



Enigmatic Renal Failure

in Agricultural Communities

Common threads and distinctions
in an atypical disease



Photo courtesy of Bridge of Life.

*For the past 20 years, a fatal form of chronic kidney disease of unknown origin (CKDu) has plagued agricultural workers worldwide, and is now at epidemic levels. Geographical regions extend from Central America to Asia, while occupations range from rice farmers to sugarcane workers and miners. Conditions, however, remain predictably consistent: An overwhelming majority of the affected agricultural workers live in rural communities, are the sole supporters of families and work the only job available in their impoverished country. Healthcare is non-accessible. Renal dialysis is unaffordable. **Premature death is certain.***

Although increases in mortality associated with CKDu has alarmed local medical professionals for years, variables in geographic location and economies relegated such concerns to regional public health agencies. Now, as scientists, medical communities and government agencies collaborate and share data, similarities and distinctions of CKDu in agricultural workers are being made across oceans of afflicted populations. Several theories have been proposed, yet etiology remains elusive.

Absent CKD Risk Factors

Currently, global definition of CKDu is nonexistent. Diagnosis is made through exclusion, when chronic kidney disease (CKD) is evident but traditional CKD risk factors are not.

Diabetes and hypertension associated with aging and obesity are recognized throughout the world as predominant risk factors for developing CKD. Women are traditionally affected more than men; globally, it's estimated one in four women and one in five men between the ages of 65 and 74 have CKD. Some types of CKD are congenital, occurring with greater frequency among certain races. CKD can also result from infectious diseases that cause glomerulonephritis—an acute inflammation of the glomeruli, which act as filters to remove excess fluid, electrolytes and waste from the bloodstream.² Glomerulonephritis can reach epidemic levels in impoverished countries.

Although ruling out traditional CKD risk factors to diagnose CKDu is uni-

versally accepted, specific criteria to determine CKDu remains inconsistent, notably in endemic regions. For example, in Central America, CKDu diagnosis is based off of urine dipstick and serum creatinine, while in Sri Lanka, CKDu diagnosis relies on persistent albuminuria, defined as an albumin-creatinine ratio ≥ 30 mg/g in urine samples.¹

Nonetheless, traditional risk factors of CKD are absent in an extraordinary amount of agricultural workers suffering from end-stage renal disease (ESRD). The vast majority are men between the ages of 20 to 60 who work physically strenuous jobs—typically, but not always, involving soil—in hot

lowland climates. Additional associations include exposure to agrochemicals, dehydration, poor water quality, use of nephrotoxic herbal medications and consumption of homemade alcohol. No associations have been made to type of crops, which include cotton, sugarcane, bananas, coffee, rice and vegetables. Service workers, such as miners, construction and dockworkers, have been affected at lesser levels.⁴

A solid majority lack access to healthcare, and the majority who seek healthcare do so when their kidney disease has reached ESRD.³

Central America

Along the Pacific coast of Central America, an epidemic of CKDu has created waves of premature death among agricultural workers. El Salvador, Guatemala and Nicaragua represent the greatest prevalence, where ESRD mortality rates are four times greater than global rates and 17 times greater than other regions in the Americas. Age-specific rates among younger men are up to 15 times higher than the U.S.^{4,5}

In the coastal city of Chichigalpa,



CKDu diagnosis is made through exclusion, when chronic kidney disease (CKD) is evident but traditional CKD risk factors are not.

Photo courtesy of Bridge of Life.

In the coastal city of Chichigalpa, Nicaragua, approximately 50 percent of mortalities in men ages 35 to 55 were attributed to CKDu in the last decade.



Photo courtesy of Bridge of Life.

Nicaragua, approximately 50 percent of mortalities in men ages 35 to 55 were attributed to CKDu in the last decade, with sugarcane workers comprising 75 percent of those mortalities.⁶

Sugarcane workers are paid by the amount of sugarcane they cut, a type of performance pay for what many consider to be the most physically intense job in the world. To earn more, workers push themselves to cut more; they easily lose more than 5 pounds in one workday while consuming, on average, 7 liters of water. Many experts believe the strenuous work in high temperatures causes heat stress, dehydration and volume depletion, all contributing factors of kidney disease. Others suspect toxins in agrochemicals and pesticides play a major role in CKDu development. In fact, emphasis on toxic exposure to agrochemicals has been a common thread throughout many reports and studies concerning Central American workers afflicted with CKDu.

However, exposure to toxic chemicals doesn't explain the rise of CKDu in coastal miners and dockworkers, whose jobs exclude continuous exposure to pesticides, fertilizers and other agrochemicals. Nor does it explain the total omission of CKDu

in agricultural workers who perform similar jobs, at similar agrochemical exposure levels, yet who work in higher altitudes with cooler temperatures.

Contradictions also appear in theories for climate-induced CKDu. Several Central American countries have temperatures comparable to El Salvador, Guatemala and Nicaragua, yet there is no indication of a CKDu epidemic in people working in sugarcane fields or other physically strenuous jobs.⁷

Sri Lanka

Similar to Central America, epidemic levels of CKDu are afflicting impoverished agricultural workers living in rural communities. Many work in hot, dry zones in areas with lower elevation, spending hours in the fields with limited water intake. Concentrations of CKDu are seen in the North Central and North Western provinces, and are also appearing in the Uva, Eastern and Northern provinces. Women and men are affected at similar rates, yet a majority of late-stage renal failure patients are men between the ages of 30 to 60. On average, those afflicted with CKDu have more than 10 years of experience working in agriculture, farming chena (vegetables and other crops) or rice. Rice farmers typically present a lower prevalence of CKDu compared to chena farmers.¹

As with Central America, studies focused on environmental factors, including affects of climate and use of agrochemicals. A joint study by Sri Lanka and WHO hypothesized chronic exposure to cadmium (a natural mineral found in the earth's crust) and arsenic in the food chain,



Photo courtesy of Bridge of Life.

Exposure to toxic chemicals doesn't explain the rise of CKDu in coastal miners and dockworkers, or the total omission of CKDu in agricultural workers who perform the same job in cooler temperatures.

as well as pesticides, were leading causes of the CKDu epidemic. The study's conclusion, however, did not support the hypothesis. Other studies have focused on phosphate fertilizers containing traces of cadmium, as well as pesticides, leaching into groundwater wells. These studies also failed to support theories. Phosphate mining in endemic areas is being considered as cause, yet study results have not been published.⁸

A paper authored by a professor at the University of Colombo, Sri Lanka, suggests that although the etiology of CKDu remains uncertain, mounting evidence shows risk factors are specific to rural agricultural work and exposure to agrochemicals. As such, the author suggests renaming CKDu to chronic agrochemical nephropathy.⁹ To date, the suggestion remains a suggestion.

Yet another study, published May 2016, links climate change to the increase of CKDu in global-rural areas. One of the study authors said this new type of kidney disease may be one of the first epidemics caused by global warming, and recommends actions to address climate change are made in tandem with uncovering the cause of CKDu.¹⁰

Bridging Access

Although hypotheses may vary, a consensus of researchers and physicians recognizes that agricultural workers living in endemic communities lack access to appropriate healthcare, and those who receive

medical care are often in final stages of renal failure. In addition, many recognize that agricultural workers are unaware that lifestyle choices, such as drinking homemade alcohol and consuming specific herbs, cause kidney damage.

Bridge of Life (BOL), a non-profit organization founded by DaVita HealthCare Partners, Inc., and operating under DaVita Village Trust, Inc., has been providing education and CKD screenings to impoverished people throughout the world. In fact, BOL's Prevention and Education program has screened and educated more than 64,000 men, women and children since 2007.

BOL began targeting specific at-risk groups, including agricultural workers, in 2016. The non-profit organization partnered with The Colorado School of Public Health and AgroAmerica, during a recent Prevention and Education medical mission to Trifinio, Guatemala. Working with local medical staff, partner volunteers provided general health assessments, education and CKD screenings to more than 1,000 banana plantation workers. Specific screening methods included taking blood pressure, testing for diabetes, testing for proteinuria (urine test for protein), collecting BMI (height and weight), and completing a targeted health questionnaire that provides further understanding of family history, lifestyle and work environment. Detailed data collected during the mission will help researchers detect similarities between lifestyle and

family genetics, in addition to similarities in blood and urine test results, to further determine potential causes and risk factors for agricultural workers developing CKDu.

Regardless of varying theories and studies, an undeniable fact is the prevalence of CKD is increasing globally. In 1990, CKD was ranked 27th on the list of causes of death worldwide; by 2010, CKD rose to 18th place. The degree of movement is second only to HIV and AIDs. In addition, approximately 10 percent of the global population is afflicted with CKD, and millions die because they do not have access to treatment.²

By supporting non-profit groups such as BOL, empathic adults and healthcare professionals help ensure all people—regardless of nation or economic levels—receive appropriate screenings, education and access to vital healthcare services. In addition, they actively show concern for those whose jobs bring affordable food to their local grocery stores and dinner tables.



To learn more about BOL, please visit
BridgeOfLifeInternational.org.

Sources:

¹Virginia M. Weaver, et al., *Global dimensions of chronic kidney disease of unknown etiology (CKDu): a modern era environmental and/or occupational nephropathy?* August 19, 2015, accessed May 2016 at biomedcentral.com

²National Kidney Foundation, *Global Facts About Kidney Disease*, March 2015, accessed May 2016 at kidney.org

³Mayo Clinic, *Diseases and Conditions: Glomerulonephritis*, March 28, 2014, accessed May 2016 at mayoclinic.org

⁴Miguel Almaguer, MD, et al., *Chronic Kidney Disease of Unknown Etiology in Agricultural Communities*, April 2014, accessed May 2016 at ncbi.nlm.nih.gov

⁵Rebecca Zumoff, *Study shows role of heat stress, volume depletion on kidney failure epidemic among Central American agricultural workers*, October 7, 2015, accessed May 2016 at nephrologynews.com

⁶La Isla Foundation, *The CKDu Public Health Epidemic*, accessed May 2016 at laislafoundation.org

⁷Megan Phelan, *Researchers Hunt Origin of an Enigmatic Kidney Disease*, April 10, 2014, accessed May 2016 at aaas.org

⁸Myles F. Elledge, et al., *Chronic Kidney Disease of Unknown Etiology in Sri Lanka: Quest for Understanding and Global Implications*, May 2014, accessed May 2016 at rti.org

⁹Saroj Jayasinghe, MBBS, MD, FRCP, *Chronic kidney disease of unknown etiology should be renamed chronic agrochemical nephropathy*, April 2014, accessed May 2016 at scielosp.org

¹⁰Robert Preidt, *Study Links Climate Change to Kidney Disease*, May 5, 2016, accessed May 2016 at nlm.nih.gov/medlineplus