Drought and Air Quality

Health Impacts Associated with Smoke Exposure from Wildland Fires

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Background: Drought and Wildfire Episodes

- A prolonged dry period increases the availability of fuels and conditions conducive for large fire events
  - Drought influences fire both directly via fuel moisture and indirectly through biological effects on vegetation
  - Warmer and drier climate leads to longer and possibly more frequent periods with flammable fuels
  - E.g., 2016 southern Appalachian fires

Photo from USDA / National Climate Assessment, 2018

Background: Pollution from Wildfires

Historical (1988-2016) PM$_{2.5}$ Trends

- Increase in PM$_{2.5}$ annual concentration attributed to an increase in wildfire emissions

Air Quality Impacts from Smoke Events

- Smoke from wildfires can travel long distances

McClure CD and Jaffe DA. PNAS 115 (31): 7901-7906, 2018

Background: Pollution from Wildfires and Health Impacts

- **Primary Air Pollutants**
  - Carbon Monoxide (CO)
  - Oxides of Nitrogen (NO\textsubscript{x})
  - Polycyclic Aromatic Hydrocarbons (PAHs)
  - Volatile Organic Compounds (VOCs)
  - Particulate Matter (PM)

- **Secondary Air Pollutants**
  - Particulate Matter (PM)
  - Ozone (O\textsubscript{3})

Background: Adverse Health Outcomes

- Outpatient visits
- Asthma, COPD, RI, IHD
- Medication Refills
  - Asthma

Background:

- All-cause mortality
- Cardiovascular-related diseases

- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Pneumonia and Bronchitis
- Respiratory infections (RI)
- Congestive heart failure (CHF)
- Ischemic heart disease (IHD)

- Outpatient visits
  - Asthma, COPD, RI, IHD
  - Medication Refills
    - Asthma

Wildfire Smoke – Health Activities: Partnerships & Collaborations

Federal Partners

Academic Institutions

CDC Smoke-Health Activities

Environmental Epidemiology

Health Informatics

Assessment of Data Sources / Data Acquisition

Development of Surveillance Indicators

Creation of Online Tools

Development of Resource Guides and Web Content

Risk Communication

Funded Recipients of CDC Grants

Asthma and Climate Tracking
Wildfire Smoke – Health Activities: Environmental Data

Computer Model (WRF-Chem)

In-situ monitors (AQS, IMPROVE)

Satellite data (MODIS, MISR, GOES)
Wildfire Smoke – Health Activities: Epidemiologic Analysis

Characterizing Impacts of Wildfire Smoke Exposure on ED Visits and Hospital Admissions

- Expand to include other wildfire episodes and compile a library of concentration—response (C-R) functions for various locations in the United States

There is a strong significant association between wildfire smoke PM$_{2.5}$ and medication refills for asthma

- Smoke-health associations remain significant for several days
- The relationship between smoke exposure and its impact on medication refills varies with the type of medication
Wildfire Smoke – Health Activities: Tools for Public Health

Real-Time Smoke Vulnerability Assessment

Vaidyanathan A, et al.. Developing an online tool for identifying at-risk populations to wildfire smoke hazards. STOTEN, 619, pp.376-383.

https://ephtacking.cdc.gov
Wildfire Smoke – Health Activities: Tools for Public Health

Prescribed Burn Impact Assessment

Hu Y, Ai H, Odman MT, Vaidyanathan A et al. International Journal of Environmental Research and Public Health (Accepted)

https://sipc.ce.gatech.edu/SIPFIS/map
Web-Content / Resources for Public Health Professionals

Wildfires

More and more people make their homes in areas that are prone to wildfires. You can take steps to be ready for a wildfire and prepare your home and landscaping to reduce your risk. Learn how to protect yourself and your family from a wildfire, evacuate safely during a wildfire, and how to stay healthy when you return home.

Before a Wildfire
- Wildfire, Are You Prepared? 
- Is your home Firewise? 
- Make a Plan

During a Wildfire
- Wildfire Smoke
- Burns
- Wound Care
- Ready.gov Wildfires
- Protecting Pets
- Animals in Evacuation Centers

After a Wildfire
- What to Do After a Home Fire
- Preventing Injury
- Returning Home After a Disaster
- Your Emotional & Physical Well Being

https://www.cdc.gov/disasters/wildfires/index.html
Summary

- Existing scientific literature suggests a relationship between drought and wildfire episodes.

- There is a positive association between wildfire smoke PM and adverse health outcomes:
  - Regional air quality issue – smoke impacts downwind human populations.
  - Smoke PM levels during wildfire episodes exceed prevailing ambient air quality levels.
  - Majority of the areas impacted by smoke have vulnerable populations.

- The combination of advance warning (tools) and education could potentially increase awareness to health impacts associated with smoke and exposure and shed light on public health needs for combating wildland fires.

- In a climate context, longer wildfire season and larger wildfires, combined with increasing development at the wildland–urban interface pose increasing risks to public health.