“Silent Killers”

Madeleine K. Scammell, DSc.
Associate Professor of Environmental Health

Chelsea East Boston Heat Study (C-HEAT)
The ‘silent massacre’ killing El Salvador’s sugarcane workers

Feb 20, 2018 6:10 PM EST

https://www.pbs.org/newshour/show/the-silent-massacre-killing-el-salvadors-sugarcane-workers

Fred de Sam Lazaro
Feb 2018
HEAT STRESS HYPOTHESIS

Meeting Abstract

Heat stress and workload associated with sugarcane cutting - an excessively strenuous occupation!

Rebekah Al Luci1, Theo Bodin2, Ramon Garcia-Trabanino3, Catharina Wesseling4, Jason Glaser5, Illana Weiss6, Emmanuel Jarquin5, Kristina Jakobsson1, David H Wegman1

Environmental Research

Volume 142, October 2015, Pages 746-755

Heat stress, dehydration, and kidney function in sugarcane cutters in El Salvador – A cross-shift study of workers at risk of Mesoamerican nephropathy

Ramón García-Trabanino a b, Emmanuel Jarquin a, Catharina Wesseling a, Richard J Johnson a, Marvin González-Quirouz a, Illana Weiss a, Jason Glaser b, Juan José Vindel c, Leo Stockfelt c, Carlos Roncal d, Tamara Harra c, Lars Barregard c, d

Annals of Nutrition and Metabolism

Proceedings

Mechanisms by Which Dehydration May Lead to Chronic Kidney Disease

Roncal-Jimenez C. a, Lanaspa M.A. a, Jensen T. a, Sanchez-Lozada L.G. b, Johnson R.J. a

International Journal of Environmental Research and Public Health

Article

Climate Trends at a Hotspot of Chronic Kidney Disease of Unknown Causes in Nicaragua, 1973–2014

Zoe E. Petropoulos a, b, c, Oriana Ramirez-Rubio a, b, c, Madeleine K. Scammell a, Rebecca L. Laws a, Damaris Lopez-Pilarte a, Juan Jose Amador a, Joan Ballester a, Cristina O’Callaghan-Gordo a, b, c, d, e, f, g and Daniel R. Brooks a

Journal of Pharmacological Sciences

Volume 141, Issue 1, September 2019, Pages 49-55

Full Paper

A novel rat model of contrast-induced nephropathy based on dehydration

Kun Liu a, Ling-yun Zhou b, Dai-yang Li b, Wen-jing Cheng b, Wen-jun Yin b, Can Hu a, Yue-liang Xie a, Jiang-ling Wang a, Shan-rui Zuo b, Lin-hua Chen c, Ge Zhou a, Xiao-cong Zuo b, c, d
Prevalence and Risk Factors for CKD Among Brickmaking Workers in La Paz Centro, Nicaragua

Lyanne Gallo-Ruiz,* Caryn M. Sennett,* Mauricio Sánchez-Delgado, Ana García-Urbina, Tania Gámez-Altamirano, Kornel Basra, Rebecca L. Laws, Juan José Amador, Damaris López-Pilar, Yorghos Tripodis, Daniel R. Brooks, Michael D. McClean, Joseph Kupferman, David Friedman, Aurora Aragón, Marvin González-Quiroz, and Madeleine K. Scammell

Rationale & Objective: In Central America, there is a high prevalence of chronic kidney disease (CKD) of nontraditional etiology often observed among agricultural workers. Few studies have assessed CKD prevalence among workers in nonagricultural occupations, which was the objective of this investigation.

Study Design: Prospective cohort study.

Setting & Participants: Male and female workers (n = 224) employed by artisanal brickmaking facilities in La Paz Centro, Nicaragua.

Predictors: Age, sex, education, smoking status, body mass index, alcohol consumption, water consumption, first-degree relative(s) with CKD, years worked, hours worked per week, job category, study visit (baseline and follow-up), and self-reports.

Outcomes: Glomerular filtration rate (2 time points: 4).

Analytical Approach: A mixed-effects linear regression model was used to estimate demographic, occupational, and environmental factors and time with change in eGFR was also evaluated. Multivariable logistic regression models were used to evaluate predictors of CKD.

Results: The CKD prevalence was 12.1% (n = 27). 100% of cases were male, 30% had stage 5 CKD (eGFR < 15 mL/min/1.73 m²), and 22% were younger than 35 years. Proportions of participants with eGFRs < 60 mL/min/1.73 m² at baseline and follow-up were 13.8% and 15.2%, respectively. Linear regression analysis demonstrated significant predictors of lower kidney function at baseline including oven work, older age, lack of education, and having an immediate family member with CKD. Predictors of CKD identified using logistic regression analysis included oven work and lack of education.

Table 3: Linear Regression Models of eGFR

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean Difference (95% CI)</th>
<th>P</th>
<th>Coefficient From Time Interaction (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, per 1 y older</td>
<td>-0.95 (-1.42 to -0.47)</td>
<td>&lt;0.001</td>
<td>0.07 (-0.27 to 0.41)</td>
<td>0.7</td>
</tr>
<tr>
<td>Male sex</td>
<td>-5.24 (-10.72 to 6.54)</td>
<td>0.4</td>
<td>-2.22 (-10.88 to 6.45)</td>
<td>0.6</td>
</tr>
<tr>
<td>BMI ≥ 30 vs &lt;30 kg/m²</td>
<td>-2.28 (-12.85 to 8.29)</td>
<td>0.7</td>
<td>-0.77 (-9.38 to 7.85)</td>
<td>0.9</td>
</tr>
<tr>
<td>Education</td>
<td>-14.17 (-24.30 to -4.09)</td>
<td>0.006</td>
<td>-1.98 (-9.29 to 5.32)</td>
<td>0.6</td>
</tr>
<tr>
<td>Primary</td>
<td>-3.9 (-12.50 to 4.69)</td>
<td>0.2</td>
<td>-5.70 (-11.88 to 0.47)</td>
<td>0.07</td>
</tr>
<tr>
<td>Secondary/University</td>
<td>1.00 (reference)</td>
<td>—</td>
<td>1.00 (reference)</td>
<td>—</td>
</tr>
<tr>
<td>Immediate family member with CKD (Y vs N)</td>
<td>-7.66 (-16.17 to -3.32)</td>
<td>0.05</td>
<td>-1.64 (-7.14 to 3.86)</td>
<td>0.6</td>
</tr>
<tr>
<td>Fatality rate (reference)</td>
<td>3.91 (-1.44 to 1.88)</td>
<td>0.6</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Job</td>
<td>-15.52 (-26.02 to -5.01)</td>
<td>0.004</td>
<td>7.10 (-0.59 to 14.79)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Complete author and article information provided before references.

Correspondence to M. González-Quiroz (mgon9999.00@yahoo.co)

*L.GFR and C.M.S.

Copyright © 2019 by the National Kidney Foundation, Inc.
El Salvador:
Dr. Emmanuel Jarquin
Dr. Ramon Trabanino

Nicaragua:
Dr. Juan Jose Amador
Lic. Damaris Lopez
Research Group for the Study of Chronic Kidney Disease in Central America.

MANOS BU Team

- Dan Brooks
- Jessica Leibler
- Sinead Keogh
- Zoe Petropolous
- Iris Delgado
- Erin Polka
- David Friedman (Harvard/BIDMC)
- Yorghos Tripodis
- Mike McClean

Collaborators:

- Linda McCauley, Emory University
- Ana Navas-Acien, Columbia University
- Patrick Parsons, State University of New York
- Kannan Kurunthachalam, New York University
- Chirag Parikh, Johns Hopkins University
Characterizing Heat Exposure & Heat Stress

Zoe Petropoulos, PhD
NIEHS F31 ES030974

Core Body Temperature

Heart Rate and Accelerometry
HEAT STRESS HYPOTHESIS

- Prevención de enfermedades a causa del calor
HEAT STRESS HYPOTHESIS

Boston University School of Public Health
Department of Environmental Health

Estimated Percentage of Heat-related Deaths by Citizenship (2005-2014)

96% Non-U.S. Citizen
4% U.S. Citizen

Three states: Arizona, California and Texas accounted for 95% of non-U.S. citizen deaths, and 37% of U.S. citizen deaths in 2005-2014.

Non-U.S. citizens age 18 to 24 were 20 times more likely to die from excessive heat exposure than were U.S. citizens in the same age group.

Heat-related deaths accounted for 999 (2.23%) deaths among non-U.S. citizens compared with 4,196 (0.02%) deaths among U.S. citizens.

https://www.apha.org/
No Tropical Paradise: Urban 'Heat Islands' Are Hotbeds For Health Problems

Updated July 07, 2017 By Martha Bebinger

[Image of a city street with cars and pedestrians]
C-HEAT:
A study of heat exposure in Chelsea and East Boston, Massachusetts

A collaborative research project between GreenRoots and the Boston University School of Public Health.

The main goal of the project is to build the capacity for these communities to respond to extreme heat events. Our research considers heat exposure and related health concerns among the most vulnerable populations in the Chelsea Creek communities.

c-heatproject.org
Twitter: @C_HEATProject

Funded: Barr Foundation
Thank you to C-HEAT Study participants

City of Chelsea
- Victor Tiernan and Ben Cares

Advisory team
- Zoe Davis City of Boston, Climate Resilience Program
- Matt Frank Chelsea Housing Authority
- Melanie Gárate Mystic River Watershed Association/Mystic Resilience Collaborative
- Indrani Ghosh Weston & Sampson
- Rafael Mares The Neighborhood Developers
- Fidel Maltez City of Chelsea, Department of Public Works

GreenRoots
- Roseann Bongiovanni
- Bianca Bowman
- Ibrahim Lopez-Hernandez

Boston University
- Patricia Fabian
- Flannery Black-Ingerson
- Pilar Botana
- Leila Heidari
- Patrick Kinney
- Julie de Lange
- Hannah Levine
- Jonathan Levy
- Alina McIntyre
- Chad Milano
- Abgel Negassa
- Ameera & Alex Saba

Barr Foundation
- Kalila Barnett
Goal and Objectives

▪ **Build capacity to respond to extreme heat events:**
  
  ▪ **Map.** Characterize high-risk locations and populations AND mitigating community assets via participatory mapping and monitoring.
  
  ▪ **Measure.** Analyze personal and home temperature exposure patterns via field measurements.
  
  ▪ **Listen.** Learn about barriers and opportunities to maintain temperature control among vulnerable residents via Photovoice, surveys, and questionnaires.
  
  ▪ **Translate.** Key findings from our studies into intervention strategies at individual, community and city level.
C-HEAT:
A study of heat exposure
Boston, Massachusetts
A collaborative research project between
GreenRoots and the Boston University School of Public Health.
About the Study

Heat Vulnerabilities

Looking at heat requires understanding areas and populations that are most vulnerable and/or susceptible to the increasing temperatures associated with a warming climate. In this and the following tabs, explore datasets for Chelsea and East Boston areas related to environmental, health, economic, social, and housing factors of the urban heat island effect.

Click on the green words below to view the map:
- **Vulnerability Index** - Vulnerability Index Score for heat climate impacts, higher score indicates higher vulnerability. Averages across heat, adaptive, and sensitive indices (MSPC 2019).
- **Adaptive Capacity Index** - Adaptive Capacity Index Score for heat climate impacts, higher score indicates higher adaptive capacity. Indicators include: renter-occupied units, mobile housing units, vehicle status, internet access, education, employment, median household income, poverty rate, Latino population, Black population, Asian population, Indigenous, multiracial, senior living alone, single-parent families, linguistic isolation, population with no health insurance, population in different residence (MSPC 2019).
- **Sensitivity Index** - Sensitivity Index Score for heat climate impacts, higher score indicates higher sensitivity. Indicators include: overcrowding, population in group quarters, age 65 or below, age 65 and older, central A/C, basement flood risk, disability prevalence, cardiovascular disease prevalence, asthma hospitalization rate, diabetes prevalence, and exposed workers (MSPC 2019).
- **Land Surface Temperature** - Land surface temperature, ranging from blue to red, with red representing 34 degrees celcius and blue representing 18 degrees celcius.

Social Vulnerabilities

34 degrees C
93.2 degrees F
City Heat Plans: Urban Heat Island Mitigation and Adaptation in the United States

New York City: Get Cool NYC (2020)

New York City is providing up to 74,000 air conditioning units for low-income seniors this summer. 4,395 units have been installed as of June 12, 2020.

References:

Outdoor temperature

- Partnered with City of Chelsea
- Municipal Vulnerabilities Planning grant
- 24 households
- Recruited via email list serv, member mtgs, word of mouth
Indoor and personal data collection

Phone data connects to a cloud database.

Azure function (Microsoft service available at BU) requests (1) and receives (2) data, and uploads (3) to the HIPAA Sharepoint database every 10 minutes.

Biometric data:
(heart rate, step count, sleep)

Location data:
(Latitude, Longitude) *

Temp / Relative Humidity:

Data in the cloud

--

Boston University School of Public Health
Department of Environmental Health

FitBit, Tile, HOBO images taken from manufacturer
Where is it hot?

- **20 ambient sensors** on trees in Chelsea and East Boston
- **Installed** between May 21 and June 17
- As of August 31, we collected on average \(~69\) days of data per sensor
Where is it hot?

Hourly outdoor temperatures...
Ranged: 55°F to 101°F
Hottest sensor on average: 7 °F higher than coolest sensor

Mary C. Burke Elementary Complex
Washington & Cherry
Broadway & Fourth
Boatswains Way
Trustman & Brandywyne
London & Porter

Boston University School of Public Health
Department of Environmental Health
On a hot week: *Outdoor Temperatures*

Outdoor Temperatures 8/21 through 8/28

Average Hourly Temp. Degree F.

Outdoor Temperature Recording Devices
What makes homes hot?

Variables Considered:

- Roof tone
- Façade tone
- Façade type
- Window-wall ratio
- AC type
- Shade tree
- Floor
- Roof shape
- % Impervious
- % Pavement
- Direction
- % Trees
- Year Built
- Stories
- Style
- Value
On a hot week: *Indoor* Temperatures

Indoor Temperatures Measured between 8/21 through 8/28

Comfortable Indoor Temperature Range: 75 – 80.5°F
What makes homes hotter or cooler?

Among our participants, cooler indoor temperatures for those...

- **Using AC** in a given week (as indicated by weekly check-ins)
- **With Central AC** (compared to other AC)
- **Living below floor 2** (compared to on/above floor 2)
- **With lighter-colored roofs** (at midday, compared to darker roof tones)
Photovoice

A participatory action research method that engages participants in the use of photography to represent their experience and perspectives on a certain topic.

Goals of Photovoice

- 1) to enable people to record and reflect their community’s strengths and concerns
- 2) to promote critical dialogue and knowledge about important issue through small group discussions of photographs
- 3) to reach policy makers

Results

▪ Where are the trees? / Here are the trees!
  ▪ Tree (in)equity: there is unequal distribution and access to green space and parks. The quality, utility, and accessibility of green spaces matters.
  ▪ When we feel the heat: in transit! Feeling the lack of shade and the heat from the pavement while walking, at bus stops, and MBTA stations.
  ▪ Compounded problems: Where there is a lack of trees, there are also other exposures: noise, air pollution from cars and buses.

▪ Populations vulnerable to heat
▪ Water: the good, the bad and the ugly
▪ Keeping it cool, creatively
Where are the trees?

This is the industrial side of Chelsea which impacts the microclimate. Both factory and truck exhaust surrounding concrete adds to the heat island effect.
Here are the trees!

This street, and the rest of Admiral’s Hill, has an abundance of trees and vegetation that offer protection from the heat as well as the air and noise pollution of the Tobin Bridge. I am hopeful that when city officials see these photos, they’ll see how much inequity is present.
Keeping it cool

Cuando sales y miras a tu alrededor, ves muchos aires acondicionados en las ventanas. La mayoría de ellos son viejos, poco eficientes, y ruidosos. En nuestra comunidad, hay mucha gente que no se puede permitir comprar un aparato de aire nuevo. Muchos de ellos, tampoco tienen donde almacenarlo, así que los deben dejar en las ventanas todo el invierno.
Youth Engagement and Social Media

https://storymaps.arcgis.com/stories/b2678cc9407c446e8bcfe7be184dccac

TikTok

Urban heat islands
Chelsea

Collaboration between BU School of Public Health and ECO from GreenRoots
Opportunity: Evaluate use of **Drinking Water & Misting** Stations
2021-2022 Interventions & Future Analyses

White roofs
Williams Jr. High School

Playgrounds & parks

Sensor

Burke Elementary Complex

Bus stops
Analyze data from “Cool block interventions”

Other City MVP interventions
- Street reflective murals
- Sidewalk pavers
- Greenspace

White roof (City MVP grant)

Lot reimagining (GreenRoots/BSLA)

Mural at Boys and Girls Club
Climate Disease and Kidney Injustice

By Madeleine K. Scammell
November 6, 2017

https://www.publichealthpost.org/research/climate-chronic-kidney-disease/