

Kidney Disease: An Occupational Hazard on the Rise

Amid extreme heat, an epidemic hits farmworkers especially hard.

By Nicole Fauteux



Roxana Chicas, assistant professor in the Nell Hodgson Woodruff School of Nursing at Emory University in Atlanta, places a heat monitor on a Georgia farmworker. Photo courtesy of Emory University.

As the planet warms and temperatures rise, heat exposure has become an occupational hazard for a growing segment of the workforce. Among those at greatest risk: the people who harvest our food. These otherwise healthy, often young adults are showing up in EDs with acute kidney injury and chronic kidney disease (CKD), conditions that impair the kidneys' ability to filter waste products from the blood.

Acute kidney injury traditionally appears in hospitalized patients, especially those receiving intensive care, and CKD typically afflicts older adults with diabetes and high blood pressure. But about 30 years ago, epidemiologists began to notice CKD in Central American sugarcane workers who lacked traditional risk factors for the disease. Today, the term *chronic kidney disease of unknown origin* (CKDu) is used to denote this condition, which has been widely documented, especially in tropical regions. Although researchers are still investigating the precise causal mechanisms behind CKDu, studies indicate that exposure to extreme heat and dehydration likely play key roles in the condition's rising prevalence.

If left untreated, CKD can progress to kidney failure, which requires dialysis—the mechanical filtering of a patient's blood over several hours, typically three times a week—or a kidney transplant, which can take years to acquire. Given the debilitating effects of end-stage kidney disease and the cost and intensity of treatment, researchers and advocates are asking urgent questions. What can be done to protect farmworkers, especially in the United States, where many are undocumented immigrants who lack regular access to health care? What policies and practices will best mitigate the risk of heat-related kidney disease among all outdoor workers?

ACUTE KIDNEY INJURY

For more than a decade, faculty at Emory University's Nell Hodgson Woodruff School of Nursing have been partnering with the Farmworker Association of Florida to study the health effects of heat on Florida's agricultural workers, and their findings are alarming. Dehydration is widespread, and about a third of the workers who were monitored in 2015 and 2016 were found to be experiencing acute kidney injury at least once a week. Researchers also observed a 47% increase in the odds of experiencing acute kidney injury for each 5 °F rise in the heat index.

Roxana Chicas, PhD, RN, FAAN, an assistant professor at the Nell Hodgson Woodruff School of Nursing, is looking for ways to reduce the incidence of acute kidney injury among farmworkers. She led a small pilot study that looked at the potential benefit of electrolytes in reducing acute kidney injury. Participants were assigned to drink either five liters of water over the course of their workday or five liters of water containing a rehydrating electrolyte solution. The researchers, who published their findings in the *Journal of Occupational and Environmental Medicine* in 2022, found that both groups were adequately hydrated at the end of the workday, but the incidence of acute kidney injury in the water group increased from 9% to 23%, whereas in the electrolyte group, it dropped from 30% to zero.

More recently, Chicas's team published findings in the same journal in 2024, looking at how piece-rate compensation, which incentivizes workers to forgo rest breaks and hydration, impacts acute kidney injury prevalence. Post-workday rates of acute kidney injury among piece-rate agricultural workers rose from 21% to 43% during the two-and-a-half-year study, whereas acute kidney injury rates remained stable at 11% for similar workers who were compensated with an hourly wage.

Chicas's team is currently using a wearable patch to collect vital signs from farmworkers throughout the workday and applying predictive analytics to the data to determine who is at greatest risk for acute kidney injury and other heat-related illnesses. She is hoping to persuade Florida growers to adopt use of the patch.

"Some growers are recognizing that if they want to keep a workforce that can tend to the crops, they're going to have to embrace interventions, and it seems as though technology is something they are really curious about," Chicas says.

CHRONIC KIDNEY DISEASE

Repeated acute kidney injury increases the risk of developing CKD and could be responsible—independently or in combination with other factors—for the rise in CKDu. Researchers at the Centers for Health, Work & Environment at the Colorado School of Public Health are studying the epidemic of kidney disease and testing ways to mitigate the risk of CKDu among Guatemalan sugarcane workers. The center has partnered with a Guatemalan agribusiness to ensure workers receive the following: access to shade, water, and electrolytes; rest breaks; education on the importance of hydration and other healthy behaviors; and acclimatization at the start of each season. The grower also has field nurses and physicians on site to monitor workers for signs of heat-related illness.

These protections are crucial but may be insufficient. Studies by the center's researchers reveal that many sugarcane workers' core body temperatures continue to rise after they leave the fields, giving their bodies little chance to recover from work-related heat stress despite being acclimatized. Additionally, they are exposed to agrochemicals and particulate matter from the routine burning of the sugarcane fields—exposures that could help explain what triggers CKDu.

Farmworkers are 35 times more likely to die from heat-related causes than workers in other industries, and construction workers experience disproportionately high levels of heat-related mortality.

"We feel confident that heat is absolutely playing a role, but it doesn't explain all of the disease that we see," says Miranda Dally, DrPH, MS, a research assistant professor at the Colorado School of Public Health's Center for Health, Work & Environment and Department of Environmental and Occupational Health. To learn more, the team is currently collaborating with laboratory scientists at the university to look at how silica found in air samples from the sugarcane fields influences kidney disease.

Researchers at the Stanford University School of Medicine posit groundwater contamination as another potential contributor. They superimposed unexplained cases of end-stage kidney

What Clinicians Need to Know

- Farmworkers and other people who are regularly exposed to extreme heat should be screened for kidney disease.
- The Centers for Disease Control and Prevention (CDC) estimates that one in seven U.S. adults have CKD, but up to 90% of them may not know it.
- Acute kidney injury and early-stage CKD may be asymptomatic. Test patients' blood for creatinine to see how the kidneys are functioning, and test their urine for protein, which may indicate kidney damage.
- Everyone exposed to extreme heat should be counseled to wear light clothing, seek shade, take regular breaks from exertion, and drink plenty of water, preferably with electrolytes.
- Consult the CDC, National Kidney Foundation, and other resources to learn more about the prevention, testing, and treatment of kidney disease in public health, primary care, and emergency settings.
- Clinicians can also advocate for worker protections at the local, state, and federal levels and support efforts to modify state emergency Medicaid policies.

disease in California's Central Valley on a map showing nitrate concentration in the state's groundwater. The researchers found that the percentage of end-stage kidney disease cases classified as unexplained was more than twice as high in regions with above-average nitrate concentrations in the groundwater than in the rest of the state.

POLICYMAKING FALLS SHORT

Efforts to document and mitigate heat-related acute kidney injury and CKDu come at a time when attempts to protect workers from heat stress are under attack. In 2023, Texas passed a law prohibiting local governments from instituting rules that go beyond what is already authorized by state law, effectively overturning ordinances in both Dallas and Austin that allowed for 10-minute water and sun protection breaks every four hours for construction workers. Florida passed a law in 2024 that explicitly banned local governments from mandating heat protections for workers. Legislative efforts in the state last spring that would have required heat safety protections failed to make it out of committee, leaving outdoor workers vulnerable to the negative health consequences of prolonged heat exposure in the nation's hottest state.

The Occupational Safety and Health Administration (OSHA) sets standards employers must follow to protect workers from known hazards, which include extreme heat, but OSHA lacks a specific heat safety standard. A draft standard was released in 2025, but it appears unlikely to be adopted any time soon. This makes it difficult for OSHA to hold employers accountable for heat-related injuries or to impose penalties that would compel compliance.

In the absence of meaningful federal protection, seven states have implemented occupational heat safety standards,

and several more have introduced legislation to do the same. Compelling employers to provide water, electrolytes, shade, rest breaks, and time to acclimatize could go a long way toward reducing the incidence of kidney disease among outdoor workers of all types. However, for such policies to be effective, governments need inspectors to enforce them, and sufficiently high fines for those who break the rules. Dally points to another challenge: employers don't necessarily know how to put heat safety policies into practice. She believes partnerships with universities, associations, and other trusted messengers can engage business owners and give them the resources they need to better protect their workers from the heat.

ACCESS TO KIDNEY CARE LIMITED

In most states, undocumented people with CKD may only access dialysis through hospital EDs and when they are on the brink of death. In an open letter to state Medicaid directors in 2021, the National Kidney Foundation, the American Society of Nephrology, and eight other organizations called the care these people receive "inhumane, extraordinarily expensive, and largely ineffectual." They urged the Medicaid directors to modify state emergency Medicaid policies—in which hospitals are reimbursed for treating people with emergency conditions who might otherwise qualify for Medicaid but don't have eligible immigration status—to allow this population access to home

and outpatient dialysis and directed living-donor kidney transplantation.

Currently, 30 states, including Florida and Texas, provide no access to kidney transplants or scheduled dialysis for undocumented residents. California and four other states provide both. Colorado, which changed its Medicaid policy to cover scheduled dialysis for undocumented immigrants with kidney failure in 2019, saw its per-patient costs fall from almost \$20,000 to \$5,574 per month, even with an increase in the number of patients served.

Farmworkers are 35 times more likely to die from heat-related causes than workers in other industries, and construction workers experience disproportionately high levels of heat-related mortality. Letter carriers are also at risk, accounting for two heat-related deaths in Texas in the past few years. With no immediate prospect of slowing or reversing global warming, the rise in kidney disease and other heat-related conditions demands increased attention from policymakers, employers, and clinicians. (For more, see *What Clinicians Need to Know*.)

"When a high school athlete dies from the heat, that makes the news and we're all very upset—rightly so," says Chicas. "But I think we also need to take that concern to this other population that is working outdoors in the heat and also needs our protection." ▼

DOI-10.1097/AJN.000000000000296

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