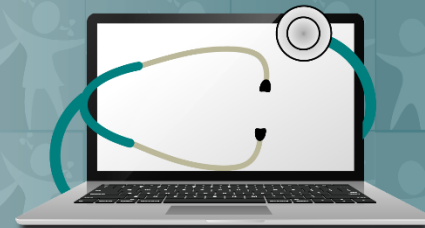




# PEHSU NATIONAL CLASSROOM

Pediatric Environmental  
Health Specialty Units



[www.pehsu.net/nationalclassroom.html](http://www.pehsu.net/nationalclassroom.html)



## Webinars

Series of scientific webinars that provide a forum for discourse on scientific issues.

Live and On-Demand

Case Conferences  
Journal Clubs  
Grand Rounds

CE Available



## Online Courses

Evidence-based online courses on a variety of children's environmental health topics.

Interactive and Self-Paced

CE Available



## Resource Catalog

Fact sheets, journal publications, reports, and other resources for parents, community members, patients and healthcare professionals

Topics included:  
Air Quality, Pesticides,  
Natural Disasters, BPA,  
Mold, Lead, Mercury



# Mitigating the Health Impact of Wildfire Smoke

## Guidance for Health Professionals

Ana Rappold PhD

Susan Lyon Stone MS

Wayne E. Cascio MD, FACC

Moderator: Marissa Hauptman, MD, MPH



This presentation is dedicated in memory of Dr. James M. Seltzer of the Western States (Region 9) PEHSU and the first responders and others who have responded to and been affected by wildfires in their community.



This presentation was supported by the American Academy of Pediatrics and the American College of Medical Toxicology and funded (in part) by the cooperative agreement award number FAIN: U61TS000237 and UG1TS000238 from the *Agency for Toxic Substances Disease Registry (ATSDR)*. The U.S. EPA supports the PEHSU by providing funds to ATSDR under Inter-Agency Agreement number DW-75-92301301.

Neither U.S. EPA nor ATSDR endorse the purchase of any commercial products or services mentioned in PEHSU publications. Support for this presentation (Dr. Hauptman) was provided by the National Institute of Environmental Health Sciences, National Institutes of Health grant number P30ES000002-53S2.

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# Learning Objectives

- 1) To identify scope of wildfires in the U.S. and identify interagency resources available.
- 2) To describe health impacts of wildfires and identify populations of concern.
- 3) To learn risk communication strategies to address wildfire smoke for health professionals.

# Wildfire Smoke and Public Health

## Where is it? What can we do?

Ana Rappold

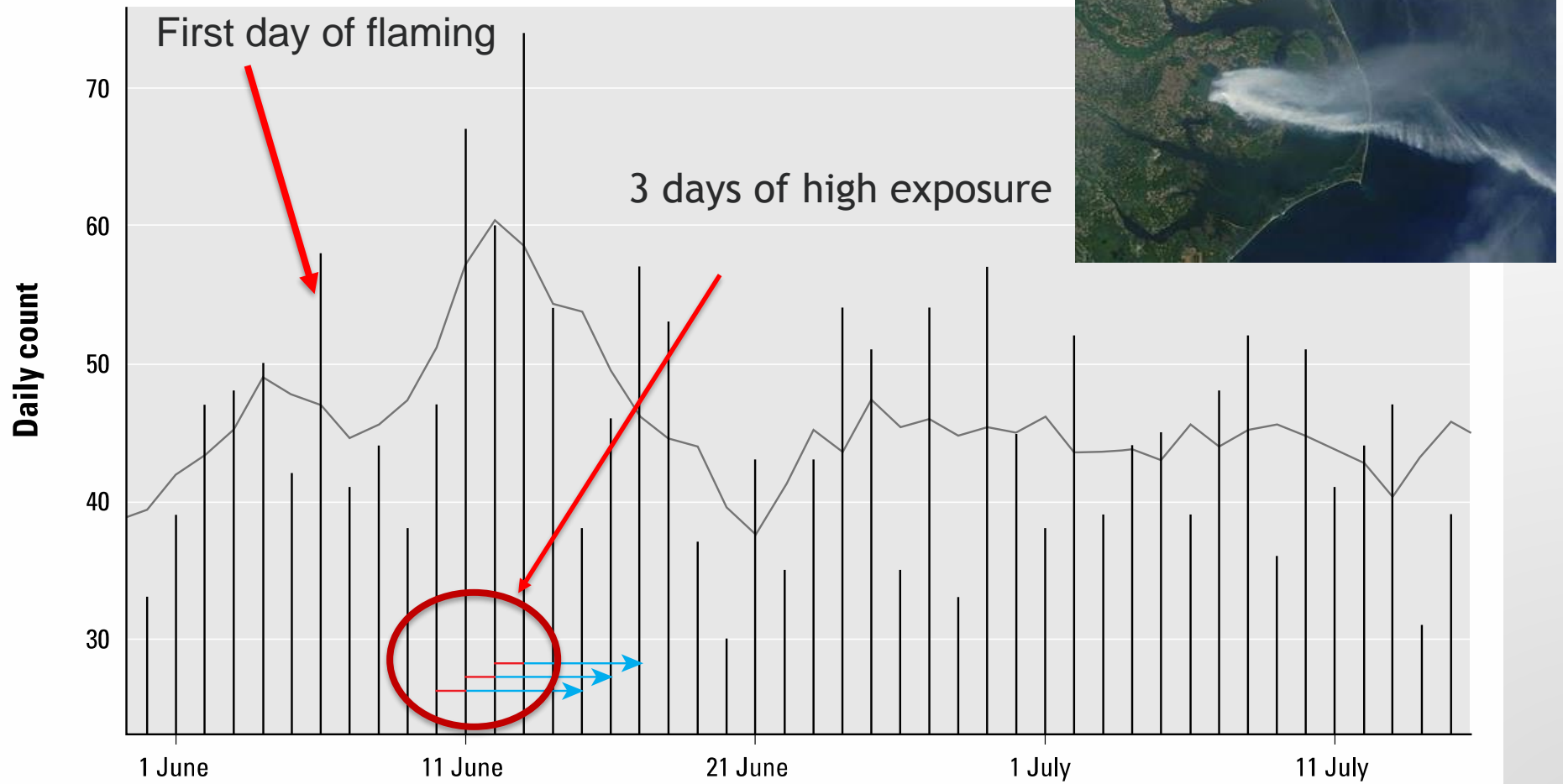
# Overview

- Health effects of wildland fire smoke – Rappold
- AirNow website – Stone, Cascio
  - Smoke tools
    - Fires: Current Conditions web page
    - Wildfire Smoke: Guide for Public Health Officials
  - Health tools
    - PM Web course
    - Ozone web course, fact sheets

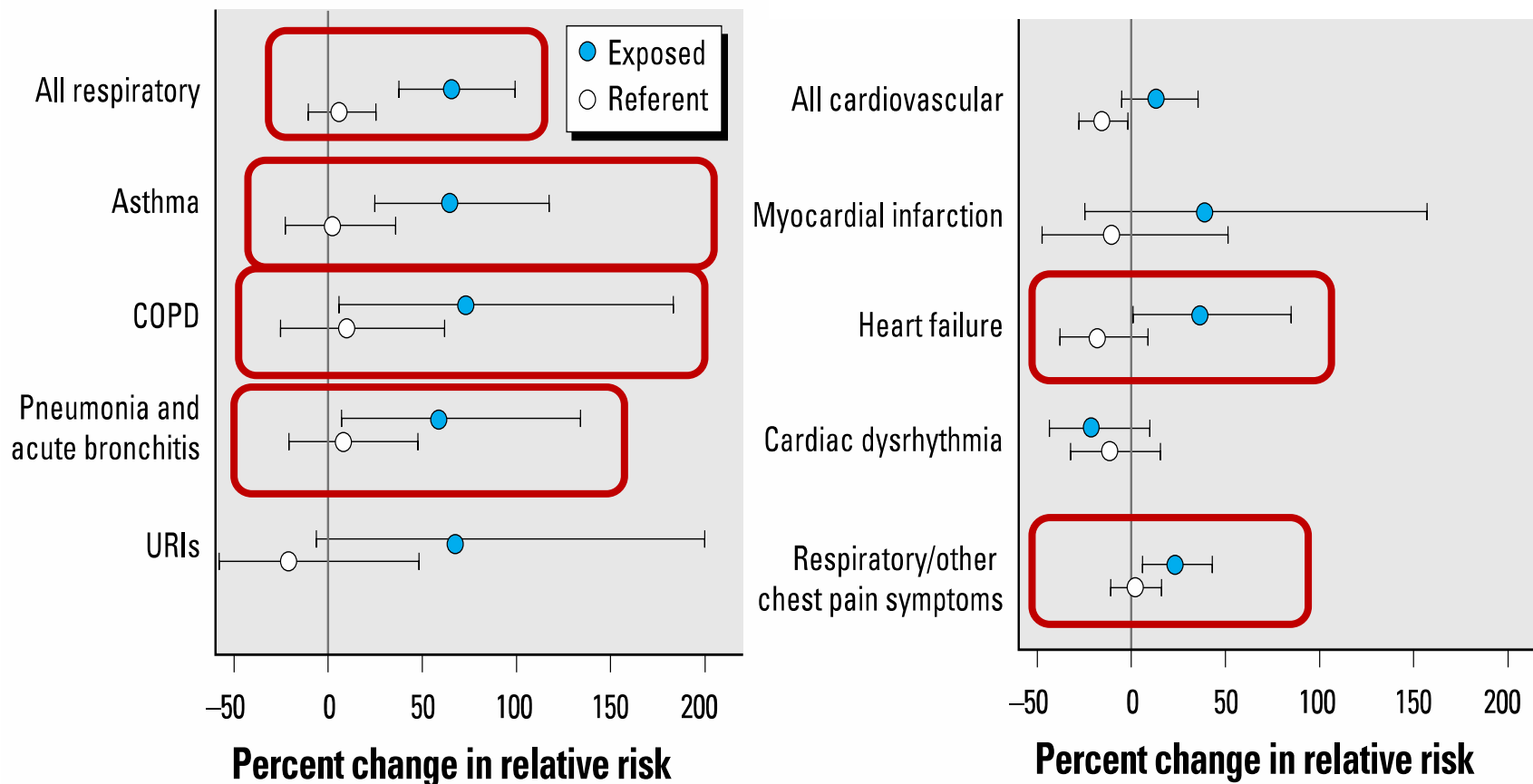


# Health effects of smoke

## *Daily Counts of Asthma ED Visits; Pocosin Lakes NC 2008*



# Health Effects of Wildland Fire Smoke



Percent change in cumulative RR by discharge diagnosis category for exposed and referent counties in NC during 3-day period of high exposure compared with the entire 6-week study period.

*Rappold AG et al. Environ. Health Perspectives 2011*



# Health Effects of Wildland Fire Smoke



- Reviewed 61 peer reviewed journal articles on the topic of forest fire/wildfire smoke and health, published between 1 January 1986 and 30 May 2014.
- Since May 2014 several more studies have emerged including Tinling et al 2016, Haikerwal et al 2016, Haikerwal et al 2015; Resnick et al 2015; Johnston et al 2014; Reid et al 2016.

# Health effects of smoke

## ***Health effects known or suspected to be caused by wildland fire smoke:***

- All-cause mortality
- Asthma & COPD exacerbations
- Bronchitis & pneumonia
- Childhood respiratory disease
- Cardiovascular outcomes
- Adverse birth outcomes
- Symptoms such as: eye irritation, sore throat, wheeze and cough

Source: Studies reviewed in Liu et al 2015.

# Who is at risk?

- ***Susceptible populations include –***
  - Pregnant women and fetuses
  - Children
  - Older populations
  - Populations with pre-existing respiratory disease
  - Populations with pre-existing cardiovascular disease
  - Populations with lower socio-economic status
- ***Populations suspected to be at greater risk –***
  - Populations with chronic inflammatory diseases (e.g., diabetes, obesity)
  - Populations with specific genetic polymorphisms (e.g. GSTM1) that mediate physiologic response to air pollution

# How often do fires impact air quality?

AIR QUALITY INDEX CHART

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
<i>When the AQI is in this range:</i>	<i>...air quality conditions are:</i>	<i>...as symbolized by this color:</i>
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

		AQI Color Code				
		Green	Yellow	Orange	Red	Purple
Ozone	% of AQI codes on clear days	89.50%	9.15%	1.26%	0.08%	0.01%
	% of AQI codes on plume days	70.30%	24.00%	5.27%	0.43%	0.03%
	% Plume Days for each AQI code	6.10%	18.00%	25.80%	30.10%	28.80%
	Odds Ratio	0.278	3.13	4.34	5.2	4.82
FRM PM <sub>2.5</sub>	% of AQI codes on clear days	70.60%	28.80%	0.58%	0.08%	0.00%
	% of AQI codes on plume days	46.40%	51.70%	1.65%	0.25%	0.01%
	% Plume Days for each AQI code	4.20%	10.60%	15.80%	16.50%	50.00%
	Odds Ratio	0.36	2.65	2.88	3.02	15

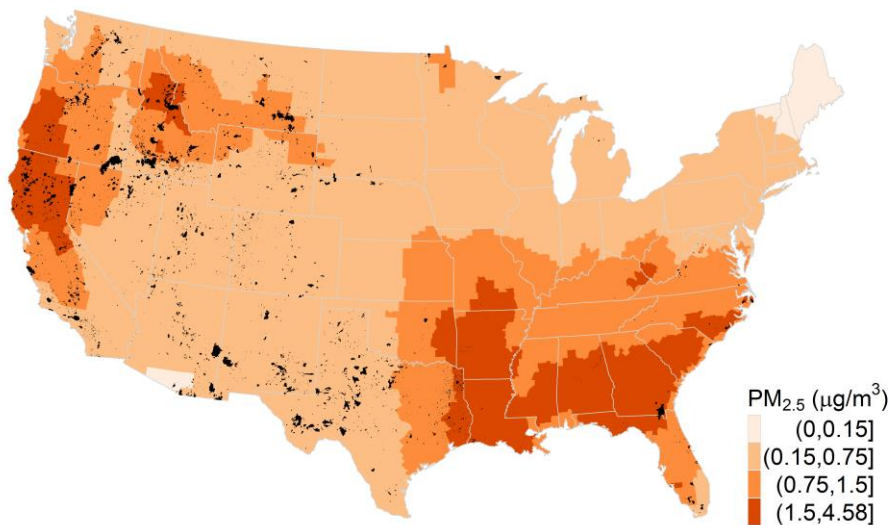
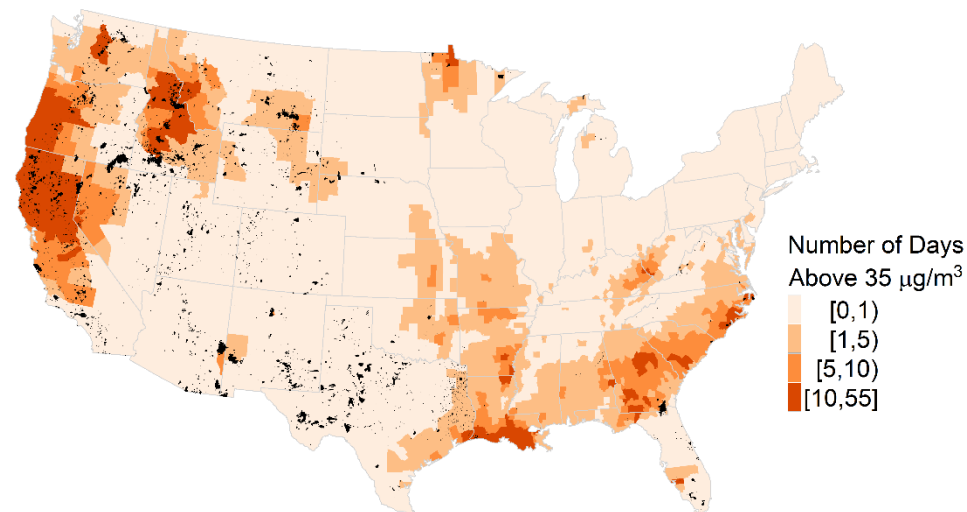
[https://airnow.gov/index.cfm?action=particle\\_health.index](https://airnow.gov/index.cfm?action=particle_health.index)

# Air Quality Impacts of Wildland Fires

How much does smoke contribute to air quality and how often does it lead to exceeding daily standard?

Health protective standards  
Annual -  $12 \mu\text{g}/\text{m}^3$  daily average  
Daily -  $35 \mu\text{g}/\text{m}^3$

2008-2012

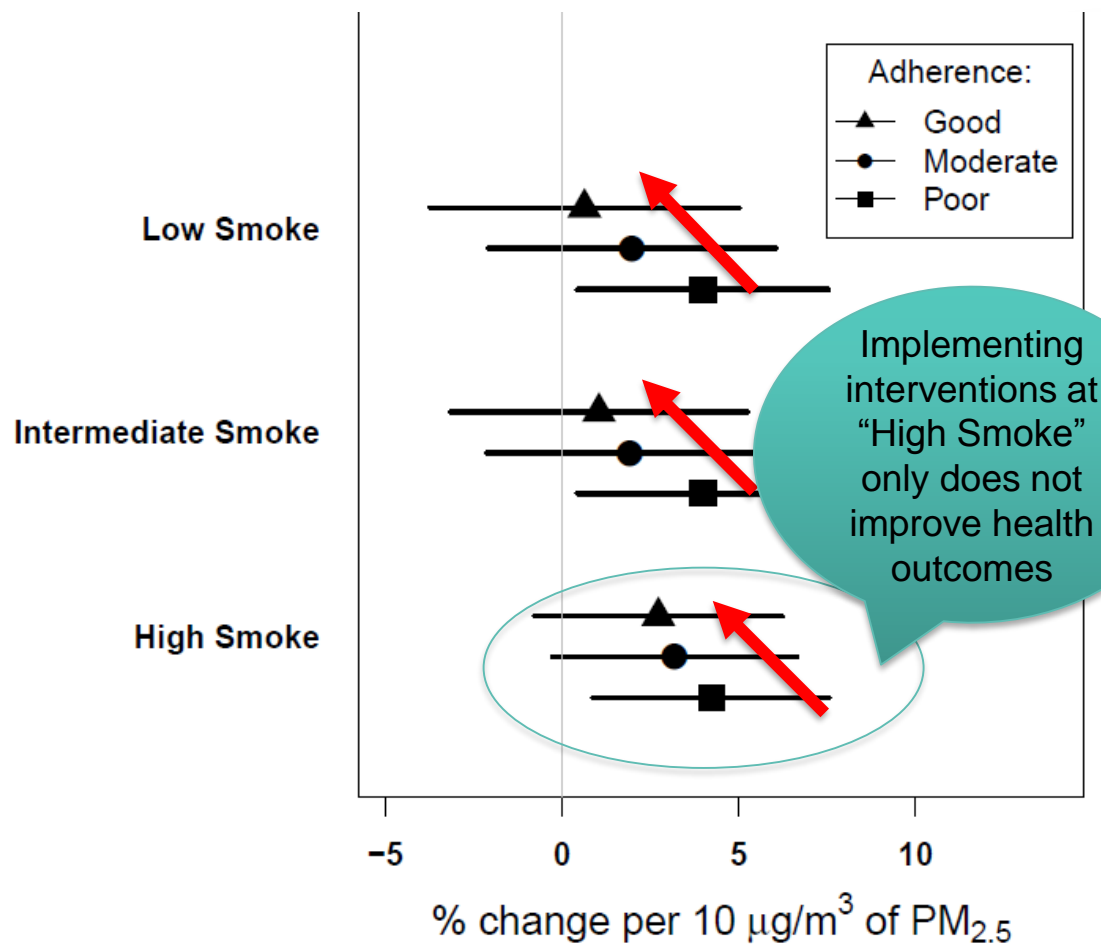


# Forecast based intervention study

We simulated *forecast - based interventions in population*

using forecast predictions of  $PM_{2.5}$  from NOAA's Smoke Forecasting System and asked

“ If we reduced exposures according to the forecasts would we observe a corresponding reduction in health effects?”



# Other Forms of Interventions

***Current research and other activities focus on reducing the impacts on health in the affected communities.***

- Workshop on Wildfire Smoke and Health Risk Communication, RTP, Sept 2016 was organized to improve health risk communication and management.
- Improving Air Quality Awareness through Message Content and Delivery Mechanism - Identified among the 5 key gaps in workshop.

## ***Smoke tools***

Air Quality Flag Program






Fires: Current Conditions web page

Wildfire Smoke: Guide for Public Health Officials

## ***Health tools***

PM Web course

Ozone web course, fact sheets

Air Quality Index	Outdoor Activity Guidance
 GOOD	Great day to be active outside!
 MODERATE	Good day to be active outside! Students who are unusually sensitive to air pollution could have symptoms.*
 UNHEALTHY FOR SENSITIVE GROUPS	It's OK to be active outside, especially for <b>short activities</b> such as recess and physical education (PE). For <b>longer activities</b> such as athletic practice, take more breaks and do less intense activities. Watch for symptoms and take action as needed.* Students with asthma should follow their asthma action plans and keep their quick-relief medicine handy.
 UNHEALTHY	For <b>all outdoor activities</b> , take more breaks and do less intense activities. Consider moving <b>longer or more intense activities</b> indoors or rescheduling them to another day or time. Watch for symptoms and take action as needed.* Students with asthma should follow their asthma action plans and keep their quick-relief medicine handy.
 VERY UNHEALTHY	Move <b>all activities</b> indoors or reschedule them to another day.

**Air Quality and Outdoor Activity Guidance for Schools**

[www.airnow.gov/flag](http://www.airnow.gov/flag)



[AirNow.gov](https://airnow.gov)

# Wildfire Smoke and Public Health Information

Susan Lyon Stone

# AirNow (www.AirNow.gov)



Local Air Quality Conditions  
Zip Code:  Go State:  Go

Forecast | Current AQI | AQI Loop | More Maps

**Today's AQI Forecast**  
Monday, April 25, 2016

Generated: 2016-04-25 11:46:57Z

Good Moderate USC Unhealthy Very Unhealthy Hazardous ! Action Day

**Highest 5:**  
[About the Highest 5](#)

Today's Forecasts | Tomorrow's Forecasts | Current AQI

<a href="#">Yuma, AZ</a>	130
<a href="#">Imperial Valley, CA</a>	123
<a href="#">Coachella Vly, CA</a>	101
<a href="#">Nipomo, CA</a>	98
<a href="#">Cincinnati, OH</a>	95

**Fires: Current Conditions**  
[Click to see map](#)

**U.S. Embassies and Consulates**  
Data from air quality monitors at select U.S. embassies and consulates around the world

**Announcements**  
4/14/16: The Air Quality Flag Program [Spring Challenge](#) starts tomorrow, April 15 and ends May 15.  
3/9/16: NEW: [Spanish-language website](#) for Air Quality Flag Program - NUEVO: [En español—El sitio web](#) del programa de banderines sobre la calidad del aire  
[more announcements](#)

**Air Quality Basics**  
[Air Quality Index](#) | [Ozone](#) | [Particle Pollution](#) | [Smoke from fires](#) | [What You Can Do](#)

**Health**  
**Learning Center**

 Apps

 Facebook

 Webcams

 Videos

 AirNow on Google Earth

 EnviroFlash Email

 Widgets

 RSS

 Twitter

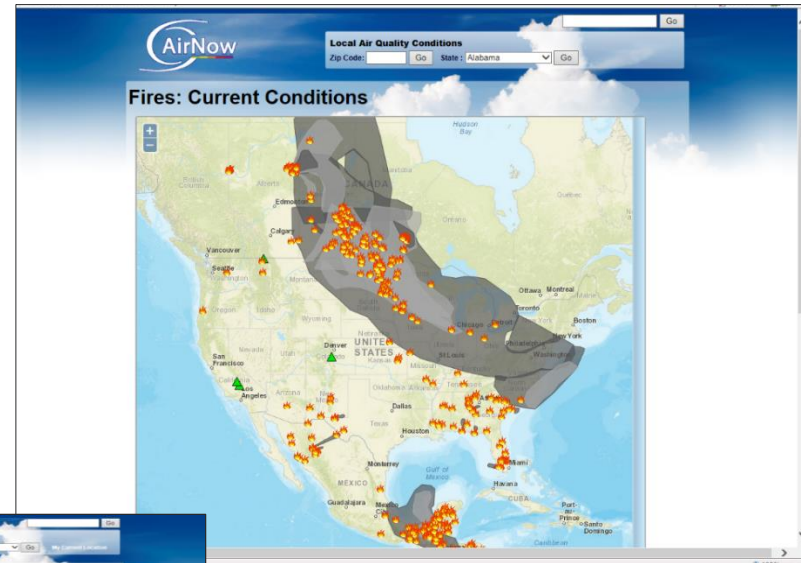
 Developer Tools

**Popular Links**

# Fires: Current Conditions Page

- Current Smoke Map generated by NOAA HMS
- Current Advisories – State/Local/Tribal agency blogs and Wildland Fire Air Quality Response Program

Current Conditions Map - May 9, 2016




Current Advisories

Site	Yesterday	Today	Tomorrow	Comments
Johns Landing	Good	Good	Good	Expect high morning impacts with slow clearing gradually improving as the burn ends.
Kennedy Meadows	Good	Good	Moderate	Generally clear but potential impacts tomorrow afternoon and evening.
Kennville	Moderate	Good	Good	Expect morning and evening impacts. Smoke will be slow to clear out during the day.
Lane Pine	Good	Good	Moderate	Morning impacts should clear out by the afternoon. Smoke impacts expected overnight.
Parkerville	Moderate	Good	Moderate	Impacts expected in the morning. Slow clearing today and tomorrow, improving late - Midweek improvement through the week.
Springville	Good	Good	Moderate	Morning impacts should clear out by the afternoon. Smoke impacts expected overnight.
Three Rivers	Moderate	Good	Moderate	Impacts expected in the morning. Slow clearing today and tomorrow, improving late - Midweek improvement through the week.

CA Smoke Blog

USFS Wildland Fire Air Quality Response Program

# How Smoke from Fires Can Affect Your Health



**Local Air Quality Conditions**  
Zip Code:   State:   [My Current Location](#)

## How Smoke from Fires Can Affect Your Health

Updated January 2017

### Smoke may smell good, but it's not good for you


While not everyone has the same sensitivity to wildfire smoke, it's still a good idea to avoid breathing smoke if you can help it. And when smoke is heavy, such as can occur in close proximity to a wildfire, it's bad for everyone.

Smoke is made up of a complex mixture of gases and fine particles produced when wood and other organic materials burn. The biggest health threat from smoke is from fine particles. These microscopic particles can penetrate deep into your lungs. They can cause a range of health problems, from burning eyes and a runny nose to aggravated chronic heart and lung diseases. Exposure to particle pollution is even linked to premature death.

### Some people are more at risk

It's especially important for you to pay attention to local air quality reports during a fire if you are

- **a person with heart or lung disease**, such as heart failure, angina, ischemic heart disease, chronic obstructive pulmonary disease, emphysema or asthma.
- **an older adult**, which makes you more likely to have heart or lung disease than younger people.
- **caring for children, including teenagers**, because their respiratory systems are still developing, they breathe more air (and air pollution) per pound of body weight than adults, they're more likely to be active outdoors, and they're more likely to have asthma.
- **a person with diabetes**, because you are more likely to have underlying cardiovascular disease.
- **a pregnant woman**, because there could be potential health effects for both you and the developing fetus.



### How to tell if smoke is affecting you

High concentrations of smoke can trigger a range of symptoms.

- **Anyone** may experience burning eyes, a runny nose, cough, phlegm, wheezing and difficulty breathing.
- **If you have heart or lung disease**, smoke may make your symptoms worse
  - **People with heart disease** might experience chest pain, palpitations, shortness of breath, or fatigue.
  - **People with lung disease** may not be able to breathe as deeply or as vigorously as usual, and may experience symptoms such as coughing, phlegm, chest discomfort, wheezing and shortness of breath.

### Protect yourself!

It's important to limit your exposure to smoke - especially if you are at increased risk for particle-related effects. Here are some steps you can take to protect your health:

### Prepare for fire season if you live in a fire-prone area

If you have heart, vascular or lung disease, including asthma, talk with your health

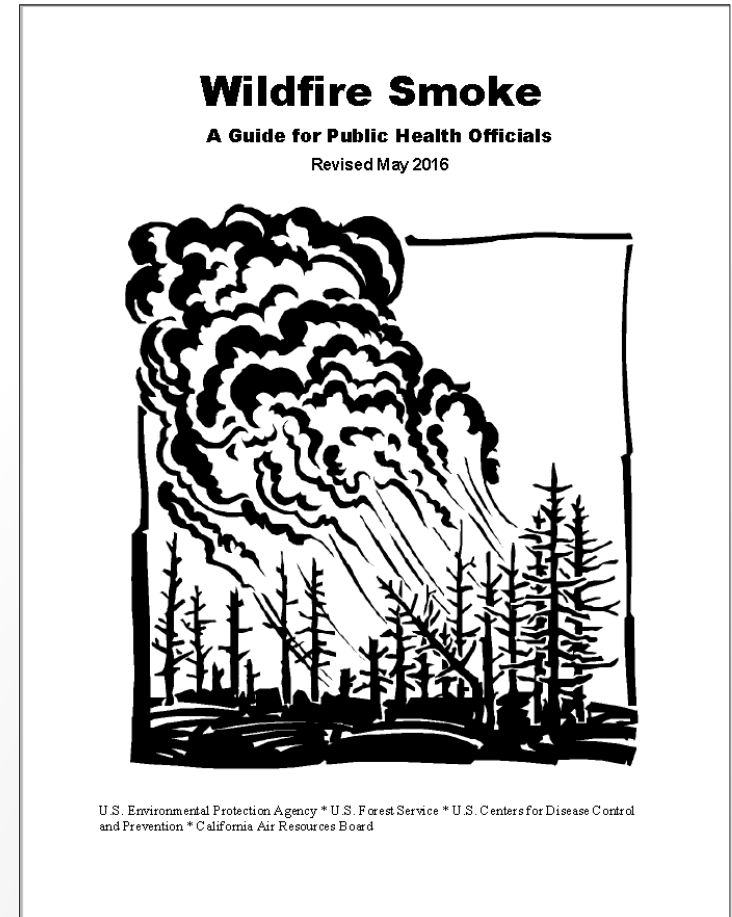


<https://airnow.gov/index.cfm?action=smoke.index>



# Wildfire Guide 2016

- Primarily a federal/California document; housed on AirNow website
- Updated air quality and health information
- 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
- PEHSU fact sheets about children’s health, 2011
- Information about new interagency Wildland Fire Air Quality Response Program



[https://www3.epa.gov/airnow/wildfire\\_may2016.pdf](https://www3.epa.gov/airnow/wildfire_may2016.pdf)

# Wildfire Guide 2017

- Updated look
- Addition of ozone
- Smoke vs urban particles
- Add sections
  - PM web course
  - Sensors
  - Ash clean-up
- Stand-alone fact sheets
  - Children
  - Older adults
  - Pets/livestock
  - Preseason preparedness
  - Exposure reduction
  - Respirator use
  - Ash clean-up
  - Know when to evacuate



## CHAPTER TWO

### Specific strategies to reduce smoke exposure

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Stay indoors.....	18
Reduce activity.....	19
Reduce additional sources.....	19
Air conditioners and filters.....	20
Room air cleaners.....	21
Ozone generators.....	23
Clean room.....	23
Humidifiers.....	4
Inside vehicles.....	24
Respiratory protection.....	25
Cheal air shelters.....	30
Closures.....	30
Evacuation.....	30
Summary.....	31

"The emissions from wildfire smoke have tremendous public health implications."

EPA's Dr. Wayne Casico  
in National Geographic

# Wildfire Guide 2017 – Example Draft Fact Sheets



## WILDFIRE SMOKE FACTSHEET

### Prepare for Fire Season

If you live in an area that is regularly affected by smoke or where the wildfire risk is high, prepare for fire season. Know how to get ready before a wildfire. Know how to protect your family from smoke exposure during a wildfire.

Being prepared for fire season is especially important for the health of children, older adults, and people with heart or lung disease.

#### Prepare Before a Wildfire

- **Stock up** so you don't have to go out when it's smoky. Have several days of medications on hand. Buy groceries that do not need to be refrigerated or cooked, because cooking can add to indoor air pollution.
- **Create a "clean room"** in your home. Choose a room with as few windows and doors as possible, such as a bedroom. Use a portable air cleaner and avoid indoor sources of pollution.
- **Buy a portable air cleaner** before there is a smoke event. High-efficiency particulate air (HEPA) filter air cleaners, and electrostatic precipitators that do not produce ozone, can help reduce indoor air pollution.
- **Understand** how you will receive alerts and health warnings, including air quality reports and public service announcements, from local officials.
- **If you have heart or lung disease**, check with your doctor about what you should do during smoke events.
- **If you have asthma or other lung disease**, update your respiratory management plan.
- **Have a supply of N95 respirators** if you have them. They are sold at many home improvement stores and online.
- **Organize** your important items ahead of time and know where to go in case you have to evacuate.



## WILDFIRE SMOKE FACTSHEET: Indoor Air Filtration

### Exposure to Particle Pollutants

Indoor sources of particulate matter (PM) come from combustion events such as smoking, candle burning, cooking and wood-burning. During a wildfire event, outdoor PM can increase indoor PM levels well above the levels normally found. As outlined in the Guide, reducing indoor sources of pollution is a major step to lower the concentrations of PM indoors. Further reductions in indoor PM can be achieved using one of the filtration options discussed below.

### Filtration Options

There are two effective options for improving air filtration in the home: upgrading the central system filter, or using high efficiency portable air cleaning appliances. Before discussing filtration options, it is important to understand the basics of filter efficiency.

#### Filter Efficiency

The most common industry standard for filter efficiency is known as the Minimum Efficiency Reporting Value, or MERV rating. The MERV scale for residential filters ranges from 1-20. The higher the MERV rating the greater the percentage of particles captured as the air passes through the filter media. Higher MERV (higher efficiency) filters are especially effective at capturing very small particles that can most affect health.

#### Central Air System Filter

The filter used in the central heating/cooling system of the home can effectively reduce indoor PM. A home typically will have a low MERV (1-4)

fiberglass filter that is a medium efficiency filter. Upgrading to a medium efficiency filter with a medium efficiency pleated filter can significantly improve indoor air quality. Higher efficiency filters (e.g., MERV 11, 12, 13, 14, 15, 16) in the central system can provide as a 95%. However, more resistance to air flow may be experienced. You may wish to consult a technician or the manufacturer's instructions to confirm the system can handle the higher efficiency filter. If you have a more efficient filter, continuously by switching from "Auto" to "On" has been shown to reduce concentrations by as much as 50%.

#### Portable Air Cleaners

Portable air cleaners are appliances that can be used to enhance central filtration. Their effectiveness depends on several factors. The filter unit is turned on and cleaners fitted with high efficiency filters can reduce indoor PM concentrations.

### Portable Air Cleaners: Choose

There is a wide variety of portable air cleaners ranging in price from under \$50 to over \$1,000. The most important factor in choosing a portable air cleaner is the type of filter it uses.

Most air cleaners fall into two categories: mechanical and electrostatic.



## WILDFIRE SMOKE FACTSHEET

### Children

#### Background

- **Wildfires** expose children to fire, smoke, the byproducts of burning, and other chemicals released from burning structures and furnishings in addition to the psychological stress associated with these events.
- **During the acute phase** of wildfire activity, the major problems are fire and smoke. Smoke can travel many miles downwind from a burning fire.
- **Children**, individuals with pre-existing lung or cardiovascular diseases (e.g., asthma) are especially vulnerable during wildfires.
- **Children are in a critical period of development** when toxic exposures can have profound negative effects, and their exploratory behavior often places them in direct contact with materials that adults would avoid.

#### Health Effects from Smoke

- **Wildfire smoke** has very small particles, liquid droplets, and gases such as carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>) and other volatile organic compounds (VOCs).
- **Symptoms** from smoke inhalation can include chest tightness, shortness of breath, wheezing, coughing, respiratory tract and eye irritation and burning, chest pain, dizziness, or lightheadedness and other symptoms.
- **Children with allergies and asthma** may have more symptoms than usual.
- **The risk of developing cancer** from short-term exposures to smoke is vanishingly small.

#### Recommendations Planning Ahead

- **Stock up** so you don't have to go out when it's smoky. Have several days of medications on hand.
- **Buy groceries** that do not need to be refrigerated or cooked, because cooking can add to indoor air pollution.
- **Create a "clean room"** in your home. Choose a room with as few windows and doors as possible. Use a portable air cleaner and avoid indoor sources of pollution.
- **Buy a portable air cleaner** before there is a smoke event.
  - High-efficiency particulate air (HEPA) filter air cleaners and electrostatic precipitators that do not produce ozone can help reduce indoor air pollution.
- **Organize** and plan ahead of time and know where to go in case you have to evacuate.

#### During Wildfires – Around Your Home & Car

- **Stay indoors** with the doors and windows closed. If you have an air conditioner, run it with the fresh-air intake closed (recirculate mode) to keep outdoor smoke from getting indoors.
- **Do not add to indoor air pollution.**



Wildfire Factsheets Under Development.

Original PEHSU Wildfire Factsheet available at: <http://www.pehsu.net/cgi/page.cgi/resources.html>



**Health Providers Page**

# Health Tools

Wayne E. Cascio

# Web Course Tour – Health Providers Page

## Particle Pollution and Your Patients' Health



The screenshot shows the EPA website's page for the course "Particle Pollution and Your Patients' Health". The page features the EPA logo at the top left, navigation links for "Environmental Topics", "Laws & Regulations", and "About EPA", and a search bar. The main heading is "Particle Pollution and Your Patients' Health". Below this, there is a dark grey box stating "Helps health care providers advise their patients about particle pollution exposure." and a light blue box stating "This course is designed for family medicine physicians, internists, pediatricians, occupational and rehabilitation physicians, nurse practitioners, nurses, asthma educators, pulmonary specialists, cardiologists, and other medical professionals." with links for "Start the Course" and "Course developers". A central image shows a healthcare provider and a patient looking at a tablet. Below the image, a paragraph describes the course as a short, evidence-based training course for healthcare providers that:

- Describes the biological mechanisms responsible for the cardiovascular and respiratory health effects associated with particle pollution exposure.
- Provides practical education tools to help patients understand how particle pollution exposure can affect their health and how they can use the Air Quality Index to protect their health.

At the bottom, there are links for "Start the Course", "Course developers", and "Contact Us" to ask a question, provide feedback, or report a problem.

Applied for  
continuing  
education credit  
from CDC for  
physicians,  
nurses, and  
health educators

<https://www.epa.gov/pm-and-your-patients-health/patient-education-tools>

# What Is It? Who Is It For?

***Particle Pollution and Your Patients' Health*** is a short, evidence-based training course that:

- Describes the biological mechanisms for cardiovascular and respiratory health effects with particle pollution exposure
- Helps health-care providers advise their patients about particle pollution exposure
- Provides practical education tools to help patients understand how particle pollution exposure can affect their health and how to use Air Quality Index to protect health

***Particle Pollution and Your Patients' Health*** is designed for:

- Diverse range of physicians
- Nurses and nurse practitioners
- Asthma educators
- Other medical professionals who counsel patients about lung, heart or vascular disease

# What is Particle Pollution?

## Particle Pollution and Your Patients' Health

[Contact Us](#) [Share](#)

[Course Home](#)

[About this course](#)

**[What is Particle Pollution?](#)**

[Particle Pollution Exposure](#)

[Cardiovascular Effects](#)

[Respiratory Effects](#)

[Patient Exposure and the Air Quality Index](#)

[Patient Exposure and High Particle Pollution Events](#)

[Clinical Scenarios](#)

[Frequent Questions](#)

[Course Outline/Key Points](#)

[Review Questions](#)

[Patient Education Tools](#)

[Course Evaluation](#)

[References](#)

[Glossary](#)

## What is Particle Pollution?

On this page:

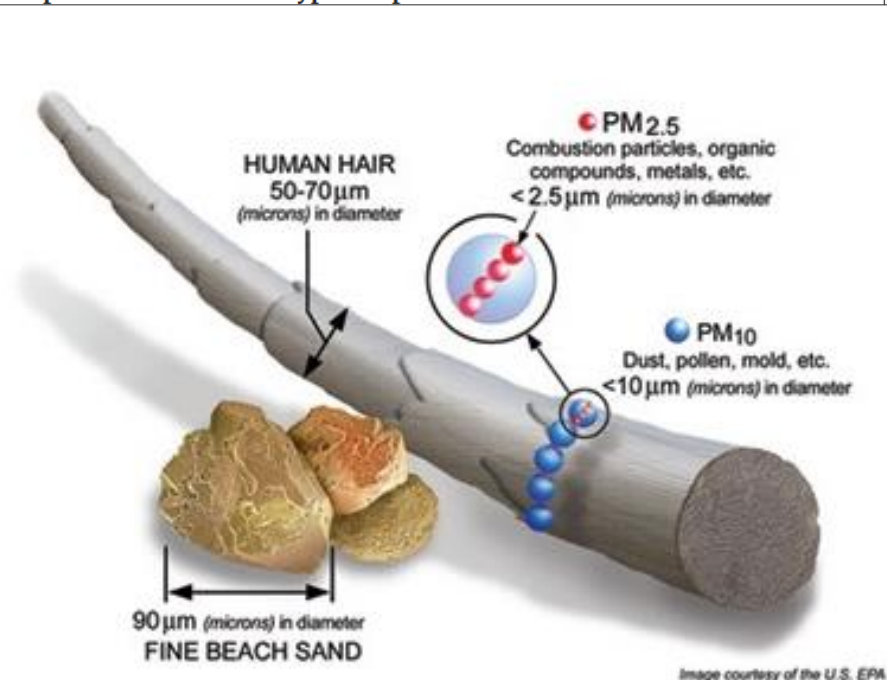
- [What is particle pollution and what types of particles are a health concern?](#)
- [Where does particle pollution come from?](#)
- [Where and when is particle pollution a problem?](#)

### What is particle pollution and what types of particles are a health concern?

Particle pollution and liquid droplets can be made up of a variety of compounds (such as chemicals, soot, or spores).

The air we breathe contains dust, dirt, soot, and other particles that they can only be seen with a microscope.

Your patients who are concerned about the effects of particle pollution are concerned about the effects of particle pollution because these particles are so small that they can pass through the lungs and might enter the bloodstream. Once inhaled, the particles can cause health problems.



<https://airnow.gov/index.cfm?action=aqibasics.particle>

# Cardiovascular Effects

## Particle Pollution and Your Patients' Health

Contact Us Share

Course Home

About this course

What is Particle Pollution?

Particle Pollution Exposure

**Cardiovascular Effects**

Respiratory Effects

Patient Exposure and the Air Quality Index

Patient Exposure and High Particle Pollution Events

Clinical Scenarios

Frequent Questions

Course Outline/Key Points

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References

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## Cardiovascular Effects

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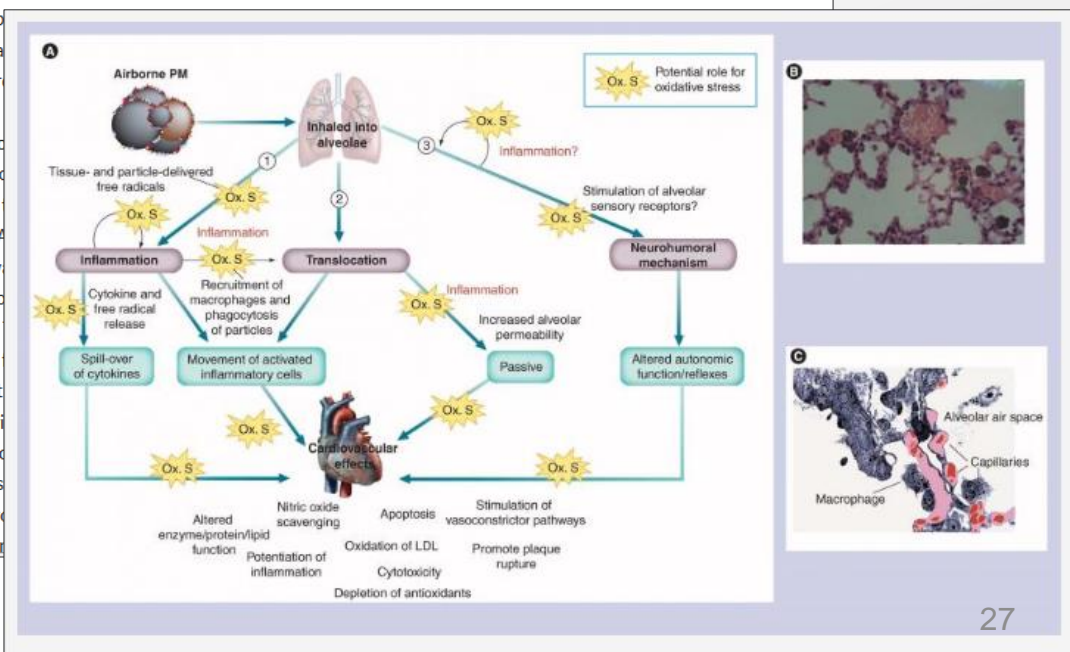
- [Why is particle pollution a cardiovascular health concern?](#)
- [How does particle pollution affect the cardiovascular system?](#)
- [What are the cardiovascular effects?](#)
- [What are the acute exposure effects?](#)
- [What are the chronic exposure effects?](#)

### Why is particle pollution a cardiovascular health concern?

Cardiovascular disease accounts for the greatest number of deaths in the United States. One in three

Americans has heart or blood vessel disease. In every three deaths is a cardiovascular disease represent 17 per

Traditional risk factors for cardiovascular disease, such as high blood pressure, high cholesterol, and smoking, act independently or in combination to increase the risk of cardiovascular disease. The development of, and the adverse effects on cardiovascular health, of cardiovascular disease by particle pollution over a long-term period (Newby DE, et al., 2014). Particle pollution increases the risk of nonfatal events and that particle pollution increases the risk of fatal events (al., 2010). While the risk of cardiovascular disease from many other well-established risk factors, such as acute cor



# Respiratory Effects

## Particle Pollution and Your Patients' Health

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[About this course](#)

[What is Particle Pollution?](#)

[Particle Pollution Exposure](#)

[Cardiovascular Effects](#)

**[Respiratory Effects](#)**

[Patient Exposure and the Air Quality Index](#)

[Patient Exposure and High Particle Pollution Events](#)

[Clinical Scenarios](#)

[Frequent Questions](#)

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[Course Evaluation](#)

[References](#)

[Glossary](#)

## Respiratory Effects

On this page:

- [Why is particle pollution a respiratory health concern?](#)
- [How does particle pollution affect the respiratory system?](#)
- [What are the respiratory effects of acute exposure?](#)
- [What are the respiratory effects of chronic exposure?](#)
- [How does particle pollution affect people with asthma?](#)
- [What are the health disparities for asthma?](#)
- [How does particle pollution affect people with COPD?](#)
- [What is the role of fine particles in lung cancer incidence and mortality?](#)

### Why is particle pollution a respiratory health concern?

Studies have linked particle pollution exposure to a variety of respiratory health effects, including:

- Respiratory symptoms including cough, phlegm, and wheeze
- Acute, reversible decrement in pulmonary function
- Inflammation of the airways and lung (this is acute and neutrophilic)
- Bronchial hyperreactivity
- Acute phase reaction
- Respiratory infections
- Respiratory emergency department visits
- Respiratory hospitalizations
- Decreased lung function growth in children

[https://airnow.gov/index.cfm?action=health\\_providers.index](https://airnow.gov/index.cfm?action=health_providers.index)

<https://airnow.gov/index.cfm?action=aqibasics.particle>



# Patient Exposure and the AQI

## Particle Pollution and Your Patients' Health

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What is Particle Pollution?

Particle Pollution Exposure

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## Patient Exposure and the Air Quality Index

On this page:

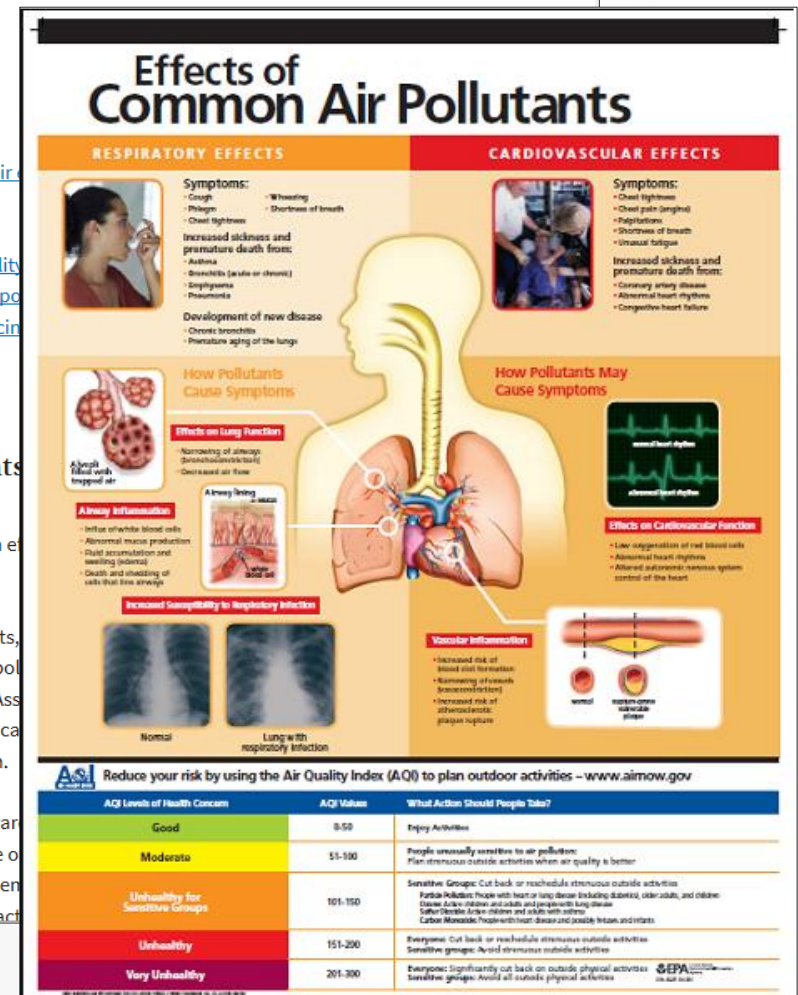
- [Should I recommend that my patients reduce their exposure to particle pollution?](#)
- [What is the Air Quality Index \(AQI\)?](#)
- [Where can I find daily air quality reports?](#)
- [What can I advise my patients to do when air quality is poor?](#)
- [How can my patients reduce particle pollution exposure?](#)
- [How effective are air quality notifications in reducing exposure?](#)
- [What education materials are available?](#)

### Should I recommend that my patients reduce their exposure to particle pollution?

Yes. All people should be educated about the health effects of particle pollution and how to reduce exposure.

Your patients with heart or lung diseases, older adults, and those with lower SES are more likely to be affected by particle pollution. The American Heart Association (Brook et al., 2010), concluded that all patients with cardiovascular disease should be advised about the cardiovascular risks posed by air pollution.

In your patient education, you should encourage awareness of weather broadcasts, on websites, or through the use of mobile apps ([airnow.gov](#) has forecasts as well as links to the environmental health recommendations for reducing exposure by basing activities on the AQI).





# High Particle Pollution Events

## Particle Pollution and Your Patients' Health

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## Patient Exposure and High Particle Pollution Events

On this page:

- [Introduction](#)
- [What steps can I advise for my patients who live in areas where wildfires are likely to occur?](#)
- [How can my patients use respirators to protect themselves from wildfire smoke?](#)

### Introduction

Ozone and the other common pollutants rarely reach very high levels in the U.S. But almost every year, in many parts of the country, particle pollution levels reach the very unhealthy or hazardous ranges of the AQI. These events are usually associated with fires or dust storms. The fires are often wildfires, but on a smaller spatial and temporal scale high particle pollution levels may be found near other types of fires or combustion. Examples of these high particle events can include residential wood burning in valleys during winter, for reducing exposure to particle pollution. If particles are wildfires, other fires, transportation, and other sources are needed with some fires depending on the location.

Portions of the text in the following sections are from the [Guidance for Public Health Officials \(May 2016\)](#), for smoke events, to take measures to reduce exposure with the public about wildfire smoke and the assistance and expertise of a number of agencies, including the U.S. Environmental Protection Agency, National Institute of Environmental Health Protection Agency, Lawrence Berkeley National Laboratory, and the California Health Specialty Units, and the California Department of Public Health.

Consistent with Wildfire Smoke:  
Guide for Public Health Officials



Photo Courtesy of California Department of Public Health

# Clinical Scenarios

## **Balanced, evidence-based responses to these scenarios:**

- Man (75 yr) with a history of hypertension, hyperlipidemia, diabetes, & atherosclerotic coronary artery disease has shortness of breath and chest pain when walking
- Woman (68 yr) with heart failure appears to be volume overloaded with increased central pressures
- Man (57 yr) with a five-year history of coronary artery disease, received a shock from his ICD for sustained and rapid ventricular tachycardia
- Elderly gentleman, complains of frequent cough with phlegm, which he has developed in the recent months
- Boy (6<sup>th</sup> grade) with asthma, has wheeze
- Woman (35yr), non-smoker who has seasonal allergy symptoms (rhinitis, conjunctivitis) that she cannot control with the over-the-counter medication

# Ozone Web Course for Health Professionals

## Ozone Pollution and Your Patients' Health

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[Health Effects in the General Population](#)

[Health Effects in Patients with Asthma](#)

[Patient Exposure and the Air Quality Index](#)

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## Ozone and Your Patients' Health: About this Course

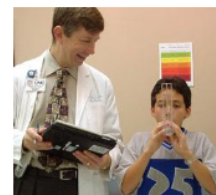
Ozone and Your Patients' Health is designed for family practice doctors, pediatricians, nurse practitioners, asthma educators, and other medical professionals who counsel patients about asthma, air pollution, or exercise. Patients and their families may also use this material to learn the science behind ozone's effect on respiration and how to manage their respiratory health using the Air Quality Index.

## Course Objectives

Upon completion of this course, you will be able to:

- Describe how ozone is formed and where it is found
- Identify the effects that exposure to ozone has on the general population
- List the different effects of ozone at varying exposure concentrations and durations
- Identify the effects that ozone has on asthma patients
- Explain the purpose and use of the Air Quality Index
- Identify common sources of information about the Air Quality Index
- Address typical patient questions and clinical scenarios relating to ozone exposure

### Clinical Scenarios





The [Clinical Scenarios](#) section of this

Does not offer CME at this time

<https://www.epa.gov/ozone-pollution-and-your-patients-health/ozone-and-your-patients-health-about-course>

# Downloadable Factsheets

## Asthma



### ASTHMA AND OUTDOOR AIR POLLUTION

**1 Air pollution can make asthma symptoms worse and trigger attacks.**

If you or your child has asthma, have you ever noticed symptoms get worse when the air is polluted? Air pollution can make it harder to breathe. It can also cause other symptoms, like coughing, wheezing, chest discomfort, and a burning feeling in the lungs.

Two key air pollutants can affect asthma. One is *ozone* (found in smog). The other is *particle pollution* (found in haze, smoke, and dust). When ozone and particle pollution are in the air, adults and children with asthma are more likely to have symptoms.

**2 You can take steps to help protect your health from air pollution.**

► **Get to know how sensitive you are to air pollution.**




- Notice your asthma symptoms when you are physically active. Do they happen more often when the air is more polluted? If so, you may be sensitive to air pollution.

► **Know when and where air pollution may be bad.**

- Ozone is often worst on hot summer days, especially in the afternoons and early evenings.
- Particle pollution can be bad any time of year, even in winter. It can be especially bad when the weather is calm, allowing air pollution to build up. Particle levels can also be high:
  - Near busy roads, during rush hour, and around factories.
  - When there is smoke in the air from wood stoves, fireplaces, or burning vegetation.

► Also notice any asthma symptoms that begin up to a day *after* you have been outdoors in polluted air. Air pollution can make you more sensitive to asthma triggers, like mold and dust mites. If you are more sensitive than usual to indoor asthma triggers, it could be due to air pollution outdoors.

## Cardiovascular Disease – February 2016



### Enfermedades del corazón, ataques cerebrales y contaminación del aire

**1 ¿Sabía que la contaminación del aire puede provocar ataques al corazón, ataques cerebrales y otros problemas de salud?**

Según estudios médicos, la contaminación del aire puede provocar ataques al corazón, ataques (derrames) cerebrales y arritmia, sobre todo en personas que están en situación de riesgo de padecer estas afecciones. Además, en las personas con una afección llamada insuficiencia cardíaca, la contaminación del aire puede reducir aún más la capacidad del corazón de bombear la sangre de la forma que necesita hacerlo. Las partículas muy pequeñas son los contaminantes más preocupantes que provocan estos efectos. La contaminación por partículas se encuentra en la neblina, el humo y el polvo, y a veces en el aire que parece limpio. Esta hoja informativa le explica cómo puede:

- Conseguir información actualizada sobre la calidad local del aire
- Proteger su salud cuando la contaminación por partículas se encuentra en niveles insalubres

**2 ¿Tiene usted un riesgo más elevado?**

Los adultos mayores y las personas con factores de riesgo de padecer enfermedades del corazón o un ataque cerebral pueden tener un riesgo más elevado. Tiene un riesgo mayor si:

- Ha sufrido un ataque al corazón, angina de pecho, bypass coronario (derivación vascular), angioplastia con o sin estent, obstrucciones en las arterias del cuello o de las piernas, insuficiencia cardíaca, arritmia, diabetes o enfermedad pulmonar obstructiva crónica.

Puede tener mayor riesgo de padecer enfermedades del corazón o ataques cerebrales (y, por lo tanto, ser más susceptible a la contaminación por partículas) si le corresponden cualquiera de estas condiciones:

- Es hombre de 45 años o más, o mujer de 55 años o más.
- En su historial familiar existen ataques cerebrales o enfermedades del corazón tempranas (en padre o hermano antes de cumplir 55 años; en madre o hermana antes de cumplir 65 años).

**3 ¿Cómo puede proteger su salud?**


Hacer ejercicio con regularidad es importante para tener buena salud, sobre todo si padece de enfermedades del corazón. Ajustar cuándo y dónde hace ejercicio le permitirá llevar un estilo de vida más saludable y reducir su riesgo de padecer problemas del corazón o ataques cerebrales provocados por la contaminación del aire. Además:

- Si padece de enfermedades del corazón o ha sufrido un ataque cerebral, consulte con su proveedor de atención médica sobre las mejores formas de proteger su salud cuando la calidad del aire es insalubre.
- Hable con su proveedor de atención médica si corre el riesgo de padecer de enfermedades del corazón o un ataque cerebral y planea hacer más ejercicio físico del habitual.

► **Sepa dónde y cuándo los niveles de contaminación por partículas pueden ser insalubres.**

Los niveles de contaminación por partículas pueden ser elevados en cualquier época de año. También pueden ser elevados:

- Cerca de vías muy transitadas, en zonas urbanas (sobre todo en horas pico) y en zonas industriales.
- Cuando hay humo en el aire proveniente de cocinas de leña, chimeneas, quema de vegetación o incendios forestales.



[www3.epa.gov/airnow/asthma-flyer.pdf](http://www3.epa.gov/airnow/asthma-flyer.pdf) (English)  
[www3.epa.gov/airnow/health-prof/EPA-poster-Spanish-2008.pdf](http://www3.epa.gov/airnow/health-prof/EPA-poster-Spanish-2008.pdf) (Spanish)

[www3.epa.gov/airnow/heartflyer.pdf](http://www3.epa.gov/airnow/heartflyer.pdf) (English)  
[www3.epa.gov/airnow/heartflyer-sp.pdf](http://www3.epa.gov/airnow/heartflyer-sp.pdf) (Spanish)

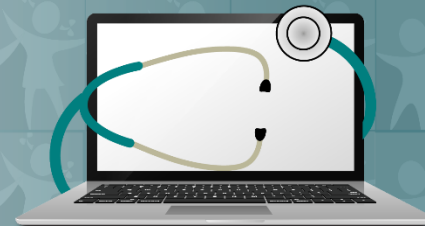
# Key Resources

- [AirNow](#)
  - [Air Quality Flag Program](#)
  - [Current Conditions](#)
  - [Health Providers Page](#)
  - [Wildfire Smoke and Health](#)
  - [Wildfire Smoke: Guide for Public Health Officials](#)
  - [Wildfire Trends](#)
- [California Air Resources Board Resources](#)
- [CDC Wildfire Factsheets](#)
- [PEHSU Wildfire Fact Sheet](#)
- [Wildland Fire Air Quality Response Program](#)



# PEHSU NATIONAL CLASSROOM

Pediatric Environmental  
Health Specialty Units



[www.pehsu.net/nationalclassroom.html](http://www.pehsu.net/nationalclassroom.html)



## Webinars

Series of scientific webinars that provide a forum for discourse on scientific issues.

Live and On-Demand

Case Conferences  
Journal Clubs  
Grand Rounds

CE Available



## Online Courses

Evidence-based online courses on a variety of children's environmental health topics.

Interactive and Self-Paced

CE Available



## Resource Catalog

Fact sheets, journal publications, reports, and other resources for parents, community members, patients and healthcare professionals

Topics included:  
Air Quality, Pesticides,  
Natural Disasters, BPA,  
Mold, Lead, Mercury