

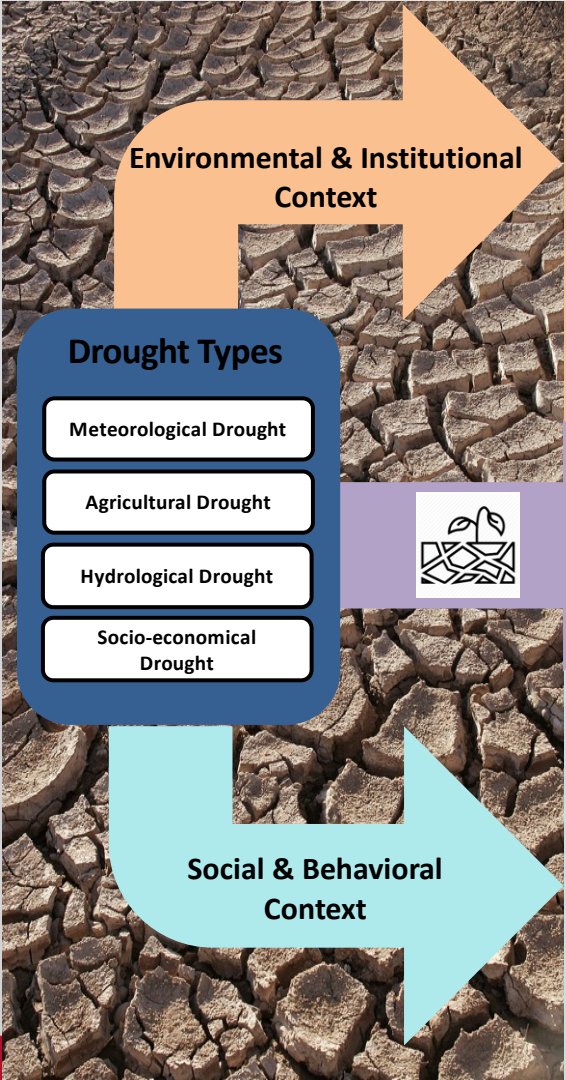
Drought and Human Health Midwest and Missouri River Basin Workshops

Jesse E. Bell, PhD

Rachel Lookadoo, JD

Keith Hansen, MBA





Environmental & Institutional Context

Drought Types

Meteorological Drought

Agricultural Drought

Hydrological Drought

Socio-economical Drought



Social & Behavioral Context

- Water Supply
- Local Environmental Conditions
- Preparedness of Health Departments
- Agricultural Management Practices
- Power, Transportation, Communication and Healthcare Infrastructure

Exposure Pathways

- Increase in Dust and dust Storms
- More Frequent Wildfires
- Decrease in Water Quality and Quantity
- More Frequent and More Intense Heat Waves
- Change in Vector Habitat and Range
- Loss of Agriculture and Food Security

Health Outcomes

- Respiratory Issues
- Allergy-related Illnesses
- Injuries
- Infectious Disease
- Hunger/Famine
- Heat Illnesses
- Gastrointestinal Illnesses
- Mental Health Consequences

- Social Determinants of Health
- Occupation
- Rural/Urban
- Race/Literacy/Age
- Dependence on Caregivers and Medication

Increase in Mortality with Drought



Articles

Drought and the risk of hospital admissions and mortality in older adults in western USA from 2000 to 2013: a retrospective study

Jose O Barajas, Katalin Bhatt, Roger D Peng, Francesca Dominici, Michelle L Bell

Summary

Background Occurrence, severity, and geographic extent of droughts are anticipated to increase under climate change, but the health consequences of drought conditions are unknown. We estimate risks of cardiovascular-related and respiratory-related hospital admission and mortality associated with drought conditions for the elderly population in western USA.

Methods For this retrospective study, we analyzed the 2000 to 2013 data from the US Drought Monitor for 418 counties in the western USA to identify full drought periods, non-drought periods, and worsening drought periods stratified by low-severity and high-severity. We used Medicare claims made between Jan 1, 2000, and Dec 31, 2013, to calculate daily rates of cardiovascular admissions, respiratory admissions, and deaths among adults aged 65 years or older. Using a two-stage hierarchical model, we estimated the percentage change in health risks when comparing drought with non-drought period days, controlling for daily weather and seasonal trends.

Findings On average, 2.1 million days were classified as non-drought periods and 0.6 million days were classified as drought periods. Compared with non-drought periods, respiratory admissions significantly decreased by -1.99% (95% posterior interval -3.56 to -0.38) during the full drought period, but not during worsening drought conditions. Mortality risk significantly increased by 1.55% (0.17 to 2.95) during the high-severity worsening drought period, but not the full drought or low-severity worsening drought periods. Cardiovascular admissions did not differ significantly during either full drought or worsening drought periods. In counties where droughts occurred less frequently, we found risks for cardiovascular disease and mortality to increase during worsening drought conditions.

Interpretation Drought conditions increased risk of mortality during high-severity worsening drought, but decreased the risk of respiratory admissions during full drought periods among adults aged 65 years and older. Counties that previously had fewer drought events show larger risk for mortality and cardiovascular disease. This research describes an understudied environmental association with global health significance.

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Introduction

The UN refers to droughts as “the most far reaching of all natural disasters”.¹ In 2011–12, a pan-continental drought spanned 62% of the contiguous USA land area, exceeding the historical 1998 percentile for drought size and affecting nearly 150 million people.² California is experiencing an extreme drought that has been ongoing since 2013.³ However, although health effects of some natural disasters (eg, heat waves and floods) are well studied,^{4,5} little is known about drought, despite its global impact. Most drought and health research focuses on developing nations and indoor offices, such as vector-borne diseases and malnutrition,⁶ but an almost total absence of direct health effects research exists worldwide. So far, the study of drought and health has been hampered by the unique characteristics of drought, including gradual onset, persistence, large geographical extent, and difficulty assessing when one begins or ends.¹⁴ Additionally, drought can be categorized as four distinct types:

meteorological, agricultural, hydrological, and socio-economic.⁷ The distinct drought types can create challenges in the estimation of human exposures and health effects because each type can potentially affect disease outcomes in a different way.

The biological mechanisms through which drought affects health are unknown. Several pathways are hypothesized. Drought might act on disease through secondary exposures, increasing airborne dust or wildfire smoke and modifying the maturation and dispersal of allergenic pollen and fungal spores.^{8,9} Long-term drought has the potential to degrade the environment and affect community-level economic livelihood, inducing psychological stress.^{10,11} Chronic stress will evoke behavioral and physiological responses, including haemodynamic, endocrine, and immunological dysfunction that increase risk of cardiovascular and upper respiratory diseases.^{12,13} In extreme cases, this dysfunction can increase mortality. Community studies from Australia found associations



Jose O Barajas (lead author)
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See Comment page 22

School of Forestry and Environmental Studies, Yale University, New Haven, CT, USA (J O Barajas-PI)

John H. Garfield, Director of Environmental Health Hazard Assessment, California Environmental Protection Agency, Oakland, CA, USA (J Garfield-PI)

Department of Biostatistics, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA (K Bhatt-PI)

Department of Biostatistics, Harvard T H Chan School of Public Health, Boston, MA, USA (R Peng-PI)

Department of Biostatistics, Harvard T H Chan School of Public Health, Boston, MA, USA (F Dominici-PI)

Department of Biostatistics, Harvard T H Chan School of Public Health, Boston, MA, USA (M Bell-PI)

Correspondence to: Jose O Barajas, Yale School of Forestry and Environmental Studies, New Haven, CT 06510, USA (jose.barajas@yale.edu)

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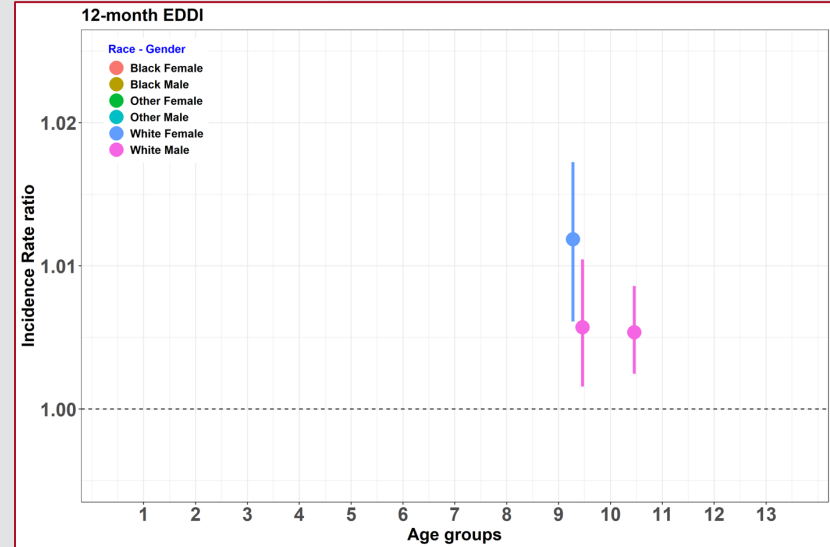
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Drought Mortality in Nebraska



• white females aged 45-54

• white males aged 45-64

Courtesy of Dr. Azar Abadi

Drought May Lead to Elevated Levels of Naturally Occurring Arsenic in Private Domestic Wells

Release Date: MARCH 18, 2021

An estimated 4.1 million people in the lower 48 states are potentially exposed to arsenic levels that exceed EPA's drinking water standards

A new [U.S. Geological Survey study](#) highlights the importance of homeowners testing their well water to ensure it is safe for consumption, particularly in drought-prone areas. The first-of-its-kind national-scale study of private well water, conducted in collaboration with the Centers for Disease Control and Prevention, showed that drought may lead to elevated levels of naturally occurring arsenic and that the longer a drought lasts, the higher the probability of arsenic concentrations exceeding U.S. Environmental Protection Agency's standard for drinking water.

Researchers estimate that during drought conditions, 4.1 million people in the lower 48 states who use private domestic wells are potentially exposed to unsafe levels of arsenic. This is an increase of 54% from the estimated 2.7 million people exposed to unhealthy arsenic levels in private wells during normal, non-drought conditions.

Arsenic is a metal that can occur naturally in bedrock and sediments around the world and is commonly reported in drinking-water supply wells. However, chronic exposure to arsenic from drinking water is associated with an increased risk of several types of cancers, including [bladder](#), [lung](#), [prostate](#) and [skin cancers](#). [Other adverse effects](#) include developmental impairments, cardiovascular disease, adverse birth outcomes and impacts on the immune and endocrine systems.

The study's findings can help public health officials and emergency managers notify well owners in areas potentially affected and further refine their strategies for addressing the issue. The EPA regulates public water supplies, but maintenance, testing and treatment of private water supplies are the



Jacks Pond in Hancock, New Hampshire. Groundwater from this area supplies nearby private wells. (Credit: Melissa Lombard, USGS.)

Contacts

Department of the Interior,
U.S. Geological Survey

Office of Communications and Publishing
12201 Sunrise Valley Drive
Reston, VA 20192
United States
Phone: 703-648-4460

Jason Burton

Public Affairs Specialist
Eastern States Office of Communications
Email: jburton@usgs.gov
Phone: 678-924-6692

Melissa A Lombard

Hydrologist
New England Water Science Center
Email: mlombard@usgs.gov
Phone: 603-226-7816



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The association between drought conditions and increased occupational psychosocial stress among U.S. farmers: An occupational cohort study

Jesse D. Berman^{a,*}, Marizen R. Ramirez^a, Jesse E. Bell^b, Rocky Bilotta^c, Fredric Gerr^d, Nathan B. Fethke^d

^a Division of Environmental Health Sciences, University of Minnesota School of Public Health, 420 Delaware Street SE, Minneapolis, MN 55455, USA

^b Environmental, Agricultural, and Occupational Health, College of Public Health at the University of Nebraska Medical Center, 984388 Nebraska Medical Center, Omaha, NE 68198, USA

^c Sciences, LLC and the National Oceanographic and Atmospheric Administration's National Centers for Environmental Information, 151 Patton Avenue, Asheville, NC 28801, USA

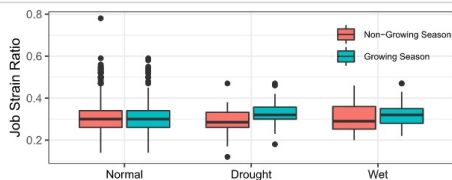
^d Department of Occupational and Environmental Health, University of Iowa College of Public Health, 145 N Riverside Drive, Iowa City, IA 52242, USA



HIGHLIGHTS

- Drought risk for farmer occupational psychosocial stress is unknown.
- Farmers are a vulnerable population to extreme weather events.
- A linear mixed effects longitudinal model evaluated farmer job strain.
- Growing season drought increased farmers occupational psychosocial stress.
- Drought planning should consider occupational psychosocial stress effects.

GRAPHICAL ABSTRACT



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ABSTRACT

Background: Drought represents a globally relevant natural disaster linked to adverse health. Evidence has shown agricultural communities to be particularly susceptible to drought, but there is a limited understanding of how drought may impact occupational stress in farmers.

Methods: We used repeated measures data collected in the *Musculoskeletal Symptoms among Agricultural Workers Cohort* study, including 498 Midwestern U.S. farmers surveyed with a Job Content Questionnaire (JCQ) at six-month intervals in 312 counties from 2012 through 2015. A longitudinal linear mixed effects model was used to estimate the change in job strain ratio, a continuous metric of occupational psychosocial stress, during drought conditions measured with a 12-month standardized precipitation index. We further evaluated associations between drought and psychological job demand and job decision latitude, the job strain components, and applied a stratified analysis to evaluate differences by participant sex, age, and geography.

Results: During the growing season, the job strain ratio increased by 0.031 (95% CI: 0.012, 0.05) during drought conditions, an amount equivalent to a one-half standard deviation change (Cohen's $D = 0.5$), compared to non-drought conditions. The association between drought and the job strain ratio was driven mostly by increases in the psychological job demand (2.09; 95% CI: 0.94, 3.24). No risk differences were observed by sex, age group, or geographic region.

Conclusions: Our results suggest a previously unidentified association between drought and increased occupational psychosocial stress among farmers. With North American climate anticipated to become hotter and drier, these findings could provide important health effects data for federal drought early warning systems and mitigation plans.

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* Corresponding author at: Division of Environmental Health Sciences, University of Minnesota School of Public Health, 420 Delaware Street SE, Minneapolis, MN 55455, USA.
E-mail address: berma186@umn.edu (J.D. Berman).

Local

Kansas farmer on alarming suicide rate: 'Nothing gets farmers more down than a drought'

By: Emily Younger

Posted: May 21, 2018 10:34 PM CDT
Updated: May 21, 2018 11:34 PM CDT



Drought Causes Stress in Farmers

The effect estimate for drought was 4x greater magnitude than people reporting pain in multiple body parts.



DROUGHT AND PUBLIC HEALTH IN THE U.S.



Why drought matters

When drought affects a community, its devastating consequences can include decreased quality and quantity, and increased risk to complex, and costly.

- Did not experience extreme or exceptional drought.
- Experienced extreme drought.
- Experienced exceptional drought.
- Experienced extreme and exceptional drought.

Public health

Plants, animals, and the environment that drought can do:



Mount and sustain diseases. Mosquitoes like virus can areas when of water eding grounds. Dusty soil increase the risk lung infection gus in the soil.

Intensify wild and dust storm thus increasing the number of particulates in air. This can worsen asthma and other heart and lung diseases.

Preparation can help reduce the mental health's (NCEH's) current drought like the National Oceanic and Atmospheric Administration (NOAA) system (NIDIS) to identify ways to better understand health effects.

CDC Features

- CDC Features
- Data & Statistics
- Diseases & Conditions
- Emergency Preparedness & Response
- Environmental Health
- Drought and Your Health
- Healthy Living
- Injury, Violence & Safety
- Life Stages & Populations
- Travelers' Health
- Workplace Safety & Health

WHEN EVERY DROP COUNTS

Protecting Public Health During Drought Conditions
A GUIDE FOR PUBLIC HEALTH PROFESSIONALS

PREPARING FOR THE HEALTH EFFECTS OF DROUGHT

A RESOURCE GUIDE FOR PUBLIC HEALTH PROFESSIONALS

Features Media

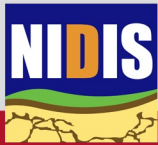
Sign up for Features

- the at-risk populations living within the affected area, and

Develop a Drought and Health Strategy



- Share the current state of knowledge on drought and health
- Identify gaps and needs for evidence-based research, capacity building, and communication
- Engage and develop a drought and health community of practice
- Jointly develop a collaborative, multi-partner NIDIS Drought & Public Health Strategy that builds upon project outcomes.



NATIONAL DROUGHT & PUBLIC HEALTH SUMMIT

June 17-19, 2019 | Atlanta, GA

Thank you to our Summit Planning Partners:

Centers for Disease Control and Prevention (CDC)
National Integrated Heat Health Information System (NIHHIS)
Environmental Protection Agency (EPA)
Natural Resources Defense Council (NRDC)
UNL National Drought Mitigation Center (NDMC)



Drought and Health Workshops

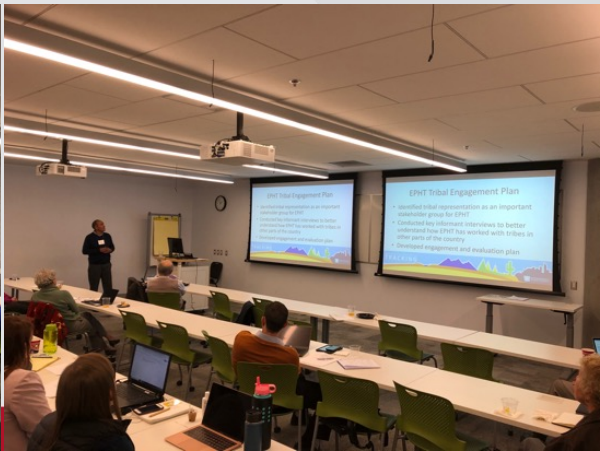
- June 17-19, 2019 – National Drought and Public Health Summit
- November 20-21, 2019 – St. Paul, Minnesota
- February 26-27, 2020 – Tucson, Arizona
- September 23-24, 2020 – Virtual Carolinas workshop
- April 12-13, 2022 – Bozeman, Montana
- October 19-20, 2022 – Portland, Oregon



Regional Workshop Development

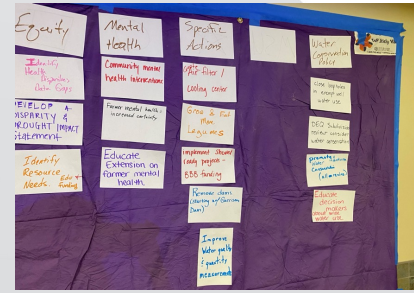


- Identify local partner
- Local partner helps identify advisory committee members
 - Mix of state gov't, local gov't, academics, tribal, etc.
- Regular calls with advisory committee
- Local partner and advisory committee approve agenda
 - **Focus on diversity and practitioners**



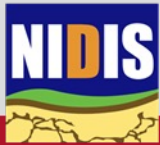


Outcomes of Workshops



Facilitated discussion using ToP process - MRB

- Communication - Include health in state and local drought planning / Engage public health departments and more targeted communication / Action steps with cross-sector collaboration
- Equity - Identify health disparities and develop a disparity and drought impact statement
- Mental health work - Educate extension around farmer mental health issues and community mental health interventions





Outcomes of Workshops

Midwest

- Regionally specific drought and health outreach materials
- Host a drought tabletop exercise with a focus on health
- CASPERs focused on droughts
- Incorporate public health in drought planning
- Address regional inequities associated with water quality and availability



Future Needs:



- Still much to be learned about drought and public health
 - What do public health departments need?
- Opportunities to address health threats associated with drought:
 - More research
 - Improved communication
 - Role of collaboration to reduce impacts
 - Water quality and mental health
 - Address inequities associated with drought
 - Rural/remote communities and tribal communities

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NIDIS

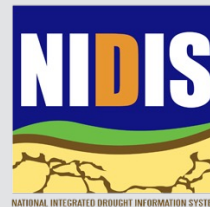
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- Azar Abadi, PhD
- Yeongjin Gwon, PhD
- Jagadeesh Puvvula
- Babak Fard, PhD
- Siddhi Munde
- Ronnie Leeper - NC State University
- Jesse Berman, PhD – University of Minnesota
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All of the state and local partners

All of the federal and academic partners





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Twitter: @JesseEugeneBell
Email: jesse.bell@unmc.edu

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