all of agriculture."

Monsanto confirmed it sells glyphosate in El Salvador and across Latin America, but said it is confident the product does not cause renal disease. "When glyphosate is used according to label directions there is no concern of harm to the kidneys," said Monsanto spokes-

vador to recognize chronic kidney disease in agricultural workers as a distinct new form of illness and designate it as a top public health priority. At the time, the United States played a key role in blocking the resolution because it did not fit the U.S.'s agenda and U.S. delegates were unaware of the ailment's severity.

El Salvador has since led a campaign by Central American nations demanding greater attention to the disease, and contended that agrochemicals are the primary culprit. Today, chronic kidney disease is the leading cause of hospital deaths in El Salvador, the PAHO resolution said.

Dr. Carlos Orantes, director of El Salvador's national research programs for the disease, compared the growing recognition of CKD's severity to the emergence of HIV/AIDS in the 1980s. "I see this as similar to what happened with AIDS," Orantes said. "The science advanced together with political advocacy. People with chronic kidney disease of non-traditional causes are people who are not recognized, who are excluded from our public health systems." ■

woman Erika Campuzano. “This herbicide has been thoroughly reviewed and registered by regulatory agencies around the world.”

Some scientists have raised concerns over the strength of El Salvador’s evidence.

A presentation by El Salvador’s government in April found widespread pesticide use and the presence of the heavy metals cadmium and arsenic in the environment in one heavily affected community, but not elsewhere in the country. The government has not produced evidence that particular brands of pesticide contain heavy metals, and glyphosate and 2,4-D are leading worldwide products that are used in countless areas that do not suffer from this distinctive form of kidney disease.

Dr. Carlos Orantes, the director of El Salvador’s national research program into the mysterious disease, said the evidence uncovered is noteworthy, and questions whether opposition to the ban was fueled by business interests.

“Here there is a struggle between toxicity and profitability,” Orantes said.

The pesticide ban has gained the support of the Archbishop of San Salvador, Jose Luis Escobar. “I am very pleased by the fact that they

have prohibited these agrochemicals because this will protect human lives,” Escobar said at a press conference in San Salvador. “God willing, the president will approve it and it will become the law of the republic.”

If El Salvador approves the ban, it will follow in the footsteps of Sri Lanka. This spring the South Asian island nation banned several pesticides following a multi-year study by its health ministry and the World Health Organization, which concluded that the heavy metal cadmium had entered the food supply and was a leading cause of CKD. Pesticides and fertilizers are believed to be the source of the contamination, and the chemicals banned in Sri Lanka overlap but do not match fully with those targeted in El Salvador.

On August 27, more than a year after its initial declarations, the Sri Lankan research team published its findings in the medical journal *BMC Nephrology*. One of their crucial results was a finding of cadmium and pesticide residues in the urine of kidney disease patients. “A significant dose-effect relationship was seen between urine cadmium concentration and CKD stage,” the study found, referring to the stages of kidney decline that indicate the disease’s progression.



Laxmi Narayna undergoes dialysis treatment at Seven Hills Hospital in Visakhapatnam, India. The coconut farmer travels hours to and from the city each week for treatment, but according to his doctor, “on dialysis people don’t do well. Holding on for a year would be just about it.”

Photo: Anna Barry-Jester

Although Sri Lanka’s ban has been officially announced, it has not yet been fully implemented, said Dr. Channa Jayasumana, a Sri Lankan researcher who has been a leading proponent of the pesticide theory. Jayasumana said that the policy’s implementation was facing opposition from agribusiness, and that several of the banned pesticides remain on the market. “We don’t know when they are going to fully implement it,” Jayasumana said.

Perhaps the most striking new

clues come from the state of Andhra Pradesh in eastern India.

Preliminary findings by a research team from Harvard University and the Andhra Pradesh state government showed that groundwater in affected villages contained the toxic mineral silica at levels three to five times higher than those encountered in United States. Silica has not emerged as a suspect in the Central American or Sri Lankan epidemics, but a recent study linked occupational exposure to the min-

eral to increased risk of CKD. Silica is used in some pesticides, including in brands used in India.

Dr. Ajay Singh of Harvard University, one of the study's directors, said the findings warranted closer examination of silica but were not yet sufficient to draw conclusions. Singh said the research was incomplete because he had not yet seen water tests from unaffected villages in the area to compare levels of silica exposure.

"There's smoke there but I'm not sure if I've detected the fire yet," he said.

As momentum builds for policies against agrochemicals, some of the scientists who have been studying the disease longest say that, at least in Central America, stronger evidence points to heat stress and dehydration. One study found that sugarcane workers with more physically strenuous jobs suffered significantly higher levels of kidney damage than others at the same company during the course of a single harvest season. Emerging evidence also points toward a possible mechanism for dehydration causing kidney failure, related to the activity of an enzyme in the kidney.

"I do not think that by banning pesticides you will solve the epidemic," said Dr. Catharina Wesseling

of the Program on Work, Environment and Health in Central America (SALTRA), a leader of CKD research in the region.

While pesticides may be a contributing factor, Wesseling said, the most important step for prevention is avoiding dangerous levels of heat stress in the sugar industry.

The two theories are not incompatible: Most scientists agree toxic exposure can create vulnerability, and heat stress can wear away at the kidneys. Wesseling cited the possibility of different chemicals or causes at work in different regions. But she emphasized that proven interventions can prevent heat stress, while the target of sweeping pesticide bans is less clear. "Prevention of heat stress is possible if you have political will," Wesseling said.

As the scientific hunt for answers continues, workers continue to sicken and die.

Ezekiel Ramirez, a former sugarcane worker in Nicaragua who suffers from CKD, expressed his frustration with the lengthy debate over the disease during a previous ICIJ visit to his community.

"We are worried because time is passing and things are going very slowly," Ramirez said. "We want this to be fixed now because of the number of people who die each day." ■