M-J5 "Extreme Heat and Wildfire Smoke" and "OEHHA's CalHeatScore Tool"

Monday March 24, 2025 3-5:00PM

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Overview

- Introduction to Extreme Heat and Wildfire Smoke
- Wildfire Smoke—Health effects and public health actions
- Extreme Heat—Health effects and public health actions
- Scientific studies on wildfire smoke and extreme heat
- Combined Exposure
  - Who is at Risk
  - Health effects
  - Public health messaging
  - Steps to take when indoors
  - Resources

Introduction to extreme heat and wildfire smoke

- Wildfire smoke and heat events are becoming more frequent and are lasting longer because of the changing climate.

- Extreme heat and smoke can both be dangerous

Exposure to both smoke and extreme heat

- Recent scientific evidence suggests that exposure to both smoke and extreme heat at the same time may be much worse for your health than exposure to either of them alone.

Wildfire smoke

- The fine particles (also called PM2.5 or fine particle pollution) in smoke can affect the lungs, heart, and other organs.
- It can also lead to asthma attacks and make chronic obstructive pulmonary disease (COPD) worse.
- It can also increase the risk of heart attacks, heart failure, and death.

Extreme heat

- If temperatures are much hotter than usual, your body may not be able to cool itself fast enough
- This can lead to heat-related symptoms and illnesses, such as heat rash, muscle cramps, heat exhaustion, heat stroke, and death.
- High humidity and high nighttime temperatures, alcohol use, prescription drug use, and sunburn might increase your risk of developing a heat-related illness.

Wildfire Smoke—
Health effects and public health actions

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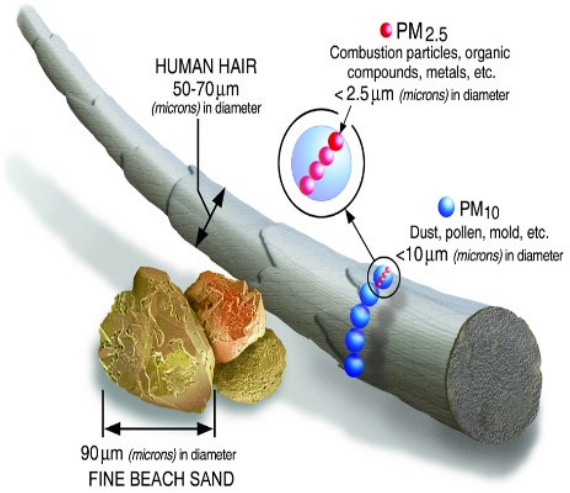
Smoke and particulate matter (PM)



- Smoke is a complex mixture that contains fine particulate matter (PM 2.5), CO, CO2, water vapor, hydrocarbons, and other organic chemicals, nitrogen oxides, and trace minerals
- Microscopic particles can penetrate deep into the lungs and cause adverse health effects
- Sensitive populations are at greater risk of experiencing health effects
- Children
- Pregnant and nursing women
- Older adults
- People with pre-existing lung and heart conditions

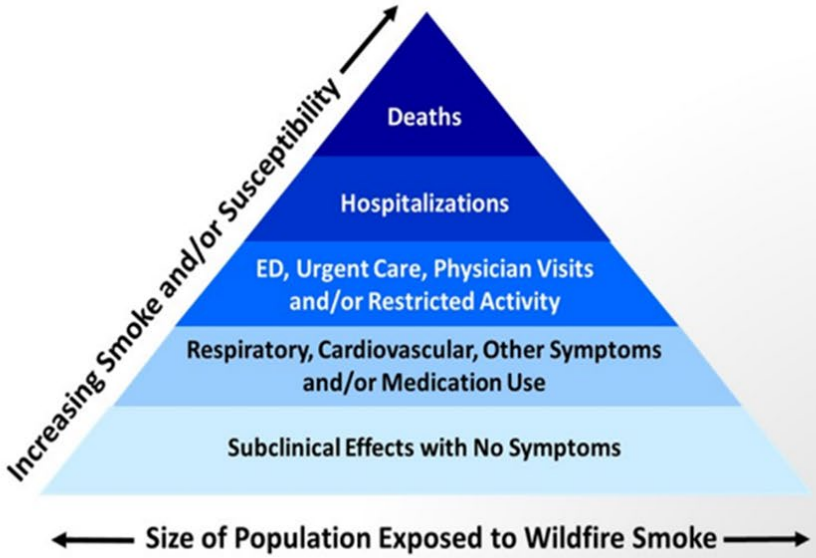
PM2.5 health effects

- PM2.5 can initiate biological pathways that can ultimately lead to health effects resulting in an emergency department visit, hospital admission, or even death.
- Documented pathways include:
  - inflammation and oxidative stress,
  - effects on the autonomic nervous system which can impact heart function, and
  - translocation of particles out of the respiratory tract into the blood where they can affect other organ systems, such as the heart.

Additional pollutants of concern

- PM2.5 has been and remains the focus of efforts around protecting public health from wildfire smoke
- Wildfires enter the wildland urban interface (WUI) and burning humanmade structures and materials
- Additional pollutants also of concern
  - Elevated concentrations of metals (e.g., lead)
  - Volatile organic compounds (VOCs) (Boaggio et al. 2022).
  - Burning of household or industrial materials, such as plastics, pesticides, and other hazardous waste

Health Effects of Smoke



Cascio et al 2018

Known Health Effects

- Eye & respiratory tract irritation
- Reduced lung function
- Bronchitis
- **Exacerbation of asthma & heart failure**

• All-cause mortality	Strong
• Increased hospitalizations	Strong

• Worsening respiratory disease
  • Asthma
  • COPD
  • Bronchitis
  • Pneumonia
	Very Strong

• Worsening heart disease	Inconclusive but suggestive
• Stroke • Type II Diabetes • Neurological and cognitive impairment • Pre-term and low birthweight babies • Others…	Growing evidence for PM2.5, little known for wildfire smoke

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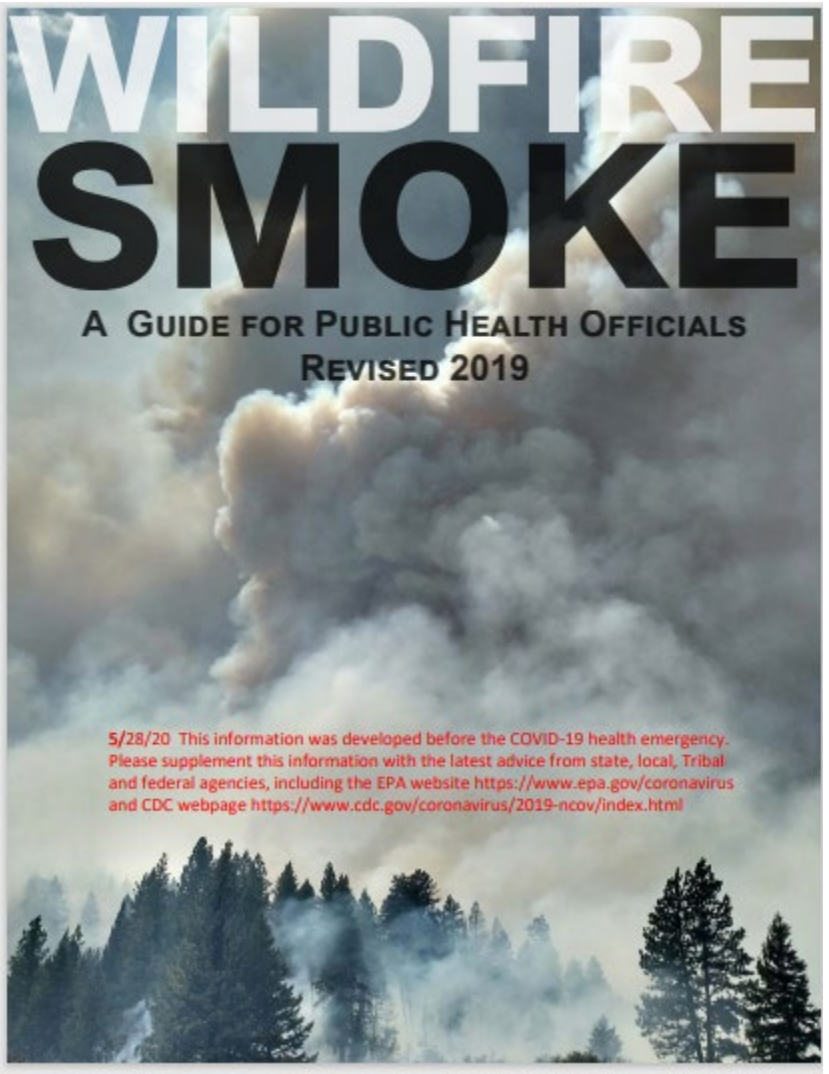
Reid et al [illegible]16 and Cascio et al 2018

Short-term smoke exposures (i.e., over a few days)	Irritation of the eyes and respiratory tract Respiratory symptoms • Coughing • Phlegm • Wheezing • Difficulty breathing Respiratory effects • Bronchitis • Reduced lung function • Increased risk of asthma exacerbation and aggravation of other lung diseases • Increased risk of emergency room visits and hospital admissions Cardiovascular effects • Heart failure • Heart attack • Stroke • Increased risk of emergency room visits and hospital admissions Increased risk of premature death

https://www.airnow.gov/sites/default/files/2021-05/wildfire-smoke-guide-revised-2019.pdf



Public health actions

Wildfire Guide Factsheets
Publications | AirNow.gov

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Air cleaners and clean air shelters

- As air quality worsens, environmental health departments may decide to recommend the use of portable indoor air cleaners, so that people can create a clean air room in their home, school, or workplace.
  - California Air Resources Board : Air Cleaner Information: https://ww2.arb.ca.gov/our-work/programs/air-cleaners-ozone-products/air-cleaner-information-consumers
- Additionally, departments may decide to open a clean air shelter
  - These can protect the health and well-being of those who may not have access to clean indoor air, such as homeless people.

The effect of wildfire smoke on children's health: A systematic review (Syed & Basu 2024)

- Reviewed 24 studies (16 respiratory and 11 non-respiratory outcomes.
  - Respiratory: positive associations with higher-risk children were asthmatic, obese, under the age of five, in low-income countries with low socio-economic status.

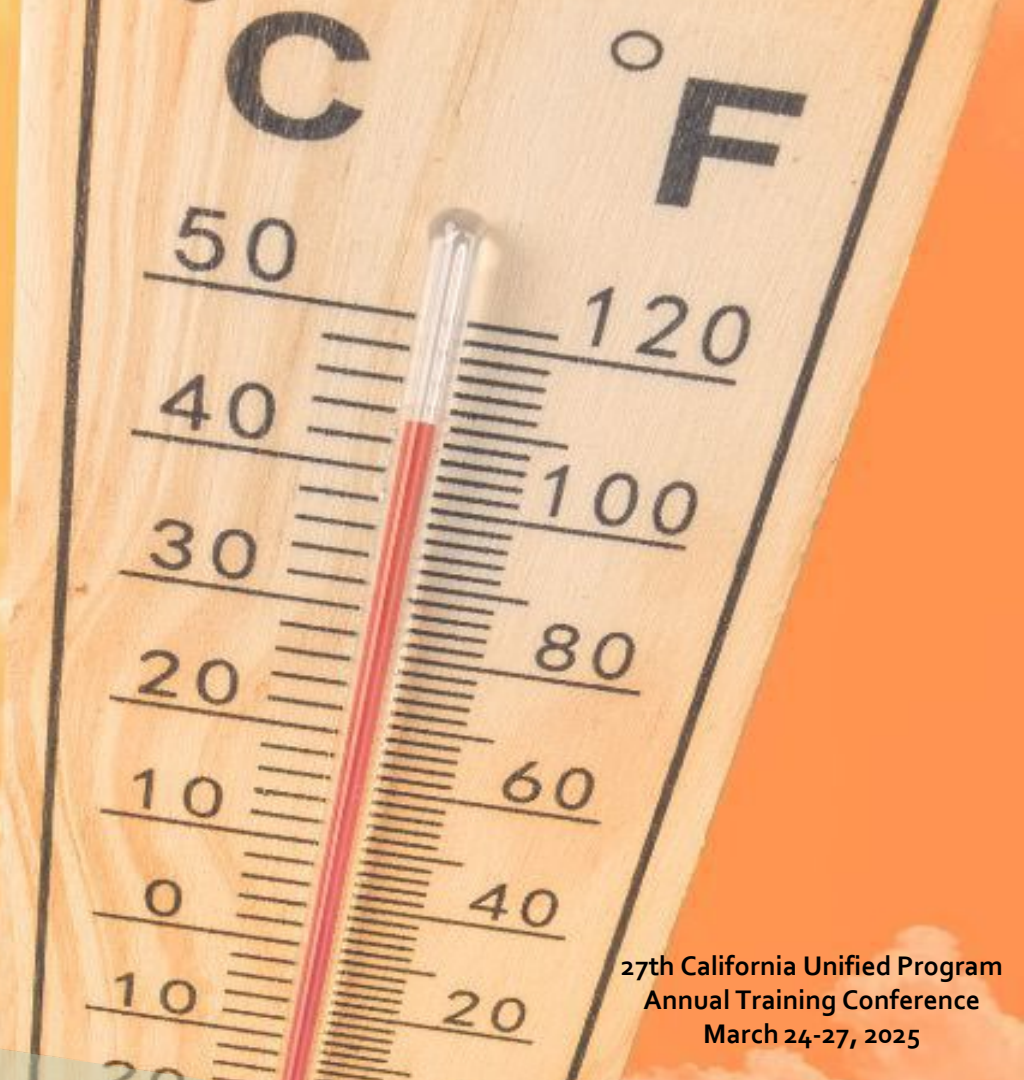
- Wildfire exposure is associated w/ adverse respiratory outcomes and some evidence of non-respiratory outcomes.

See: Syed & Basu 2024 or view this table on CalCUPA site (PDF for class)

TABLE 1 Summary characteristics of reviewed studies (refer to eTables S1.1 and S1.2 for additional study details and quantitative results).

Authors	Year	Study design	Study location	Respiratory or non-respiratory
Aguilera et al. (2021)[18]	2011–2017	Time-series analysis	San Diego, USA	Respiratory: Emergency room admissions and respiratory symptoms
Brown et al. (2019)[19]	2017	Longitudinal cohort study	Fort McMurray, Alberta, Canada	Non-respiratory: Mental health symptoms
Brown et al. (2021)[20]	2017–2019	Longitudinal cohort study	Fort McMurray, Alberta, Canada	Non-respiratory: Mental health symptoms
Ciciretti et al. (2021)[21]	2010–2013	Time-series analysis	Central Chile	Respiratory: Emergency consultation
Da Silva Sena et al. (2022)[22]	2019–2020	Time-series analysis	Australia	Respiratory: Forced vital capacity (FVC%)
del Pozo Cruz et al. (2021)[23]	2019	Randomised control trial	Australia	Non-respiratory: Physical activity measures
Dhingra et al. (2022)[24]	2010–2016	Retrospective cohort	Western USA	Respiratory: Medication prescription
Ducy et al. (2021)[25]	2018	Qualitative thematic analysis	Northern California, USA	Non-Respiratory: Mental health symptoms
Kunzli et al. (2006)[26]	2003	Prospective cohort	Southern California, USA	Respiratory: Physician visits, medication usage, respiratory symptoms
Leibel et al. (2020)[27]	2017	Time-series analysis	San Diego County, USA	Respiratory: Hospital visits
Li et al. (2022)[28]	2000–2014	Case–control study	Multi-country	Non-respiratory: Mortality
Li et al. (2023)[29]	2003–2014	Case-crossover study	Multi-country	Respiratory: Acute respiratory infection
Lipner et al. (2021)[30]	2012–2015	Retrospective cohort	Colorado, USA	Respiratory: Measures of Lung Function (Forced Expiratory Volume in 1S, Asthma Control test and Children's Asthma Control test)
Marsh et al. (2022)[31]	2018, 2020	Retrospective double-cohort study	Northern California, USA	Respiratory: Adverse respiratory events during or immediately after anaesthetic
McDermott et al. (2005)[32]	2005	Cross-sectional study	Canberra, Australia	Non-respiratory: Mental health symptoms
Mirabelli et al. (2009)[33]	2003	Cohort study	Southern California, USA	Respiratory: Adverse respiratory symptoms
Moore et al. (2023)[34]	2010–2021	Retrospective cohort	Calgary, Canada	Respiratory: Emergency visits/hospital admissions, medication prescription, respiratory symptoms
Prunicki et al. (2019)[35]	2015	Retrospective cohort	Fresno, USA.	Respiratory: Adverse respiratory symptoms Non-respiratory: Immune cell types, Foxp3 methylation in DNA
Townshend et al. (2015)[36]	2011–2012	Longitudinal mixed methods cross-sectional study	Slave Lake, Alberta, Canada	Non-respiratory: Mental health symptoms
Tse et al. (2015)[37]	2003	Retrospective cohort study	Southern California, US	Respiratory: Respiratory-related medication prescription, emergency department visits and hospitalisations, asthma diagnoses
Uttajug et al. (2021)[38]	2014–2018	Case-crossover study	Northern Thailand	Respiratory: Respiratory-related hospital visits and respiratory disease Non-Respiratory: Dermatitis and conjunctivitis
Vicedo-Cabrera et al. (2016)[39]	2012	Retrospective cohort study	Valencia, Spain	Respiratory: Adverse respiratory symptoms
Wen et al. (2022)[40]	2009–2016	Retrospective cohort study	USA	Non-respiratory: Academic success
Xue et al. (2021)[41]	2000–2014	Case–control study	Multi-country	Non-Respiratory: Mortality

Extreme Heat



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The effect of high ambient temperature on emergency room visits

(Basu et al., 2012)

- **Association between temperature and morbidity**:
  - Between mean daily apparent temperature and emergency room (ER) visits in California.
  - More than 1.2 million ER visits were included.
  - Positive associations were found for same-day apparent temperature and ischemic heart disease, ischemic stroke, cardiac dysrhythmia, hypotension, diabetes, intestinal infection, dehydration, acute renal failure, and heat illness
  - Most of these estimates remained relatively unchanged after adjusting for air pollutants and risks often varied by age or racial/ethnic group.

- **Conclusions: Increased temperatures were found to have same-day effects on ER admission for several outcomes.**

"A case-crossover study of temperature and **infant mortality** in California" (Basu et al., 2015)

- For all-cause mortality, excess risk was 4.4%
- All-cause mortality and deaths caused by gestation duration were highest for black infants 13.3%,
- White infants had elevated risk for deaths from respiratory causes 44.6%

"The impact of maternal factors on the association between temperature and **preterm delivery**" (Basu et al., 2017)

- For every 10°F (5.6 °C) increase in average cumulative weekly apparent temperature, a greater risk was observed for births occurring during the warm season (11.63%) compared to the cold season (6.18%).
- Especially for mothers who were younger, Black, Hispanic, underweight, smoked or consumed alcohol during pregnancy, or had pre-existing /gestational hypertension, diabetes, or preeclampsia.

"The effects of temperature and use of air conditioning on hospitalizations" (Ostro et al., 2010)

- Significantly increased risk of hospitalization for multiple diseases with a 10°F increase in same-day apparent temperature:
  - Cardiovascular disease, ischemic heart disease, ischemic stroke,
  - Respiratory disease, pneumonia,
  - Dehydration, heat stroke,
  - Diabetes, and acute renal failure.

- Ownership and usage of ACs significantly reduced the effects of temperature on these health outcomes

OEHHA fact sheets

These fact sheets describe why some people may be more sensitive to heat, how to recognize signs of heat illness, and how to stay cool and reduce the risk of heat illness.

Pregnancy and heat - Protecting yourself and your baby

Children and heat – Protecting infants, kids, and teens

Health Effects of Climate Change During Pregnancy and Childhood - OEHHA

Scientific studies on wildfire smoke and extreme heat

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Introduction

- Heatwaves contribute to the drying of the land
- Creates fuel for rapid spread of wildfires
- Both increase the mortality rate and the frequency of hospitalizations in the areas they affect (Rossiello and Szema 2019).

http://www.kurzweilai.net/is-climate-science-settled

"Synergistic Effects of Ambient Temperature and Air Pollution on Health in Europe: Results from the PHASE Project" (Analitis et al., 2018)

- Synergy between air pollution and meteorology and their impact on mortality in nine European cities with data from 2004 to 2010.
- Daily series of Apparent Temperature (AT), measurements of particulate matter (PM10), ozone (O3), and nitrogen dioxide (NO2) and total non-accidental, cardiovascular, and respiratory deaths.
- Some evidence of interactive effects between hot temperature and the levels of ozone and PM10 were found.

This like many studies are looking at PM10 or PM2.5 comparisons to heat but not wildfire smoke.

Studies

Ambient air pollution exposure and risk of **migraine**

- Synergistic effect with high temperature and air pollution exposure on migraines especially on high-temperature days (Lee et al., 2018)
  - Levels of particles<2.5 μm (PM2.5), particles<10 μm (PM10), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), and carbon monoxide (CO) and emergency department visits
- Synergistic effect of heatwave exposures, high levels of air pollution (PM 2.5), and lack of green space on **hypertension (high blood pressure)** incidence (Zhou et al., 2023).
- **Children's respiratory-related hospital admissions** were associated with short-term exposure to PM2.5.
  - PM2.5 associations with asthma and lower respiratory tract infection hospitalizations were strongest during cold periods, whereas associations with upper respiratory tract infections were largest during **hot periods** (Landguth et al., 2023)

Co-exposure in California during 2020

- Interaction effect of prenatal and postnatal exposure to **ambient air pollution** (PM10, sulfur dioxide, and nitrogen dioxide) and temperature on childhood asthma. Prenatal and postnatal exposure to **ambient air pollution and high temperatures** are independently and jointly associated with **asthma risk** in early childhood (Lu et al., 2022).

- Short-term exposure to extreme heat and **air pollution (PM2.5)** alone were individually associated with increased risk of **mortality** (cardiovascular and respiratory), but their co-exposure had larger effects beyond the sum of their individual effects. (Rahman et al 2022)

- **Heat and wildfire-related PM2.5** had both independent and synergistic effects on the risk of **preterm birth** in California (Ha et al., 2024).

"Exploring spatial heterogeneity in synergistic effects of compound climate hazards: Extreme heat and wildfire smoke on cardiorespiratory hospitalizations in California" (Chen et al., 2024)

- Quantified spatially varying compound exposures to extreme heat and wildfire smoke in California (2006–2019) by zip code
- Found synergistic effects between extreme heat and wildfire smoke on daily cardiorespiratory hospitalizations at the state level and across zip codes.

Higher synergistic effects in communities with **lower**:

- education attainment,
- health insurance coverage,
- income,
- proportion of automobile ownership,
- tree canopy coverage

Communities with **higher:**

- population density,
- proportions of racial/ethnic minorities

The Effects of Co-exposure to Extremes of Heat and Particulate Air Pollution on Mortality in California

- Rosenthal et al., 2022 characterized the frequency and spatial distribution of co-occurring **extreme heat and smoke PM2.5 events in California** during the record-setting wildfire season of 2020.
- **Estimated** that during the studied period, extreme smoke and heat co-occurred at least once within 68% of the state's area (~288 000 km2) and an average 2.5 times across all affected areas.
- Additionally, 16.5 million people, mostly in lower population density areas, were impacted at least once in 2020 by those synergistic events.

Rosenthal et al., 2022

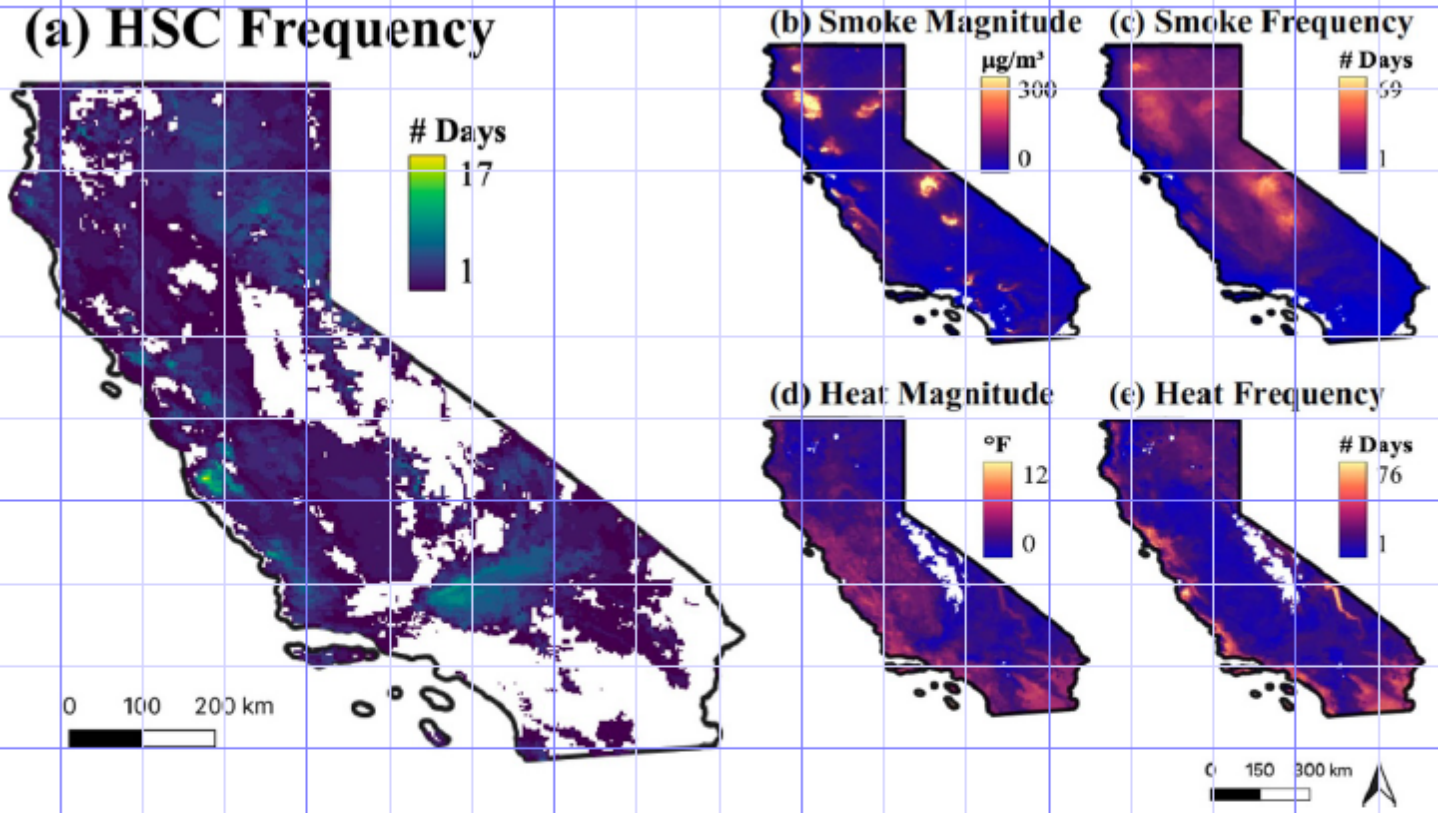

Figure 1. Spatial distribution of individual and co-occurring climate hazards. (a) The HSC map shows the frequency of HSC events in a given 3 km grid cell. Areas in white did not experience any event throughout the studied period. (b) The smoke magnitude displays the season's mean exceedance above 20 $\mu g\ m^{-3}$ for each grid cell. (c) The smoke frequency displays the total number of days with smoke magnitudes exceeding the 'extreme' threshold of 20 $\mu g\ m^{-3}$. (d), (e) The same definitions for magnitude and frequency apply relative to each grid cell's 85th percentile historical heat index.

Rosenthal et al., 2022

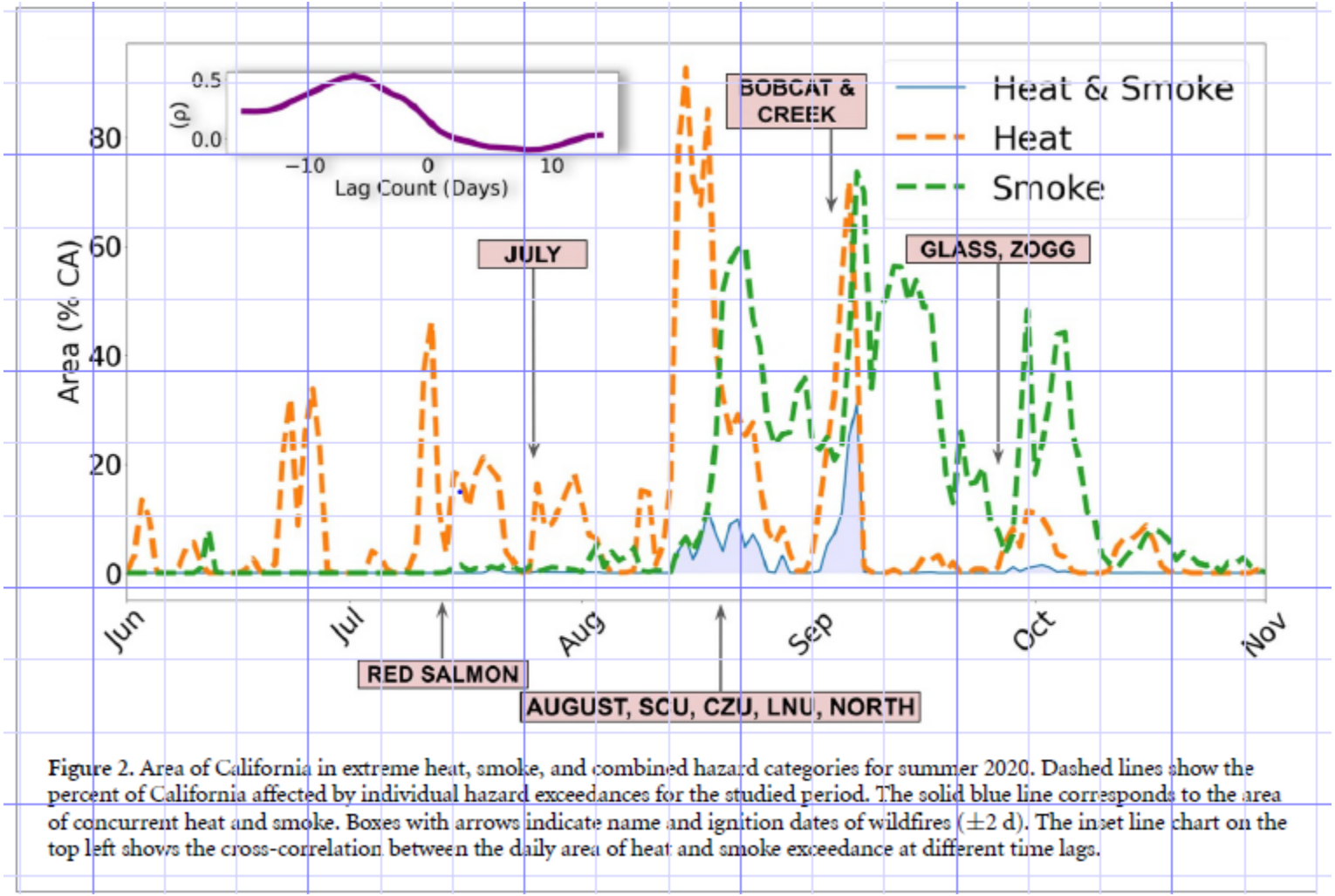

Figure 2. Area of California in extreme heat, smoke, and combined hazard categories for summer 2020. Dashed lines show the percent of California affected by individual hazard exceedances for the studied period. The solid blue line corresponds to the area of concurrent heat and smoke. Boxes with arrows indicate name and ignition dates of wildfires (±2 d). The inset line chart on the top left shows the cross-correlation between the daily area of heat and smoke exceedance at different time lags.

Evaporative coolers and wildfire smoke exposure: a climate justice issue in hot, dry regions (Solomon et al., 2025)

- Low-income families in dry regions frequently cool their homes with evaporative ("swamp") coolers (ECs), which pull unfiltered outdoor air into the home, creating a health hazard to occupants when wildfire smoke and heat events coincide.
- Air filters would reduce pollution but are a cost barrier for replacement filters.
- The FRESSCA project included community engagement, development of filtration strategies for ECs, and air quality monitoring inside homes to test various interventions.

Evaporative coolers and wildfire smoke exposure: a climate justice issue in hot, dry regions (Solomon et al., 2025)

- Temporary filtration solutions are feasible
- Combine external filtration with use of indoor HEPA indoor air cleaner
- Need to be offered to low-income households at low-or no-cost to reduce barriers to adoption.
- More permanent solutions would also require significant cost subsidies:
  - Prioritizing homes with ECs in wildfire smoke exposed regions for replacement with heat pump technology or air conditioning.
  - This would reduce water consumption but could increase energy use relative to ECs.

Public health actions for co-exposure to extreme heat and wildfire smoke

https://www.latimes.com/environment/story/2024-06-17/are-extreme-heat-and-wildfire-smoke-major-disasters

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Who is at Risk?

- Including people with:
  - Heart or lung disease
  - Older adults
  - Children and teenagers
  - Pregnant people

Agricultural and other outdoor workers are also particularly vulnerable to wildfire smoke pollution and extreme heat (Marlier et al., 2022).

- If you:
  - Spend more time exposed to wildfire smoke and heat
  - Outdoor workers
  - People experiencing homelessness
  - Exercise outdoors frequently
  - Can't reduce exposure to smoke or heat indoors

Steps to help protect yourself from wildfire smoke and extreme heat

Step 1

- If you are at increased risk from either smoke or heat, check with your healthcare provider about what to do during smoke and extreme heat events.
- Know where to find your local Air Quality Index (AQI) on the https://fire.airnow.gov/ and wildfire smoke advisories from your state, Tribe, or local governments (local air district webpages, or local sensor networks to monitor PM2.5 levels) during wildfire smoke events.
- Keep an eye on weather forecasts and heat advisory information.

Cleaner Air and Cooling Shelters

- Check with your state or local government (Tribal, county, or city) to find out whether there are cleaner air and cooling shelters available in your community during episodes of wildfire smoke or extreme heat.
  - You can also try calling 3-1-1 or other city services lines for referrals to local cooling centers, the National Center for Healthy Housing Cooling Centers by State website for more information.
  - In California:
  - California Clean Air Centers | California Air Resources Board
  - County Cooling Centers and Resources | Cal OES News

Step 2: Know the symptoms of exposure to smoke and heat:

- Smoke can cause a range of health effects, including less serious symptoms such as eye, nose, or throat irritation, coughing, or wheezing that resolve when the air clears.
- If you have these symptoms, go somewhere with cleaner indoor air, or wear a well-fitting particulate respirator such as an N-95© respirator, also known as an N-95 mask, when outdoors.

Protect Your Lungs from Wildfire Smoke or Ash | AirNow.gov
Fire Response and Recovery | CalEPA

Step 2: Know the symptoms of exposure to smoke and heat:

Smoke may also cause severe problems such as difficulty breathing or heart problems. If these occur, seek medical attention.

Why Wildfire Smoke is a Health Concern | US EPA

How Wildfire Smoke Affects Your Body | Wildfires | CDC

Step 2: Know the symptoms of exposure to smoke and heat:

Never ignore the symptoms of ***heat-related illness***:

- Early symptoms include feeling unwell, headache, sweating and thirst, nausea, lightheadedness, fatigue, heat rash, or muscle cramps.
- If you have these symptoms, go somewhere cool and sip water until symptoms improve.
- Seek medical attention if your symptoms do not improve.
  - You need immediate medical attention if you have more serious symptoms, including fainting or loss of consciousness, weakness, extreme fatigue, severe nausea, and difficulty speaking.

See CDC's Warning Signs and Symptoms of Heat-Related Illness

Step 3: Reduce your exposure to smoke and heat:

- Be aware!
- Current smoke and heat conditions

The Office of Environmental Health Hazard Assessment (OEHHA) has developed a new tool called **CalHeatScore.**

- **What is CalHeatScore: A Heat Warning Tool for Everyone**
  - CalHeatScore is a public health tool to help Californians stay informed, ready, and safe when temperatures rise. The purpose of CalHeatScore is to reduce heat-related illness and save lives by translating meteorological, weather and health data into easy-to-understand heat risk alerts.

(Presentation to follow)

Step 3: Reduce your exposure to smoke and heat:

- Follow these tips for steps to take when you are **outdoors**:
  - Limit strenuous activity and exercise. Pay attention for early signs of heat-related illness.
  - Stay hydrated (choose water or drinks with electrolytes over sugary beverages).
  - Consider using a particulate respirator to reduce smoke exposure.
  - Remove the respirator if it becomes uncomfortably warm or leads to symptoms of heat-related illness.

When you are outdoors:

- Keep an eye on air quality and temperature conditions, and **time your outdoor activities for cooler and less smoky times of day**.
  - Be aware that sometimes, the coolest part of the day can also be the smokiest part of the day. Consider using a particulate respirator mask if the cooler part of the day is a smokier time.
- Rest often in shady areas.
- Wear lightweight, loose-fitting clothing (absorbent or wicking clothing is also appropriate).

When you are outdoors: Outdoor workers

- Greater or more prolonged exposure to both smoke and extreme heat
- Exposure over the course of a work shift
- Less ability to spend time indoors

Outdoor workers should be especially careful when there is both smoke and extreme heat present

Take what measures they can to reduce exposure to both

Steps to take when you are indoors

Why do we need to modify advice or guidance on "just go indoors" with extreme heat and wildfire smoke?

Steps to take when you are indoors

- During extreme heat, you must cool down your home
- May need to allow smoke inside while using night air for cooling
- Both smoke and heat are harmful to your health, but for most people, extreme heat is more immediately dangerous.

Steps indoors without air conditioning (A/C)

If you do **NOT** have air conditioning:

To help control indoor temperatures:

- During the day when it is hot outside, close windows and window coverings such as shades, blinds, and awnings.
- At night when it is cooler, open the windows and use fans to exhaust hot air from rooms or draw in cooler air
- Do not direct the flow of fans toward yourself when the room is hotter than 90°F to avoid dehydration
- Once the air indoors is cool, close doors and windows

Steps indoors without air conditioning

If you do **NOT** have air conditioning:

To help control indoor temperatures:

- Use a portable air cleaner or a DIY portable air cleaner (i.e., box fan with a high-efficiency filter) to filter the indoor air.
- If you have forced air heat, you can also set the furnace fan to "on" at the thermostat (with heat off) and use a high efficiency furnace filter (MERV 13 or greater).

- If you cannot tolerate any smoke and do not have air conditioning, go somewhere to cool off during the smoke event.

Steps indoors with air conditioning

Central A/C

- Ensure your system is functioning properly and install the highest-efficiency filters your system can use to filter the PM2.5 in smoke. MERV 13 or higher filters are best.
- During a smoke event, run your system's fan all the time. Otherwise, your air will only be cleaned while cooling.
- Use portable air cleaners or DIY portable air cleaners to filter your indoor air, especially if your system cannot use high-efficiency filters.
- If your system has a fresh air intake, close it, or turn the system to "recirculate."

Steps Indoors With A/C

Window AC, portable AC, mini split heat exchanger:

- These devices typically do not have filters designed for the PM2.5 in smoke. Use portable air cleaners or DIY portable air cleaners to filter your indoor air.
- Make sure the seal between the air conditioner and the window or wall is as tight as possible to keep smoke out.
- Use portable ACs with a single hose sparingly during smoky conditions – these can bring more smoke inside.
- Create a clean room in the room served by the air conditioner
  How to Create a Clean Room at Home

Evaporative (swamp) cooler:

- If safely accessible, completely cover the outside air intakes with 4-inch-thick high-efficiency (MERV 13) furnace filters. Note: the external filters will be vulnerable to damage from wind or rain and may need to be replaced frequently.
- If you cannot cover the outdoor air intakes with high efficiency filters, use the evaporative cooler sparingly during smoky conditions.
- In high humidity, evaporative coolers cannot cool the air well.
- If you cannot cool your home, consider leaving the area or purchasing an affordable air conditioning unit.

Wildfire smoke, extreme heat and power safety shutoffs

- Power disruptions potentially represent significant health impacts, particularly to populations dependent on:
  - electronic medical equipment,
  - medicine that needs to be refrigerated,
  - disabilities or access and functional needs
- ability to run A/C or portable air filters
- What is needed?
  - Education
  - City planning, policies, and emergency preparedness
  - Public Messaging

WILDFIRE SMOKE FACT SHEET

Protect Yourself from Smoke and Extreme Heat

[Protect Yourself from Smoke and Extreme Heat]

https://document.airnow.gov/protect-yourself-from-smoke-and-extreme-heat.pdf

Summary

- Introduction to wildfire smoke and extreme heat
- Resources for public health
- Scientific studies on wildfire smoke and extreme heat
- Public health actions for co-exposure to extreme heat and wildfire smoke

BREAK TIME!

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Any Questions?

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