

Wildfire Smoke and Respiratory Symptoms in Children

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Air Resources Board

California Environmental Protection Agency

Good morning Chairman Nichols, and members of the Board. As we all know, one of the perils of living in California is the wildfire season, which affects air quality in addition to other more direct effects. There have been several published studies of the health impacts of specific wildfires, but the results have not been consistent. The impacts of any fire are unique to that event, and are influenced not only by the magnitude, intensity, and duration of the fire, but also by the extent to which the smoke plume moves across a populated area.

Background

- October 2003
S. California wildfires
 - Six counties
- Burned
 - 750,000 acres
 - 3,640 homes
 - 33 commercial properties
 - 1,141 other structures
- Smoke impacted six Children's Health Study sites



Kunzli N, et al. Health Effects of the 2003 Southern California Wildfires on Children. Am J Respir Crit Care Med. 174: 1221-1228, 2006. (Funded by: SCAQMD, NIEHS, Hastings Foundation, ARB).

In October 2003 a group of wildfires broke out in Southern California, which burned portions of six counties. The time of peak fire activity varied by location, but encompassed the period between October 20 and November 2. Listed on this slide are highlights of what these fires destroyed. The fires impacted 6 Children's Health Study sites directly and 6 others indirectly, offering a unique opportunity to conduct a population-based, large-scale investigation of the consequences of wildfire smoke exposure on respiratory health in children. For comparison, the 2007 fires burned about 2/3 the acreage and about 1/2 the number of homes as the 2003 fires.

The paper we are presenting this morning is by Kunzli et al., and is entitled "Health effects of the 2003 Southern California wildfires on children". It appeared in the American Journal of Respiratory and Critical Care Medicine in 2006 .

The objective of the study was to assess the acute effects of wildfire smoke exposure on participants in the Children's Health Study, which was started with ARB funding.

Methods

- Population
 - 873 high school seniors
 - 5,551 first graders
- Exposure characterization
 - Number of days smelled smoke indoors
 - PM10 on 5 highest fire days
- Health measures
 - Respiratory symptoms or illness
 - Eye irritation
 - Asthma exacerbation

The study population included 873 high school seniors and 5551 first graders.

Smoke exposure was estimated in two ways: First, by self-reports of the number of days the child smelled smoke when indoors during the fire period, and second, by the average PM10 concentration over the five days of highest fire activity. PM10 concentration proved to be the strongest marker of smoke exposure. Selection of the five-day average PM10 exposure period was based on observations that the highest PM10 concentration periods during the fires typically lasted for about five days.

The children filled out questionnaires on respiratory symptoms or illness, eye irritation, and asthma attacks experienced, along with medication usage, during the fire period.

Results

- PM10: ~3 to 8 times historical average
- Risk of symptoms increased
 - 60 to 500% with >6 smoky days
 - 30 to 250% with 1-5 smoky days
 - 30 to 300% between high vs. low PM10 communities
 - For non-asthmatics compared to asthmatics
- Asthmatics
 - Had higher baseline symptoms rate
 - Were more likely to take preventive action
- Preventive actions reduced risk of symptoms

The five-day average PM10 concentrations ranged from 104 to 252 $\mu\text{g}/\text{m}^3$ in the affected communities, which was about 3 to 8 times the long-term averages for these regions.

Risk of experiencing symptoms was related to length of exposure. This risk increased 60 to 500% with >6 smoky days, in contrast to 30 to 250% with 1-5 smoky days. Comparisons between communities showed that risk of experiencing symptoms was increased 30 to 300% in communities with the highest compared to the lowest PM10 levels, across the symptoms studied. Unexpectedly, the risk of symptoms was higher for non-asthmatics than for asthmatics, although asthmatics had a higher baseline symptoms rate, and smoke-related symptoms were added onto disease-related symptoms. In addition, the relationship between smoke exposure and asthma attacks was not statistically significant. The results also showed that asthmatics were more likely to take preventive action than non-asthmatics. This is the first study to show that preventive actions reduced the risk of smoke-related symptoms.

Implications

- Public health advisories can be based on PM10 level
 - Air Quality Index
- Preventive actions provide some benefit for asthmatics
 - Stay indoors
 - Wear masks when outdoors
 - Use air conditioner
- ARB Emergency Response Team

Air Quality Index	
0 to 50	Good
51 to 100	Moderate
101 to 150	Unhealthy for Sensitive Groups
151 to 200	Unhealthy
201 to 300	Vary Unhealthy
301 to 500	Hazardous

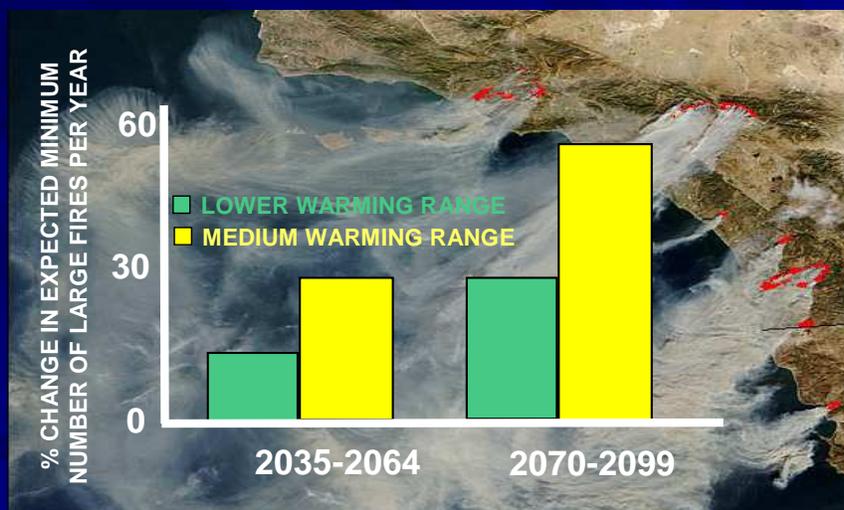


ARB is often asked about how to advise the public during wildfire events. The results of this paper suggest that public health advisories based on PM10 using the Air Quality Index would be useful for expressing the level of risk fire smoke poses to the public.

Further, preventive actions, including remaining indoors, wearing masks when outdoors, and using air conditioning, have been shown to provide some protection.

In addition, ARB has a major statewide role in air quality emergencies, including wildfires. The Emergency Response Team coordinates with local or unified incident commands to provide air monitoring, meteorological and related support services in times of substantial air emission releases that might impair public health, such as large wildfires. These efforts are coordinated with Cal/EPA, its boards, departments, and offices, the State Office of Emergency Services, and the US Environmental Protection Agency. Much of this work is carried out using the Rapid Response Trailer, pictured on the slide. Another useful resource, available on the ARB website, is a multi-agency report entitled “Wildfire smoke: a guide for public health officials”, that was designed to give guidance to local health officers faced with communicating wildfire risks to the public.

Climate Change and Increase in Wildfires



Source of data : Westerling and Bryant, "Climate change and wildfire in and around California: Fire modeling and loss modeling." 2006. www.climatechange.ca.gov

One concern looking forward is the influence of future climate change and warmer temperatures on wildfire frequency. Analyses performed for the Governor's Climate Change Initiative suggest that as temperature rises there will be an increase in the frequency of wildfires, as shown on this slide. This means that fire smoke contributions to air pollution will become greater, and that related public health concerns will become more important. Consequently, advice on effectively communicating wildfire risk to the public is likely to become a larger issue than currently.

Thank you for your attention. Staff will be happy to respond to any questions you may have.