Chronic Kidney Disease of Unknown Etiology

NIOSH Pesticide Exposure Study in El Salvador Sugarcane Workers

NIOSH Board of Scientific Counselors

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The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the National Institute for Occupational Safety and Health.
An epidemic of kidney disease believed to be driven by occupational factors.

In Mexico and Central America it is known as Chronic Kidney Disease of Unknown Etiology (cause) (CKDu), Chronic Kidney Disease of non-traditional cause (CKDnT) and Mesoamerican Endemic Nephropathy (MeN)
In the most studied region, Mesoamerica, at least 20,000 people have died in the last 10 years alone.

Cases: young, non-diabetic, non-hypertensive men
WHO IS AFFECTED AND WHERE?

Latin America: The most impacted group are sugarcane workers. Mining and construction workers are also affected.

India: Sugar, rice, coconut, and cashew farmers are most affected.

Sri Lanka: Rice and sugarcane workers show the highest prevalence.

Southeast Asia: Industry and clinicians report sugar workers affected with what appears to be a similar disease.
Current research demonstrates that CKDnT is multi-causal and occupational.

According to the leading hypothesis, heat stress and dehydration due to excessive workload exacerbate exposures to environmental toxicants.

Repeated kidney damage culminates in loss of function.
The Worker Health and Efficiency (WE) Program was born out of studies looking at heat stress and other risk factors for CKDnT.

It is executed in coordination with the following institutions:
THE WE PROGRAM ADDRESSES KNOWN RISK FACTORS FOR CKDU.

- Dehydration
- Excessive workload and heat stress
- Toxicant Exposures
- Anti-inflammatory consumption
- Infectious disease

In El Salvador, the WE program is focusing on preventing heat stress and dehydration through work, rest and shade, and worker efficiency interventions.
HYDRATION: ACCESS TO WATER IS AS IMPORTANT AS QUANTITY

Workers receive:

3-liter insulated thermos or a 2-liter CamelBak backpack and a daily electrolyte solution
Heat Stress:

Mandatory rest breaks under mobile shade tents using OSHA guidelines
Exertion:

Improved cutting practices and a new machete

Findings:
- self-reported water consumption increased 25%.
- Heat Stress & dehydration symptoms decreased
- Positive perception of new machete
- Individual daily production increased

Bodin et al, 2016
Chronic and severe dehydration can amplify the impact of toxicants. Proper hydration gives the kidneys a chance to do their job.

El Salvador legislature proposed banning 53 pesticides.

NIOSH is working to identify if pesticides are a danger to sugarcane workers.
NIOSH was asked to participate with the WE program through a technical assist request from PAHO.
Sugarcane Harvesting Process

- Typical harvest (zaffra) in El Salvador is November to March
- Harvesting is done manually
- Glyphosate may be applied to sugarcane prior to harvest to speed up sugarcane ripening and increase sugar content.
  - In the U.S. it is advised to apply glyphosate as a ripening agent 28-49 days prior to harvest.
- Sugarcane is burned just prior to harvesting, from a few days to the night before.
Recent Research

• One occupational risk considered by some to be a potential etiologic factor in CKDu in Sri-Lanka and Central America, is pesticide exposure. (Jayasumana, et al., 2014a; Ordunez, et al., 2014a; Ordunez, et al., 2014b)

• One hypothesis is that glyphosate in conjunction with arsenic and hard water, may be a potential cause of CKDu among agricultural workers in Sri Lanka. (Jayasumana, et al., 2014b)

• Self-reported carbamate pesticide use was more common among workers with a decrease in eGFR (74% versus 29% of the remaining workers). (García-Trabanino, et al., 2015)

• In the United States, a recent study found positive exposure response trends between exposure to six pesticides and end-stage renal disease. (Lebov, et al., 2015)
Sampling Methods.

• 40 sugarcane cutters (male and female) in 2 locations.
  • Inland and coastal, 20 cutters each location.
  • Sampling on 3 consecutive workdays per location.
  • Area air, hand wipe, urine, and water samples collected.
  • Analyzed for glyphosate and 2,4-D.
Security was an issue.
The State Department required armed guards.
Hand wipe sampling of sugarcane cutters.
Urine collection
Air Sampling
Families often come to the fields to have lunch.
Hard labor and hot conditions.
Results

• All air samples were ND for glyphosate and 2,4-D
  • LOD: Gly 0.08 ug/sample; 2,4-D 1 ug/sample
• All air samples were ND for respirable dust
  • LOD: Resp dust 40 ug/sample
• All hand wipe samples were ND for glyphosate and 2,4-D
  • LOD: Gly 0.8 ug/sample; 2,4-D 0.5 ug/sample
• Urine samples still being analyzed.
Next Steps

• Should NIOSH be studying CKDu in the U.S.?

• If so what should we do?
  • Surveillance - Are there any case of CKDu? What is the prevalence?
  • Exposure studies?

• Should NIOSH consider studying heat related illness and climate change?
  • Wildland firefighters
THANK YOU