The Complexity of Drought and Health Research

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How Did I get Involved in Drought and Health Research?

The Drought of 2012

This summer, the United States has experienced its worst drought in more than half a century. The Mississippi River is approaching record lows, as far as 20 feet below normal. Throughout the Midwest, meager corn harvests began on some of the earliest dates ever recorded. Corn and soybean farms are producing far smaller yields this year, which
How Did I get Involved in Drought and Health?

• Asked the question, “Is there an association between drought and health?”
• Limited research examined association between drought and mortality
  - Mental health pathway (e.g. increased suicide deaths: Hannigan et al, 2012; Guiney et al, 2012)
  - Dust storm events (Korea, Taiwan, Italy)
• Almost no research from the U.S.

So Why is This?
How do we evaluate the health risks from environmental exposures?
The Classic Approach to Risk Assessment

Hazard Identification → Dose Response → Exposure Assessment → Risk Characterization → Risk Management & Policy
The Classic Approach to Risk Assessment: An Air Pollution Example
But for Drought this Pathway is Far More Complicated!
How Come??

• Can affect people through multiple pathways
  o What is our disease of interest?

• Gradual Onset/Slow to Develop
  o When is someone exposed to drought or not?

• Multiple drought indices for multiple drought definitions
  o Which drought index is the best to examine?

• Broad geographic exposure
  o Who are the susceptible populations?

• Drought doesn’t occur in isolation
  o Should we consider co-occurring disasters?
Complicating Issue #1: The Disease Affects Drought Exposure Choice

Drought has been linked to a number of different health outcomes

**Direct Effects**
- Mental health
- Nutritional
- Waterborne Disease

**Indirect Effects**
- Air Quality
- Vectorborne Disease
- Injury

Should our measure of “drought” change based on what outcome we are interested in?
Complicating Issue #1: The Disease Affects Drought Exposure Choice

Let’s use infectious disease as a case study: West Nile Virus
Complicating Issue #1: The Disease Affects Drought Exposure Choice

Drought conditions cause birds to congregate in smaller areas.

Rapid disease incubation; enhanced zoonosis when drought ends.
Complicating Issue #1: The Disease Affects Drought Exposure Choice

Let’s use infectious disease as a case study: Lyme Disease

A tick that is questing for a host
Complicating Issue #1: The Disease Affects Drought Exposure Choice

**West Nile Virus**
- Reduced surface water
- Long-term drought
- Perhaps hydrological (?)

**Lyme Disease**
- Vegetation/Soil
- Short-term extreme drought
- Also consider heat?
- Perhaps meteorological/ ecological?

Different health outcomes; different droughts characteristics of concern!
Complicating Issue #2: Creating the Drought Exposure

How do we decide on the appropriate measure of “drought” when there are over 150 drought indices in circulation?
No Consensus in the Literature Regarding Drought Indices

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<th>Health Outcome</th>
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Complicating Issue #2: What do we Look for in a Drought Exposure?

Three drought features are critical to understand health vulnerability: 1) **severity**, 2) **spatial extent**, 3) **time frame**

Identifying which are most important for the selected health outcome will drive our choice of a drought indicator
Complicating Issue #2: Creating the Drought Exposure - Severity of Drought

Severity refers to **magnitude** of water deficit compared to normal conditions.

- **BUT**, drought indices estimate severity differently. Inconsistent scales make comparability across studies **difficult**.
Complicating Issue #2: Creating the Drought Exposure - Severity of Drought

Is drought severity the same, if you consider the time point of a drought event?

USDM conditions for Jasper County, IA from 2012-2014
Complicating Issue #3: Creating the Drought Exposure - **Time Frame of Drought**

Drought has two separate time components: 1) Time Scale and 2) Duration

- **Time Scale** – the period over which *average dryness* is evaluated
- **Duration** – the length of a drought event
The Drought Time Scale

Most indices allow time scales of 1-month up to several years

Which is best for a health effects study?
The Drought Time Scale

What happens if one study uses a 9-month variable and another uses a 1-month variable?
Complicating Issue #4: What if it is Not Just Drought, but Co-Occurrence with Other Extreme Events?

- Extreme Heat
- Brush and wildfires
- Dust Storms
Outline for Choosing a Drought Exposure

General Framework for Selecting a Drought Exposure

Disease of Interest

Characterizing Drought
- Spatial Extent
- Severity
- Temporality
  * Time Scale
  * Duration

Drought Definition
Meteorological, hydrological, agricultural, socioeconomic

Co-Occurrence with Other Environmental Hazards
- Air Pollution
- Extreme Heat
- Wildfires

At-Risk/Target Population

Drought Index/Exposure Metric
So What Do Epidemiologists Need from Drought and Climate Experts?

• In a perfect world, a single drought metric designed specifically for health studies

• Ways to compare severity, duration, and extent across different metrics

• Accessible downloads of drought data

• Links of drought conditions to Census GEOID’s
  - Climate regions are not optimal for health assessments

• Better knowledge of what policy makers need from us!
Some New Research into the Health Effects of Drought
The Impact of Drought Conditions on Occupational Psychosocial Stress among a Midwest Farmers Cohort
The Impact of Drought Conditions on Occupational Psychosocial Stress among a Midwest Farmers Cohort

• A longitudinal assessment of 518 farmers across 312 counties in 9 Midwestern states

• Survey of occupational psychosocial stress from 2012-2015 (6-month intervals)

• Association between job related stress and changing drought conditions

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Any Questions?

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