

What is killing sugar-cane workers across Central America?

Chronic kidney disease has killed tens of thousands of young men and is becoming more deadly. But nobody knows exactly what it is, or what to do about it

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It is stage five they fear the most. Stage five is the mysterious sickness in its deadliest form. "I'm entering stage five," Edilberto Mendez tells me as his wife looks on fretfully. I'm in their small home on the floodplains of Lempa River, in the dank sugar-lands of rural El Salvador, where they live in a community with about 150 other families. "How many others in the village have died of this?" I ask.

"Three close friends, just last year," says Edilberto. His wife interrupts, counting out on her fingers. "And my nephew, my brother, and Ramon, Carlos, Pablo..." She pauses. "I know *three* Pablos who have died of this."

Edilberto's kidneys are beginning to fail. It means dialysis. "This is what they've told me," he says with a defensive shrug. "But I'm still walking around. I've seen many people have dialysis. As soon as they try it, they die. I don't want it." Edilberto has his wife to support, his deaf-mute 27-year-old son, and his six-year-old granddaughter.

"If you don't have dialysis you'll die," I say. "And then what will happen to your family?"

"They will be homeless."

Behind him, Edilberto's wife has started to cry. Holding a tissue to her face, she weeps: "He's the only one I have."

"Of those you know who have already died of the disease," I ask, "how many have worked in the sugar fields?"

"All of them."

It goes by many names, but around here they call it "the malady of the sugar cane". It's a quiet epidemic that has been preying on Central America for at least 20 years, killing impoverished landworkers in their tens of thousands across Nicaragua, Costa Rica, El Salvador and Guatemala. And it is becoming ever more deadly. Between 2005 and 2009, incidents in El Salvador rose by 26%. By 2011 the chronic kidney disease (CKD) that is killing Edilberto had become the country's second-biggest killer of men.

That year the health minister, María Isabel Rodríguez, made a dramatic appeal to the international community for help, telling them: "It is wasting away our populations." But nobody knows what to do about it, because nobody knows what exactly it is. In the wealthier west, CKD is largely caused by hypertension or diabetes, but most of the victims here have neither. And it attacks the kidneys in an unusual way. Rather than damaging the filtering

system, as in ordinary CKD, this disease seems to have an impact on the tubules - the part of the kidney where the composition of the urine is determined. At the moment, the only scientific consensus is that it's real, and unexplained. I have travelled to El Salvador to investigate the mystery of the malady.

Since its discovery, a near-silence has cocooned the disease - a situation that has benefited the industry that so many victims work for. Profitable and vast, Central America's sugar-cane industry supplies 23% of the US's raw sugar imports. In 2011 the EU imported El Salvadorian sugar worth more than €4.7m: it is the country's second-biggest export. The companies themselves say they are not to blame. Nicaragua Sugar Estates, one of Central America's largest plantations, has conducted internal studies, and one in 2001 pointed to "strenuous labour with exposure to high environmental temperatures without an adequate hydration programme" as an important factor. Still, in December spokesman Ariel Granera told the Washington-based Centre for Public Integrity: "We're convinced that we have nothing to do with kidney disease. Our productive practices do not generate and are not causal factors for CKD."

But an increasing number of researchers in the US now believe the CKD is being caused by heat stress and dehydration - that the labourers are, in effect, working themselves to death. A standard day for an El Salvadorian sugar worker lasts between four and five hours, with double shifts during the summer planting season, when temperatures top out at 40C.

"It's suffocating," Edilberto says. "In the five hours there's no break. Many of my workmates have fainted in the fields. Sometimes they vomit, too." Water, he says, is not supplied. "I bring my own. Perhaps two to three litres."

As I toured the villages I heard many accounts of barbaric suffering beneath the equatorial heat. Héctor García, 33, a stage-two patient, told me: "It's very hot; we suffer. People sometimes collapse. More often they vomit, especially when the heat is worse. They do two shifts to earn more money." Ismael Ramos, 40, who is at stage five, said: "In those cane fields, I can't stand it. I'm dizzy and sweating like crazy. I've vomited. I've fainted. I drown in sweat. When I come home, I feel surrendered. Sick. Headache. I can't shower because the water [from the roof-mounted tank] is too hot."

Has he ever seen anyone die?

"Once. A 50-year-old. The big heat can cause a heart to give in."

Scientists first became aware that there was a problem in the early 2000s, and yet this is thought to have been going on as long ago as the 1970s. It remained unknown partly because in the deep countryside there are no kidney specialists to identify such an unusual condition. Out there, the poor simply die. And the majority of sufferers do not even know they are ill: CKD is asymptomatic until its latest, most deadly stages. Even when they feel unwell, many don't want to know they have it - they can't afford the medication or the recommended diet of fresh vegetables and chicken breast. Everyone I speak to fears dialysis. They have seen a correlation, in their communities, between the start of treatment and painful death and have wrongly concluded that the one causes the other. The sugar companies certainly don't appear to be encouraging diagnosis: reports from Nicaragua suggest that workers who test positive are simply fired.

In the rutted streets and chicken-pecked yards of rural El Salvador, I hear many theories. Something in the air or something in the water. Something in tyres, in painkillers or in Chinese herbal medicine. Leftover DDT from the prewar years, when the land in the region was all

cotton fields. There is a common belief that modern agrochemicals, as used by the sugar companies, are responsible. The health minister believes this - she has told a press agency so - as does Edilberto. Now 46, he worked the sugar fields for 15 years, where his job was to plant seeds and to spray pesticide, herbicide and fertiliser. "I took the risk, always the risk," he tells me, shaking his head.

But academics in the US who have been trying to solve the mystery believe these El Salvadorians to be mistaken. Professor Daniel Brooks, of Boston University's School of Public Health, tells me: "It's natural to think that, on the one hand, workers have been exposed to pesticides and on the other they have this disease, therefore pesticides must have caused the disease. It's very human to make that connection. But that doesn't necessarily mean they *are* causing CKD. While I'm aware that the group in El Salvador has this hypothesis, and I'm always open to being convinced, our data just don't seem consistent with it."

Brooks's team began studying the disease in 2009. In the Nicaraguan sugar fields they found rates of CKD in cane cutters and seed cutters - the most strenuous jobs - to be higher than in pesticide applicators, who have greater exposure to agrochemicals. In short, it's more heat that seems to correlate with more disease, and not more chemicals. "We also tested construction workers, stevedores and miners, excluding people who had ever worked at a cane company," he says. "They had elevated levels, too. And what do they all seem to have in common? They're high manual-labour jobs." A further study, published in the *American Journal of Kidney Disease*, found increased levels of kidney damage in El Salvador's hot, low-lying areas but not in its cooler high-altitude sugar plantations, despite similarities in agrochemical use. But is it really heat that's killing the thousands?

We are speeding along the storm-wet roads of Bajo Lempa, on El Salvador's low-lying western coast, past roadside pineapple sellers and one-storey dwellings of brick and wood when I see them, a fleet of them, disappearing into a field. The immature sugar cane grows up past their shoulders, rows and rows of it, the narrow leaves forming spiny corridors whose ends are so distant they are impossible to see. The workers have blue containers strapped to their backs. They are spraying.

I ask the driver to stop, and we climb our way delicately over the barbed-wire fence. To my surprise the boss, the *jefe*, nods permission for me to photograph the process. A tractor is pulling a flatbed trailer along the plantation's edge. On it, two workers mix a livid-yellow potion in huge plastic barrels. They wear no protection. One of the men stirs the mixture with a tree branch. He has a wounded finger tied in a rudimentary bandage. Soon the sprayers emerge from cane, sodden from the rain-drenched foliage. They refill their packs, pouring the thick, acrid-smelling liquid from buckets. There's no drinking water in evidence, nor any for washing skin. They have yellow stains on their clothes and on their bare fingers.

Even being close to the barrels gives me a spinny, achey pressure in my temples, of the kind you might experience when sniffing too much amyl nitrate. They wear trainers, cotton shirts and tracksuit trousers, old football tops tied around their faces. One has a baseball cap with a big black dollar sign.

I learn that the mixture is of five chemicals: amine, terbutryn, pendimethalin, 2,4-D and atrazine. I don't know what they are, but can Professor Brooks's theory really be correct? That they have nothing to do with the disease in all these sugar workers?

In a nearby village I knock on the gate of 37-year-old Omar Rojas, a *jefe* who I've heard is responsible for paying the wages of the sugar sprayers. "We pay them \$5 a day," he tells me. It's raining, lightly, and his pig is causing a commotion behind me, pushing its snout over the wall

of its small pen and blowing bubbles of muddy snot. "And whose responsibility is supplying the safety gear?" I ask.

"It's up to everybody individually," he tells me. "There are recommendations on all the chemicals, but nobody regulates it. Nobody pays any attention." What does the protective gear cost? "Boots are \$10. I don't know how much anything else costs because I never bought it." How many of your men have got sick from doing this work? "A lot," he says. "Many people don't get checked. They don't know they have it. People say: 'Don't examine me - it's better not to know.'"

Have you been checked?

"I'm in the third stage."

I'm momentarily confused. "But I thought you didn't do any spraying," I say. "I thought you just paid the men. Do you work in the sugar fields, too?"

"No, but I spray my own property," he says. "I use the same chemicals."

Later that day I meet Wilfredo Ordoñez, 48, a stage-five sufferer who has been on dialysis. "I had lower back spasms and I would vomit often," he tells me. He seems a classic case of CKD by heat stress due to overwork in the sun, until I ask about his work. "I grow rice, cassava. I farm my own land. About a hectare."

These men, I realise, could hardly be working *themselves* to death. And neither, for that matter, can all the dying women who haven't worked the cane. In the villages, many believe the sickness in females and teenagers is a result of the annual crop sprayings that "burn everything - the people, not just the crops", as Edilberto told me. "Your nose itches, your eyes tear, headache, vomiting. Animals die. You see them on the street."

His wife interjects: "You can't hide from it. Even if you close your window, it penetrates. You cover your mouth but it enters anyway."

These low-lying areas are also susceptible to flooding. The floods could wash toxins into other areas and the water supply. One sufferer, Victor Rivas, 55, a sprayer for 25 years, is convinced this caused his illness. The water from the well, he says, tasted strange, "salty".

Back in the city I arrange a meeting with Dr Carlos Orantes, of El Salvador's ministry of health. Orantes is a kidney specialist who began a formal study of the problem in 2009. His team tested and surveyed six communities in Bajo Lempa - 775 individuals in 375 families. After analysing blood and urine samples, they found that 25.7% of the region's men and 11.8% of its women had the disease.

Dr Orantes sits back in his chair, loosens his tie, takes a sip of cappuccino and announces grandly: "There are three factors: prohibited pesticides, combinations of pesticides, and no protection from pesticides." I am bewildered by how sure he seems of himself. Everybody else speaks of this disease as a mystery. I show him a cutting from the US research pointing towards heat exhaustion as a cause.

"I respect their opinion," says Dr Orantes. "But these scientists have not put on their boots and gone into the countryside like I have. Until they do, they don't know. My opinion is: to have kidney damage you have to be exposed to a nephrotoxic agent. I agree that dehydration is a factor, but you would have to be very, very dehydrated for it to damage your kidneys."

"But the farmers spoke of horrific conditions in the summer," I tell him. "They've seen people vomit and faint from the heat. One even saw someone die! This paints a picture of acute dehydration of exactly the kind that you say is necessary to cause kidney damage."

Dr Orantes is unmoved. "There are agrochemicals that make you vomit and dizzy," he says. "It's not the heat - it's the chemicals." Did his survey include any questions about dehydration? "We didn't ask about that," he admits. "But we will. You know, I'm not obsessed by agrochemicals. I'm obsessed to find out the causes. If we could show that it's dehydration, I'd be happy. It would be really easy to solve."

I phone Professor Brooks. He says that this dizziness and vomiting in the fields would signify CKD in its late stages which, if you're well enough to be out working, you're unlikely to have. "We know heat can do that to you, and we know it's hot," he says. "So I think it's more likely to be heat. But things are messy. One possibility is that heat is not the starting factor, but that it takes some initial damage and progresses it to kidney disease."

I wonder if this "initial damage" of the kidneys could be agrochemical poisoning. I send the recipe for the yellow potion I saw being sprayed in Bajo Lempa to Professor Andrew Watterson of the University of Stirling - an authority on agrochemicals and health. They were herbicides, he says. Atrazine can cause kidney damage at high levels; acute exposure to 2,4-D can cause chronic kidney damage; pendimethalin, says Watterson, is "harmful through skin contact and inhalation"; in lab tests, long-term feeding of terbutryn to rats caused kidney damage. None of them was acutely toxic, but this combination, plus the tropical climate, could worsen their effects. Moreover, sprayers are required to avoid contact with skin; to wear face shields, respiratory protection, rubber boots and specialist coveralls. Viewing the photographs, Watterson says the use in Bajo Lempa represents "a terrible system of work" and is "a potentially serious threat to public health".

And then, a twist. A new professor with a new idea. Richard J Johnson, of the University of Colorado's Division of Renal Diseases and Hypertension, thinks the problem might have its genesis in a strange mechanism that his team discovered in rats. When they were fed vast amounts of sugar, an enzyme in their kidneys reacted with the fructose in a way that was "like a little bomb". It caused tubular damage, just like that found in Central American CKD. But how could humans ingest enough sugar to trigger these quasi-explosions? "We discovered that the [human] body can make its own fructose," he explains. "And this process gets turned on when you get dehydrated. So suddenly we have a mechanism of how dehydration might cause [tubular] kidney damage."

Johnson wonders if dehydrated workers with already sugary kidneys are rehydrating with soft drinks or fruit juice, thus piling on a potentially explosive fructose load. "It's not proven, so we don't want to get ahead of the gun here," he says, of the as-yet unpublished work. "But the experimental data is quite compelling, and it could explain what's going on."

Whether the final explanation turns out to be fruit, heat or chemicals, or none of them, the answer could not come sooner for the family of Ismael Ramos. "For 10 years I worked with the pump," Ismael tells me. "We used seven chemicals. There was no choice, no other jobs. When I found out I had the disease, I went crazy. I wanted to kill myself."

I ask how parents like Ramos feel, sending their youngsters to work the cane. "We have no choice; it's the only work there is. But we're very scared for our son." He glances towards 18-year-old Carlos, who has been watching from the background. "Sometimes, down here, he has pain," Ismael says. He rubs the sides of his lower back, in the region of his kidneys.

Will Storr travelled to El Salvador with the help of Christian Aid (christianaid.org.uk)

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