Wildfire Smoke Air Pollution:
Health Hazards & Advice

What is known & not known

What can we do in planning & responding

Pre-Fire Season Briefing, 4/15/2019

Dr. Bob Bernstein, MD, PhD, MPH
Tuolumne County Health Officer
RBernstein@co.Tuolumne.ca.us
Cell: 209-770-1991

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What is known about exposures to respirable-size air pollution in **emergency*** situations?

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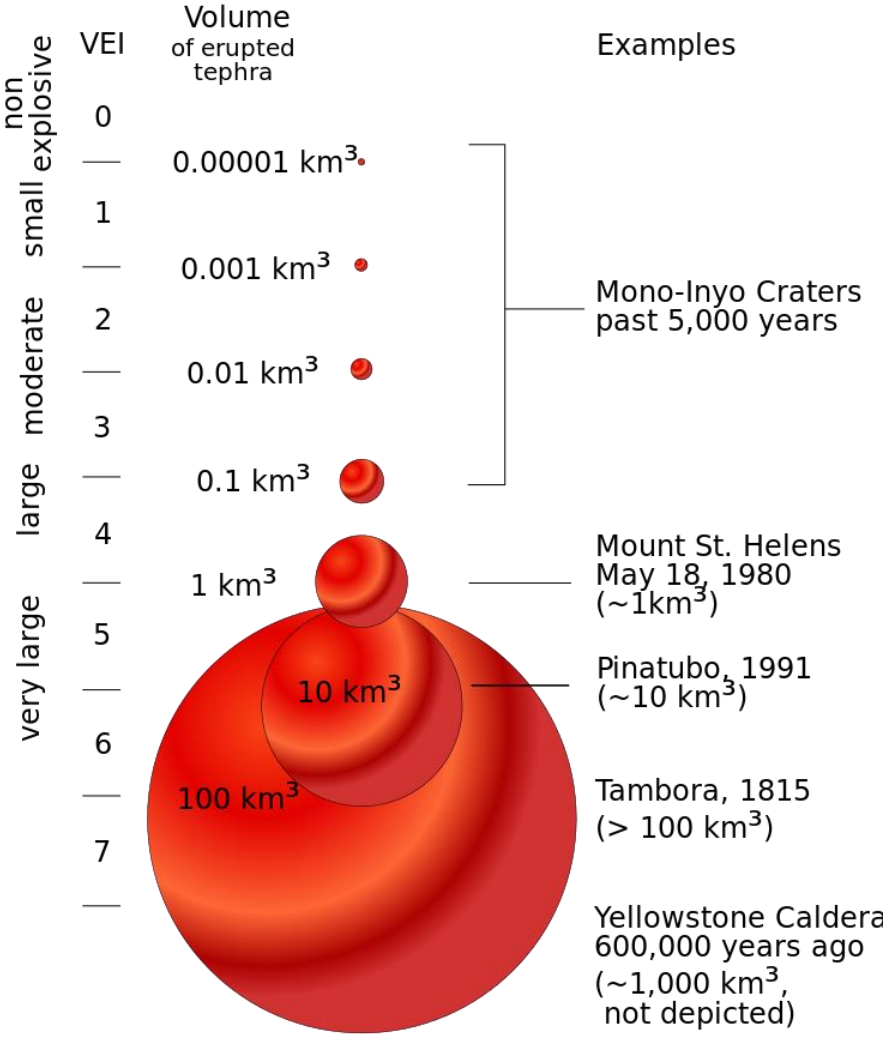
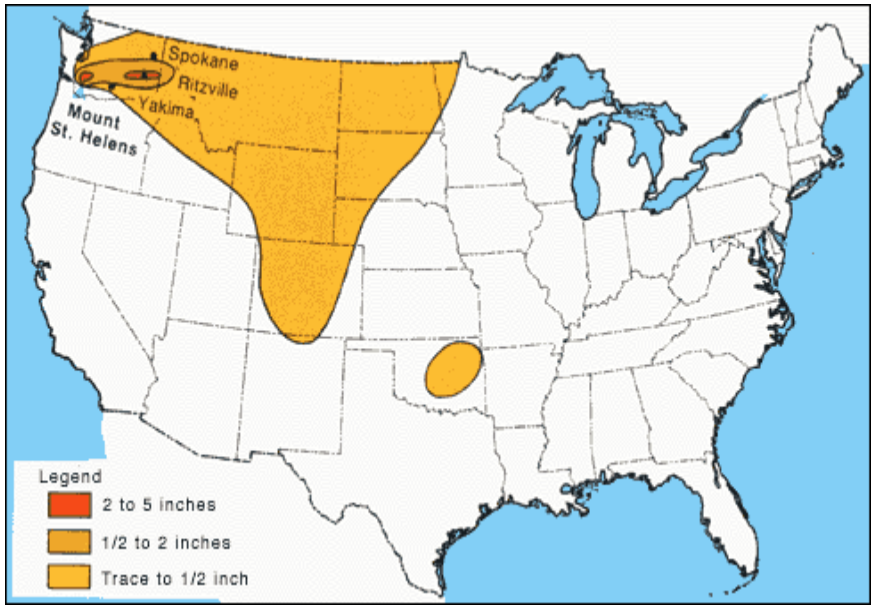
Dr. Bob Bernstein, MD, PhD, MPH
Tuolumne County Health Officer
RBernstein@co.Tuolumne.ca.us
Cell: 209-770-1991

* There is an important distinction between the health hazards that can be caused by unprotected, short-term, emergency/ natural-disaster-related, and therefore unpreventable air pollution episodes/exposures, compared to the consequences of long-term, unprotected exposures to preventable/mitigate-able man-made air pollution (e.g., compare slide 12 and the last slide).

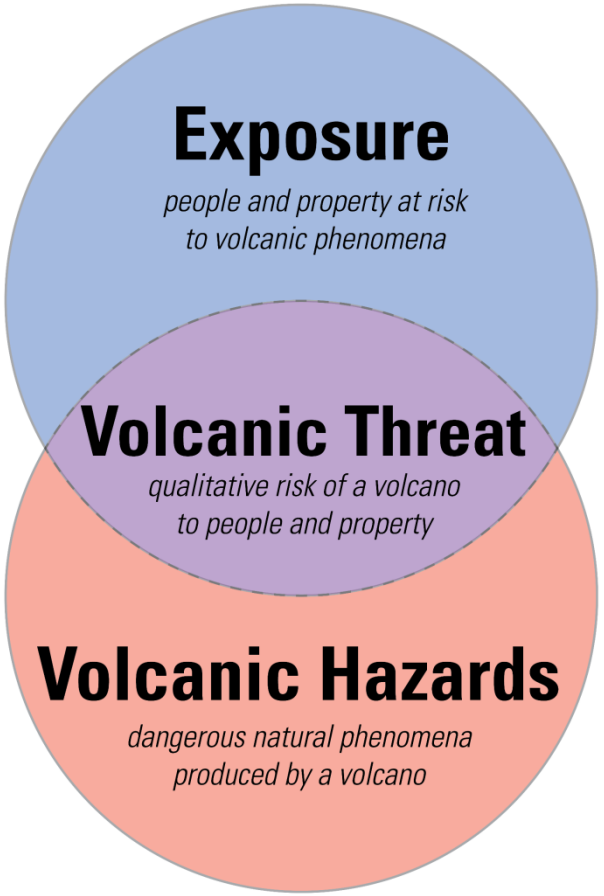
Relevance of the Explosive Eruption of Mt. St. Helens Volcano 18 May 1980

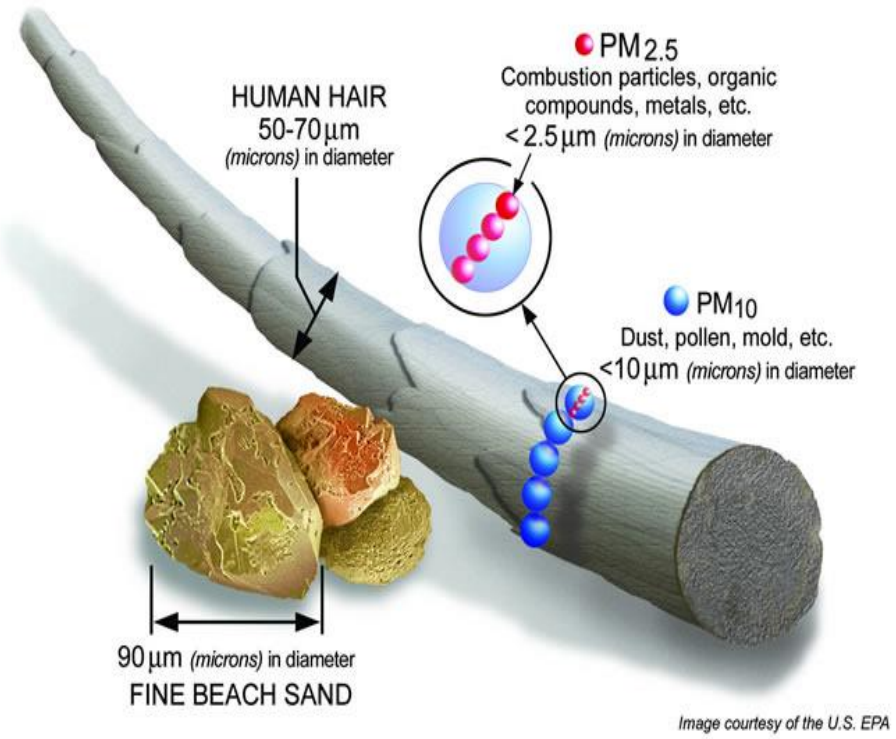


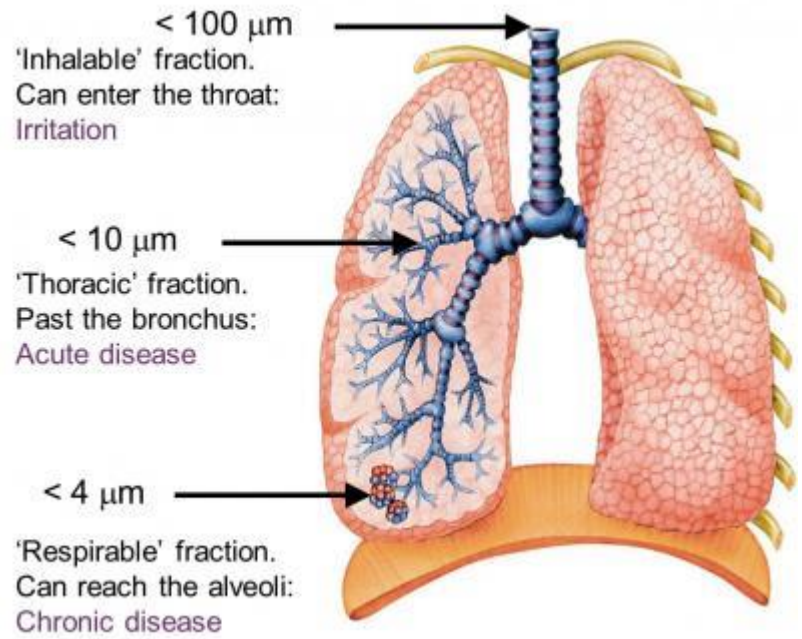


Volcanic Ash: An unpreventable episode of air pollution – what a mess: How hazardous? Who is most at risk? Prevention?

MSH Volcanic Ash – was it a lung hazard, for whom?*

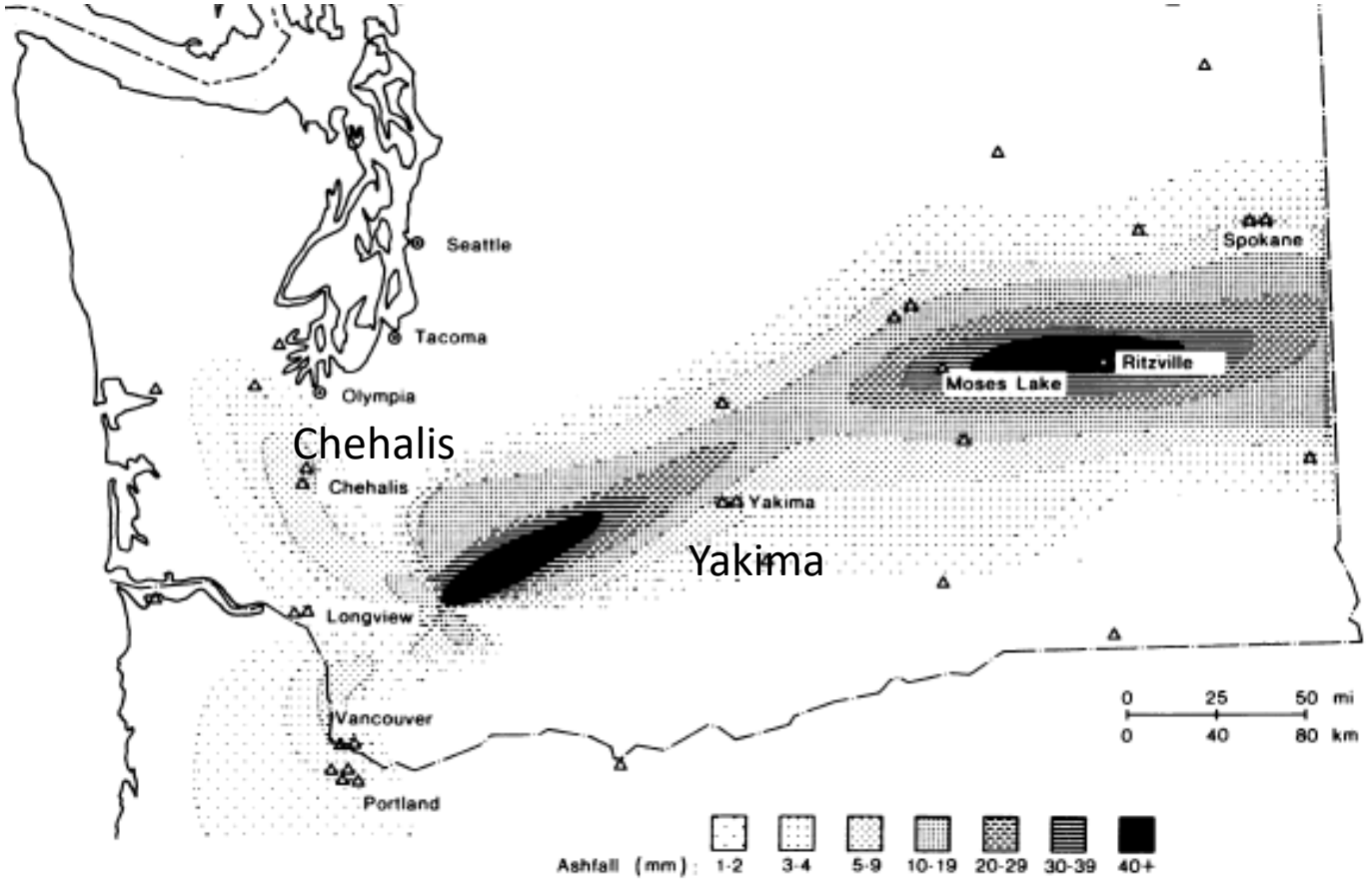


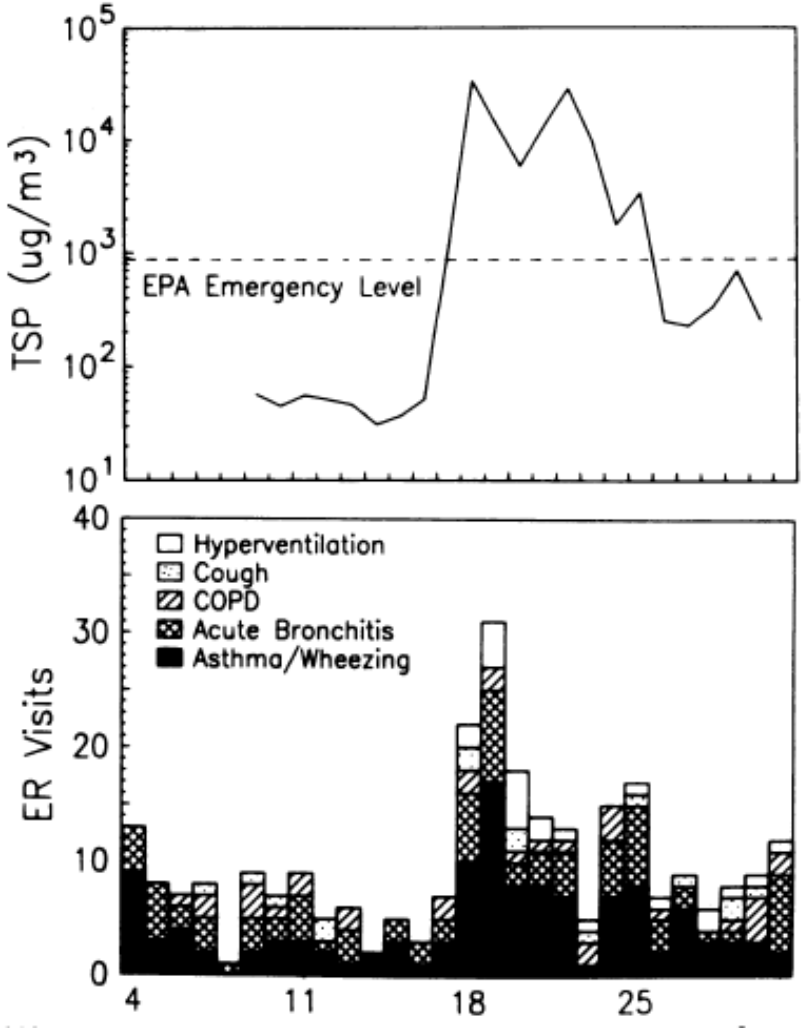




* Depends on the size, shape, toxicity, airborne concentration, and duration of exposure – and whether exposures are controlled.

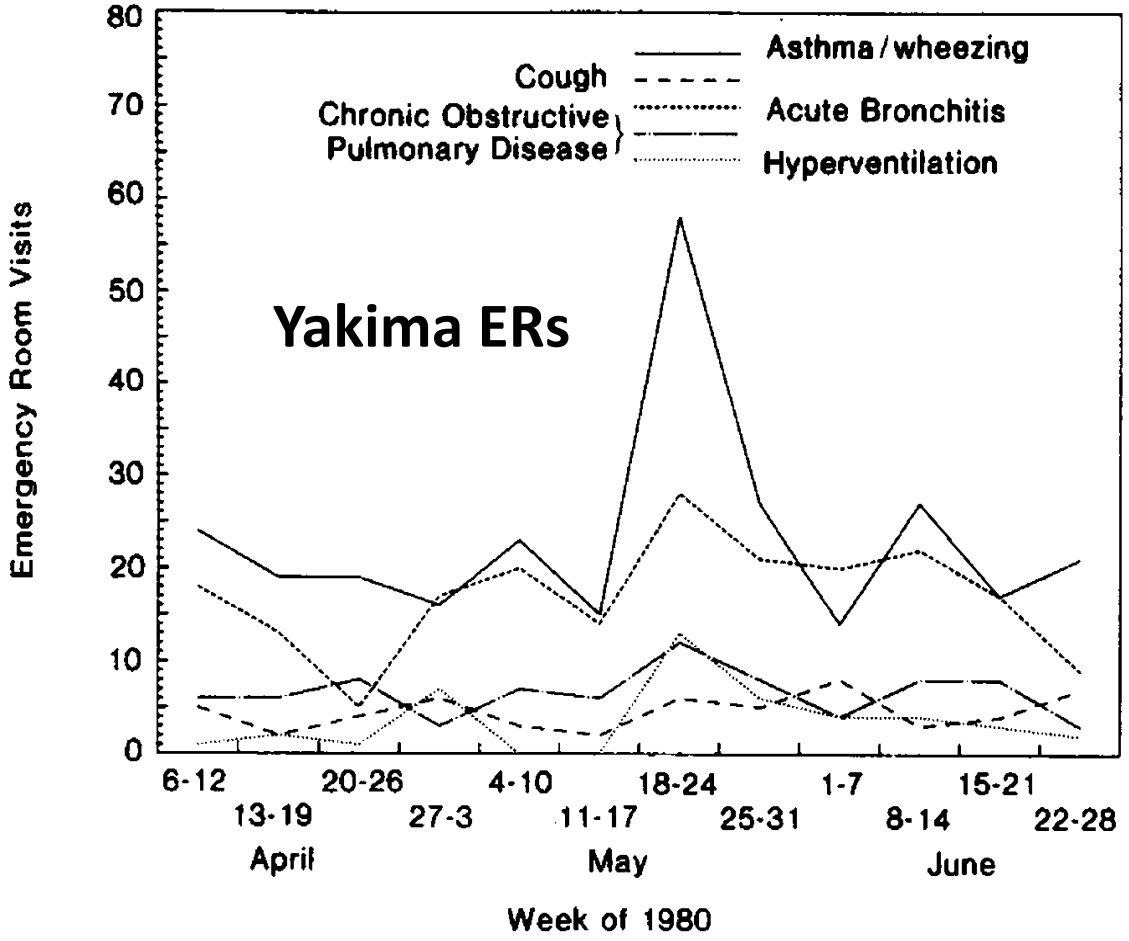
Ashfalls & Respiratory Effects of Mt. St. Helens' Eruptions and locations of Washington and Oregon hospitals participating in ER surveillance, 18 May – 12 June 1980*

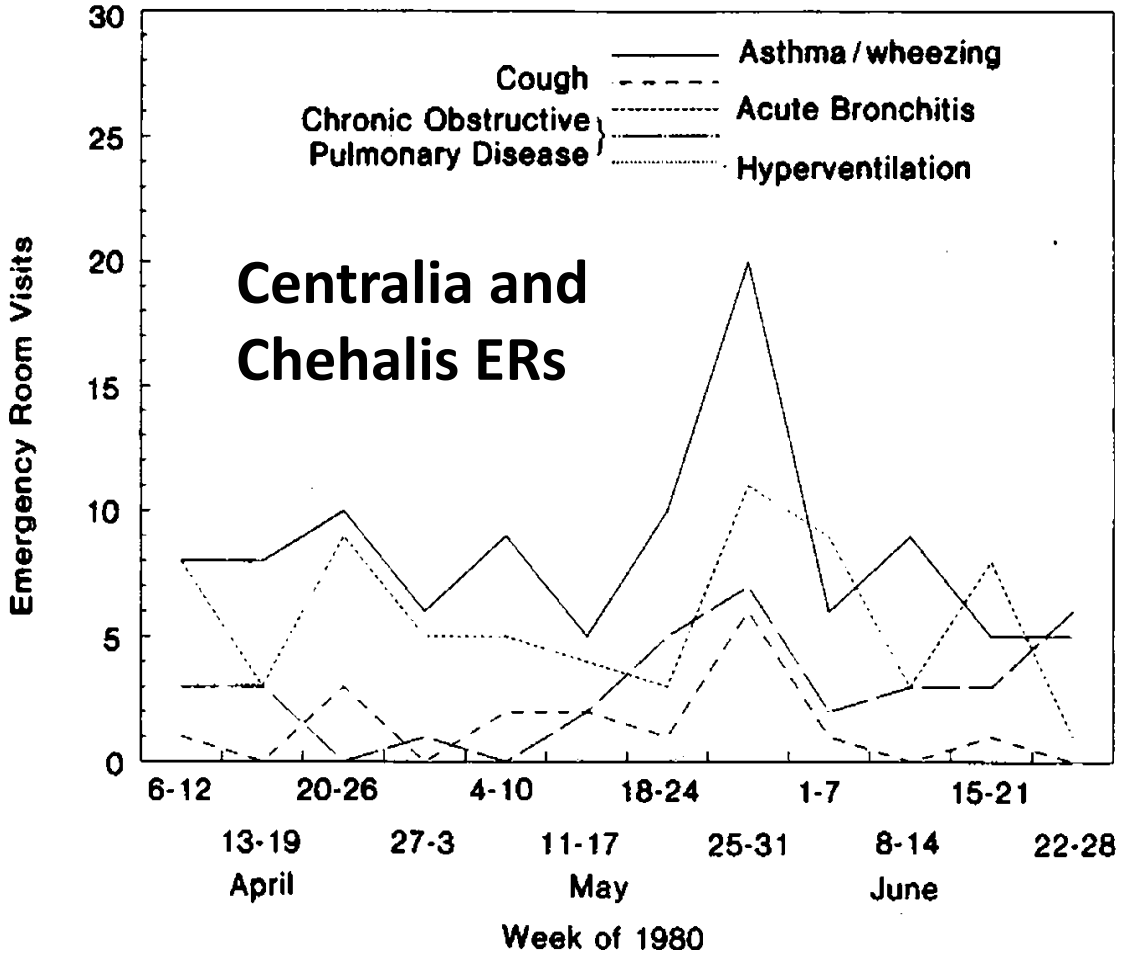




* Bernstein RS et al. Immediate Public Health Concerns and Actions in Volcanic Eruptions: Lessons from the Mount St. Helens Eruptions, May 18-October 18, 1980. AJPH March 1986, Vol. 76, Supplement

The Value of Surveillance: Emergency Room (ER) Visits for Respiratory Problems*





* Baxter PJ, Bernstein RS, et al: Mt. St. Helens Eruptions 18 May to 12 June, 1980. AJPH March 1986, Vol. 76, Supplement. Total weekly ER visits for respiratory problems in two hospitals in Yakima (Left – 8 mm ashfall 18 May) and two hospitals in Centralia and Chehalis (Right – 8 mm ashfall 25 May).

Loggers at increased risk of high ash exposure*

FIGURE 7—Ash cloud after a Douglas fir had been cut.

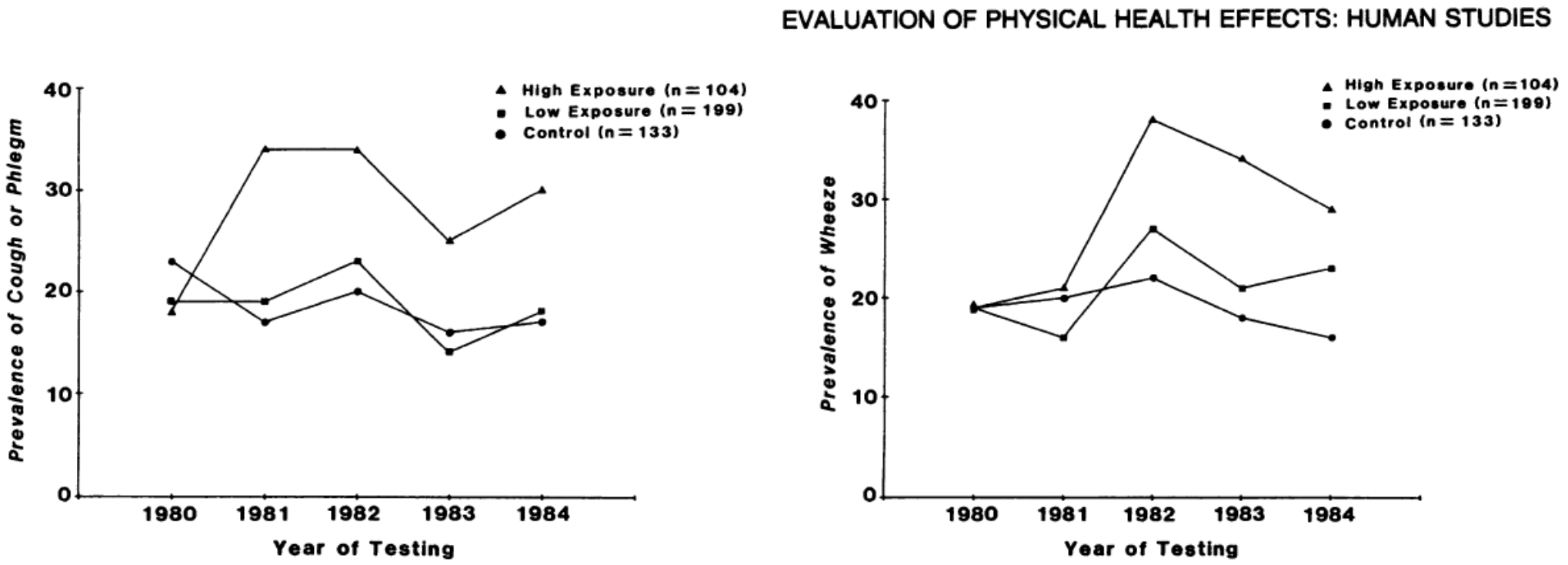
FIGURE 9—Two cutters "bucking" a tree into lengths for transportation. Cutter on the right is wearing a personal air sampler (intake pinned to his collar) to measure ambient levels of total and respirable particulates.

FIGURE 8—A logging road just above 19-mile camp in the blow-down zone of Mount St. Helens. Thick layer of ash covers everything. Tree stumps and snags are a result of the May 18, 1980 blast.

* Buist AS, Bernstein RS et al: Evaluation of Physical Health Effects Due to Volcanic Hazards. AJPH March 1986, Vol. 76, Supplement

Presidential and FEMA Response to Mt St Helens

Results of a 4-Year Study of Volcanic Ash-Exposed Loggers*



*Buist AS; Vollmer WM; Johnson LR; Bernstein RS. A four-year prospective study of the respiratory effects of volcanic ash from Mt. St. Helens. American Review Respiratory Disease. 1986 Apr; 133(4):526-34. The Mount St Helens eruption: a severe air pollution episode from volcanic ash. Baxter P, Bernstein RS, Buist S. In *Air Pollution Reviews*, 2017, Volume 6, Air Pollution Episodes, Chap. 5, pp. 73-99. (https://www.worldscientific.com/worldscibooks/10.1142/q0098#t=aboutBook). Buist AS; Bernstein, RS. Health effects of volcanoes: an approach to evaluating the health effects of an environmental hazard. American Journal of Public Health 1986 Mar;76(3 Supplement):1-2.

Lessons Learned – Applicable to Wildfire Smoke*

- Have standard methods of measuring air pollution levels and potential human exposures available, agreeable, and visible to all agencies, and ensure that they are rehearsed during quiescent times (at least once per year)
- Have redundancy in the air pollution measurement system to avoid swamping a few agencies/people with analyses (consider whether methods can be run at commercial labs)
- Have pre-prepared consistent messages on communicating locations, levels, and changes in air pollution ready to roll out that can be updated with real time information and evidence-based, action-oriented health and safety advisories as needed for responders, for healthcare facilities, and for the general public and vulnerable groups
- Consider the consequences of your air quality/water quality testing: what will your advice be for different scenarios? You don't want to be developing these advisories in real time.
    - What will you advise responding agency personnel and the public to do if you find that a high proportion of the smoke particulates are highly respirable in size (<2.5 to 10 microns), or have hazardous levels of chemical contaminants? Be honest about what you know, what you don't know, what you're doing about it, what best practices you can advise for responders (e.g., apply fit-testing and use N95 respirators) and the public (see CDC & EPA Guides in following slides), and on what time frame your advice may change….
- Use a NIMS-compliant Unified Incident Command approach to Emergency Management and include the logos of all responding agencies on public messaging (see: https://www.nrt.org/sites/2/files/ICSUCTA.pdf and https://www.caloes.ca.gov/PlanningPreparednessSite/Documents/01%20SEMS%20Maint%20Brochure%20May_2014.pdf)

* Planning and responding agencies with authorities and interests could include County agencies (OES, HSA, LE, CRA), Tribal agencies, State & Regional agencies (CalOES, CalEPA, CalFire, CHP, CDPH), Federal agencies (USEPA, USDoI/FS, CDC), etc…

Critical Review of Health Impacts of Wildfire Smoke Exposure*

Background: Wildfire activity is predicted to increase in many parts of the world due to changes in temperature and precipitation patterns from global climate change. Wildfire smoke contains numerous hazardous air pollutants and many studies have documented population health effects from this exposure.

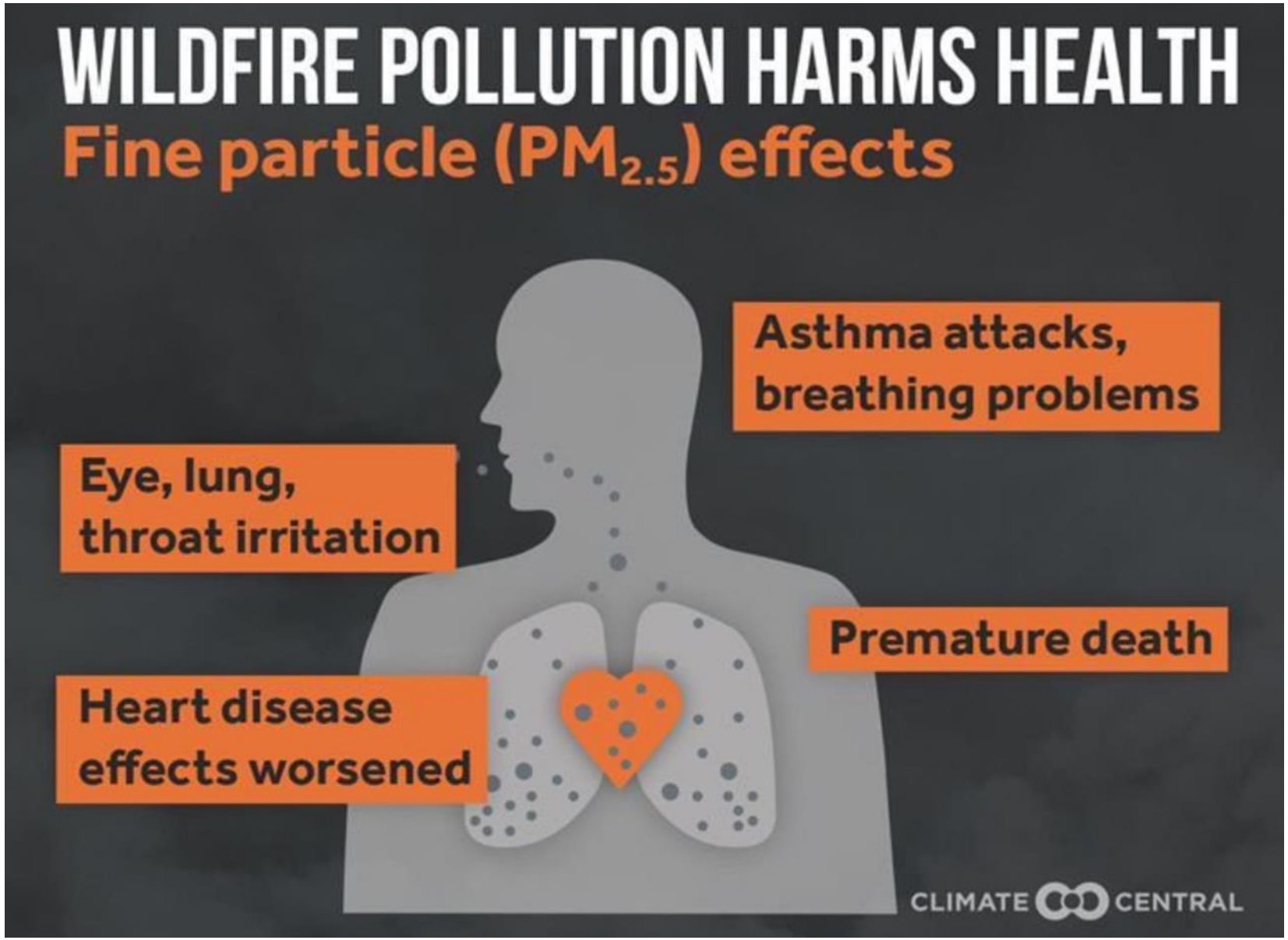
Objectives: We aimed to assess the evidence of health effects from exposure to wildfire smoke and to identify susceptible populations.

Methods: We reviewed the scientific literature for studies of wildfire smoke exposure on mortality and on respiratory, cardiovascular, mental, and perinatal health. Within those reviewed papers deemed to have minimal risk of bias, we assessed the coherence and consistency of findings.

Discussion: Consistent evidence documents associations between wildfire smoke exposure and general respiratory health effects, specifically exacerbations of asthma and chronic obstructive pulmonary disease (COPD). Growing evidence suggests associations with increased risk of respiratory infections and all-cause mortality. Evidence for cardiovascular effects is mixed, but a few recent studies have reported associations for specific cardiovascular end points. Insufficient research exists to identify specific population subgroups that are more susceptible to wildfire smoke exposure.

Conclusions: Consistent evidence from a large number of studies indicates that wildfire smoke exposure is associated with respiratory morbidity with growing evidence supporting an association with all-cause mortality. More research is needed to clarify which causes of mortality may be associated with wildfire smoke, whether cardiovascular outcomes are associated with wildfire smoke, and if certain populations are more susceptible.

* Reid CE, Brauer M, Johnston FH, Jerrett M, Balmes JR, Elliott CT. Environmental Health Perspectives 2016; 124:1334–1343.


WILDFIRE POLLUTION HARMS HEALTH
Fine particle ($PM_{2.5}$) effects
Asthma attacks, breathing problems
Eye, lung, throat irritation
Premature death
Heart disease effects worsened
CLIMATE CENTRAL

Bay Area Wildfire Scenes & Health Messages

- Keep children indoors and limit their activity
- Everyone stay indoors, windows & doors closed
- Utilize a “clean” room if available
- Limit outdoor activities
- No outdoor exercising
- If necessary, find a clean air space:
  - > local library
  - > shopping mall
  - > theater

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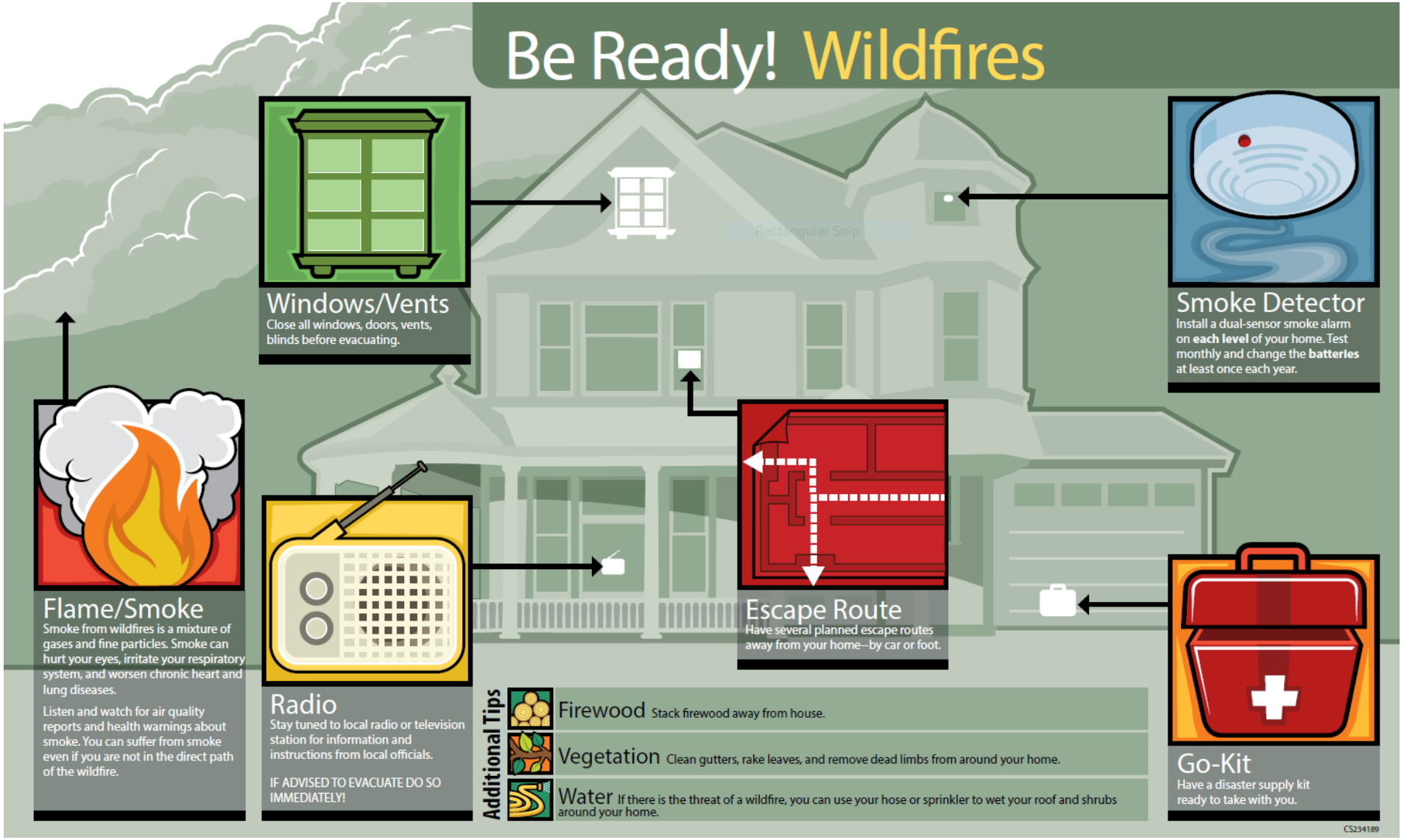
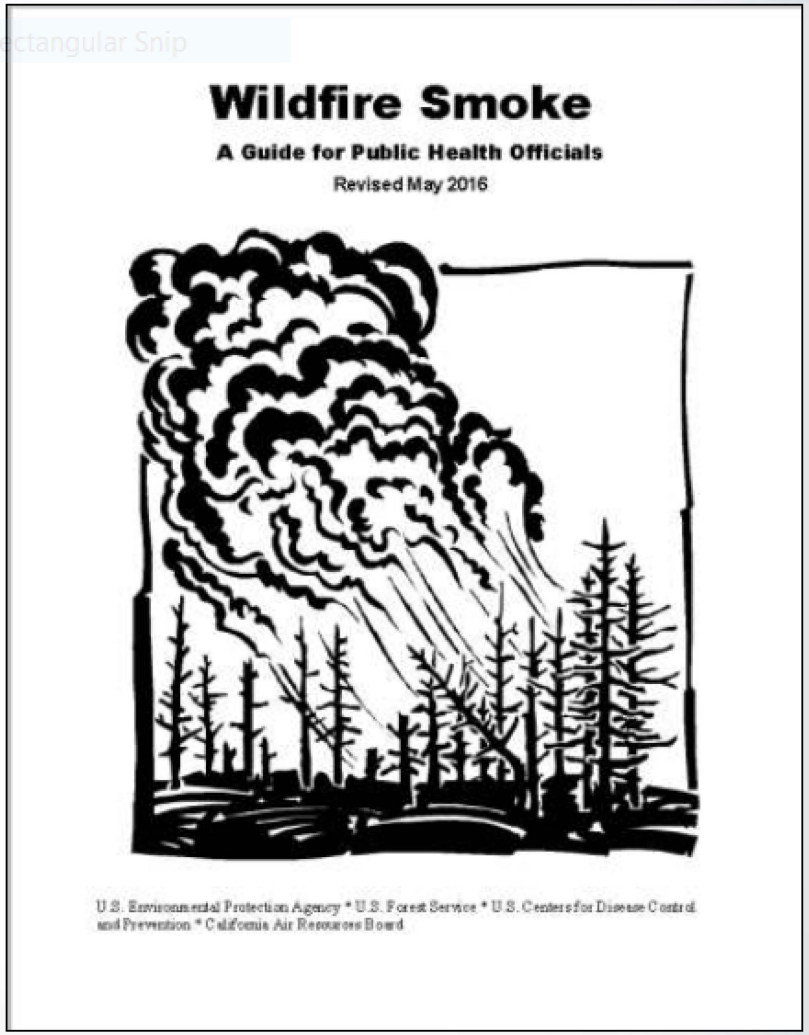
CDC Wildfire Health & Safety Preparedness Guide*



* See: https://www.cdc.gov/disasters/wildfires/index.html

Wildfire Smoke: Guide for Public Health Officials

- Air quality and health information updated 2016
- Evidenced-based exposure reduction measures
- Entirely new section on communicating air quality
  - Uses “Current PM” levels from AirNow
  - Uses satellite information on Fires: Current Conditions page
  - Visual range information updated
  - New interagency Wildland Fire Air Quality Response Program
- Used by the states which provided recommendations for improvements



https://www3.epa.gov/airnow/wildfire_may2016.pdf

EPA Guide (slide 1 of 2):
https://www.epa.gov/sites/production/files/2018-11/documents/protecting-children-from-wildfire-smoke-and-ash.pdf

EPA United States Environmental Protection Agency | PEHSU Pediatric Environmental Health Specialty Units | American Academy of Pediatrics DEDICATED TO THE HEALTH OF ALL CHILDREN®

Protecting Children from Wildfire Smoke and Ash

Background

- Children are especially at risk for health effects from exposure to wildfire smoke and ash, mostly because their lungs are still growing.
- Wildfire concerns include the fire itself, the smoke and ash, and the chemicals from materials that have burned, such as furniture.
- Smoke can travel hundreds of miles from the source of a fire. Pay attention to local air quality reports during fire season, even if no fire is nearby.

Health Effects from Wildfire Smoke and Ash

- Children who breathe in wildfire smoke and ash can have chest pain and tightness; trouble breathing; wheezing; coughing; nose, throat, and eye burning; dizziness; or other symptoms.
- Children with asthma, allergies, or chronic health issues may have more trouble breathing when smoke or ash is present.

Preparing for Wildfires

- Pay attention to local air quality reports. Stay alert to smoke-related news coverage and public health advisories.
- Look up your local Air Quality Index (AQI) on the AirNow (www.airnow.gov) web site.
- If Enviroflash is available for your area, sign up for air quality alerts. (http://www.enviroflash.info/).
- Create a "clean room" in your home. Choose a room with few windows and doors. Buy a portable air cleaner you can use in this room. Never use an ozone-generating air cleaner.
- Stock up on food, medicine and child care supplies before the threat of a wildfire.
- Remember that you may need to leave your home. Plan for it and prepare your children.

During Wildfires

- Continue to listen to local reports and public health warnings.
- Keep children indoors with the doors and windows closed. Use your "clean room". If you have an air conditioner, run it with the fresh-air intake closed to keep outdoor smoke from getting indoors. Use your portable air cleaner as well. Reduce health risks by avoiding strenuous activities.
- Keep the indoor air as clean as possible. Do not smoke. Do not use gas, propane, or wood-burning stoves, fireplaces, or candles. Never use ozone-generating air cleaners. Never use natural gas or gasoline-powered generators indoors. Do not use spray cans. Do not fry or broil meat. Do not vacuum. All of these can lead to poor air quality.
- A good time to open windows to air out the house and clean away dust indoors is once air quality improves (check AirNow for updates).
- Use common sense to guide your child's activity. If it looks or smells smoky outside, if local air quality is reported as poor, or if local officials are giving health warnings, wait until air quality improves before your family is active outdoors.

EPA Guide (slide 2 of 2):
https://www.epa.gov/sites/production/files/2018-11/documents/protecting-children-from-wildfire-smoke-and-ash.pdf

Special considerations:

- If your child has any problem breathing, is very sleepy, refuses food and water, or other health concerns, reduce his/her exposure to smoke and seek medical help right away.
- If your child has asthma, allergies, or a chronic health condition, he/she is at high risk from health effects related to wildfire smoke and ash. Seek medical advice as needed. For children with asthma, follow the asthma action plan.
- Do not rely on masks for protection from smoke. Paint, dust and surgical masks, even N95 masks, are not made to fit children and will not protect children from breathing wildfire smoke. Humidifiers or breathing through a wet washcloth do not prevent breathing in smoke.

Evacuation

- Seek shelter in another place (e.g., public air shelter) if your family does not have an air conditioner OR air cleaner OR if it is too warm in your home to stay inside with the windows closed. Plan to take the quickest route to the shelter to limit exposure to smoke.
- Bring all medication (taken by each family member) with you.
- Reduce smoke in your vehicle by closing the windows and vents and operating the air conditioning with the fresh intake closed to keep outdoor smoke from getting into car. Never leave children in a car or truck alone.

After a Wildfire

- Make sure ash and debris have been removed before bringing your child back to home or school.
- Children should not be doing any cleanup work. Fires may deposit large amounts of ash and dust with harmful chemicals.
  Avoid bringing polluted ash and dust back to areas used by children (such as a home or car). Remove shoes at the doorway, wash clothing separately, and change out of clothing before you have contact with your children.

For more information:

Learn more about wildfire smoke: *Wildfire Smoke, A Guide for Public Health Officials*: https://www3.epa.gov/airnow/wildfire_may2016.pdf
Get air quality information: Check the airnow.gov website, or your state air quality agency's website.
Air Quality Flag Program: This visual tool alerts schools and organizations and their communities to the local air quality forecast. https://airnow.gov/flag
Learn about home air cleaners: https://www.epa.gov/indoor-air-quality-iaq/guide-air-cleaners-home
Find certified air cleaning devices: http://www.arb.ca.gov/research/indoor/aircleaners/certified.htm
Contact Poison Control at 1-800-222-1222 for emergency concerns regarding ingestion or exposure to hazards.
Contact your Pediatric Environmental Health Specialty Unit with children's environmental health questions: www.pehsu.net

Tuolumne County
Public Health Department

20111 Cedar Rd. North
Sonora, CA 95370
Office: 209-533-7401
Fax: 209-533-7406
24-hour Phone: 209-533-8056

Robert S. Bernstein, MD, PhD, MPH, FACPM
Health Officer

Melissa Parrish, RN, PHN, MSW
Director of Public Health Nursing

July 18, 2018

IMMEDIATE RELEASE: Tuolumne County Air Quality Health Alert

SONORA-- Fires, including those outside of Tuolumne County, are affecting air quality in many areas in Tuolumne County. Smoke accumulation has rendered air quality unhealthy for sensitive groups in some areas and unhealthy to very unhealthy in other areas for everyone (see chart below).

The following information is provided to allow you to assess the air quality in your immediate vicinity and to provide guidance for those people who live in neighborhoods affected by poor air quality.

Because the Tuolumne County geography may entrap smoke in certain valleys and basins, the following visibility chart can be used to determine the air quality where you are. Visibility provides an excellent measure of air quality.

First identify on a map certain landmarks on the horizon. Then check to see at what distance the landmarks can no longer be seen. The distance of this landmark is the "visibility in miles."

Air Quality Index Levels of Health Concern	Visibility in Miles	Meaning
Good	10 miles and up	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	6-9 miles	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	3-5 miles	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	1.5-2.5 miles	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	1-1.25 miles	Health alert: everyone may experience more serious health effects.
Hazardous	0.75 mile or less	Health warnings of emergency conditions. The entire population is more likely to be affected.

The following guidelines can help to prevent breathing problems during times when air quality is poor due to wildfires:

1) Individuals with long term health conditions like asthma, lung or heart disease should make sure that they have a supply of medications on hand and are following their caregivers' instructions.

2) Elderly and very young children should limit their outdoor activities when local air quality is "unhealthy for sensitive groups" (visibility less than 5 miles).

3) Signs that the smoke may be bothering you include coughing, scratchy throat, irritated sinuses, shortness of breath, stinging eyes or runny nose. Sometimes symptoms may even include chest pain or headaches. Consult your caregiver for worsening symptoms.

4) If you are advised to stay indoors, keep indoor air as clean as possible. Keep windows and doors closed unless it is extremely hot outside. Run an air conditioner if you have one, but keep the fresh-air intake closed and the filter clean to prevent outdoor smoke from getting inside. If you do not have an air conditioner and it is too warm to stay inside with the windows closed, seek shelter elsewhere.

5) Consider a high-efficiency particulate air (HEPA) filter to reduce breathing problems. Room air cleaners, which utilize a HEPA filter, may reduce the number of irritating fine particles in indoor air.

6) Do not add to indoor pollution. Do not smoke because smoking puts even more pollution into the air.

The Tuolumne County Air Pollution Control District will continue to monitor air quality and will provide updates with the Public Health Department as the information becomes available.

Examples of County Health Department Advisories: Tuolumne County

Examples of County Health Department Advisories: Mariposa County

As fire agencies battle wildfires, there are measures we all can take to protect our health from harmful pollutants in our air. Smoke is a respiratory irritant that can worsen conditions such as asthma, other chronic lung conditions, or heart disease. Pregnant women, children, elderly people, smokers, and people who work or exercise outdoors are at higher risk for complications from smoke exposure.

Here are some tips you can follow to protect you and your family members from unhealthful air:

Stay indoors. Remain indoors, with air conditioning on, as much as possible when air pollution levels are unhealthful. Check the local Air Quality Index (AQI) for this information. Keep the air conditioner filter clean to prevent bringing additional smoke inside. In extremely hot weather, staying inside with the windows closed, without air conditioning may be dangerous. A swamp cooler will not provide protection and will pull in the smoky air from outside. Consider seeking alternative shelters in this situation.

Reduce outdoor activity. If it looks smoky outside, it is not a good time for outdoors exercise and activity for people of any age. People with heart or lung disease should take further measures to avoid prolonged exertion and outdoor exposure. Reducing you physical activity outdoors lowers the amount of unhealthy air your body takes in.

Consult your physician. If you or a family member have heart or lung disease, if you are an older adult, or if you have children, talk with your doctor about whether and when you should leave the area. When smoke is heavy for a prolonged period of time, fine particles can build up indoors, even though you may not be able to see them. If you have asthma or other lung disease, call your doctor if your symptoms worsen.

Have a plan. Be sure to have a family emergency plan and kit with an adequate supply of food, water, medications, and necessities for at least 72 hours in the event that you need to stay home or evacuate.

Keep informed. Visit the local Air Quality Index website (see below) for updates on the air quality and air smoke monitoring. Register for emergency alert texts and emails with the Mariposa County Sheriff.

Use of Respirators - not "Masks". Masks, such as dust, surgical masks or wet bandanas, will not protect your lungs. If the smoke is that irritating to you, the best option is to remain indoors or temporarily relocate. An option is a NIOSH approved disposable respirator, such as an N95. These can be beneficial to reduce particulate inhalation. People with heart or lung conditions should consult their doctor before using a respirator.

Take a break. If you can, take a break by traveling to a smoke-free area away from the wildfire, even if it is just for 3- 4 hours. This can be helpful for both your physical health, and a relief from other stressors.

More Resources:

Mariposa County Air Quality Index Website:
http://www.mariposacounty.org/index.aspx?NID=1434

AirNow Website "How Smoke from Fires Can Affect Your Health"
https://www.airnow.gov/index.cfm?action=smoke.index

CMA Guide for Physicians Providing Healthcare Coverage for Wildfire Patients*

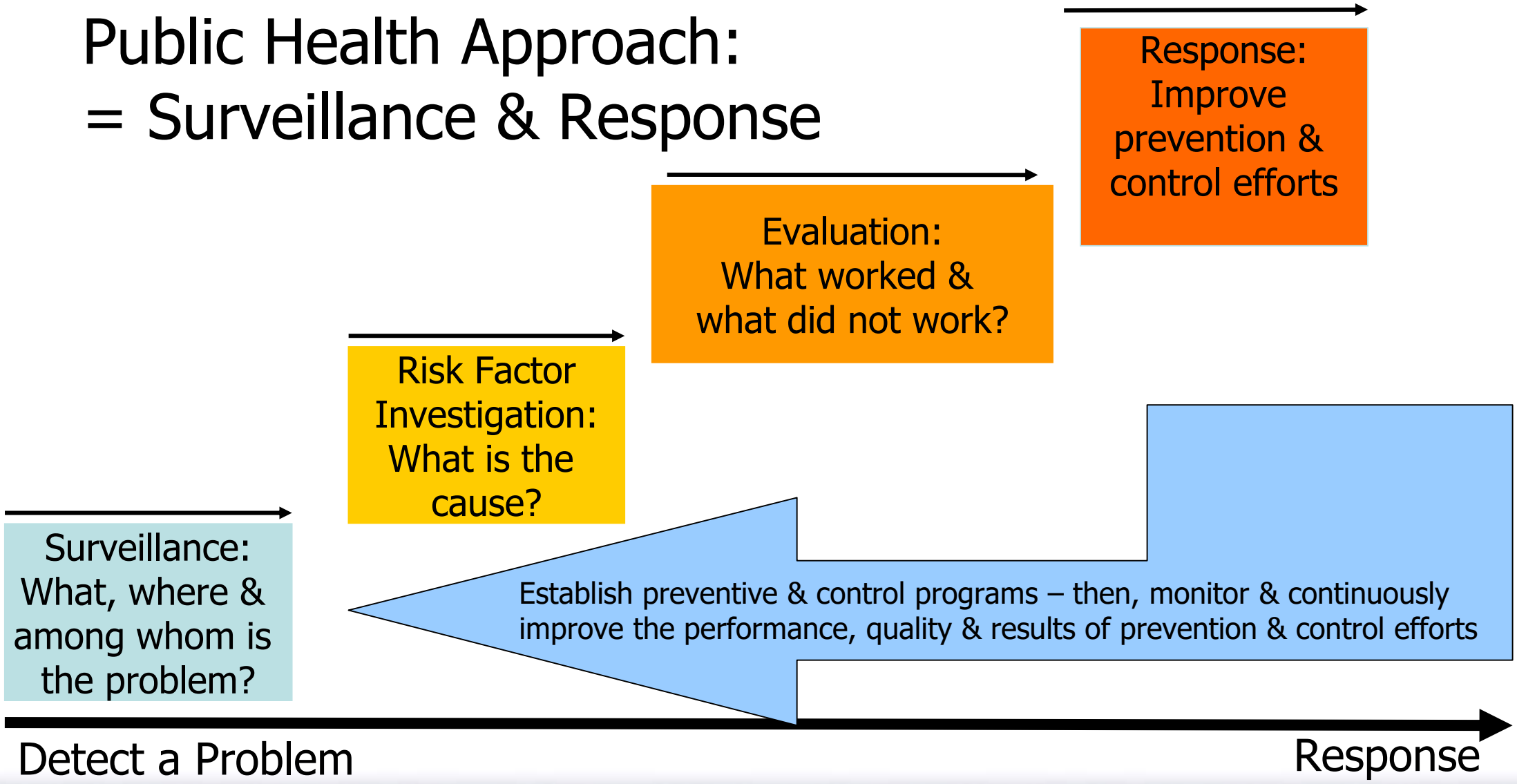
The California wildfires in Butte, Los Angeles and Ventura counties destroyed thousands of homes, structures and medical practices, as well as displaced thousands of Californians.

Payors are taking action to ensure physicians can continue to render care to their patients.

CMA compiled this guide to help physicians navigate the services offered by each payor.

*See: https://www.cmadocs.org/Portals/CMA/files/public/A%20Guide%20for%20Physicians%20Impacted%20by%20Wildfires.pdf

Public Health Approach: = Surveillance & Response



Estimates, trends, and drivers of the global burden of type 2 diabetes mellitus attributable to particulate matter air pollution:
an analysis of data from the Global Burden of Disease Study 2017*

Background: Experimental and epidemiological studies indicate a relationship between **long-term exposure** to particulate matter air pollution and increased risk for type 2 diabetes. Given the high and increasing prevalence of diabetes, we quantified the burden of diabetes attributable to long-term particulate matter exposures originating from ambient and household air pollution.

Findings: Approximately one-fourth of the global burden of diabetes was attributed to long-term exposure to PM2.5, with an estimated 276 thousand (95% uncertainty interval (UI): 186–340 thousand) deaths and 15.2 thousand (10.0–19.9 thousand) disability-adjusted life-years (DALYs) in 2017.

Interpretation: Long-term exposure to air pollution constitutes a major risk factor for diabetes, with a larger attributable burden than tobacco or physical inactivity. Air pollution mitigation therefore may have an important role in reducing the global disease burden from diabetes.

* Katrin Burkart, Kate Causey, Aaron Cohen, et al. – in preparation for submission to *The Lancet*. See other GBD papers at: http://www.healthdata.org/sites/default/files/files/policy_report/2019/GBD_2017_Booklet.pdf