

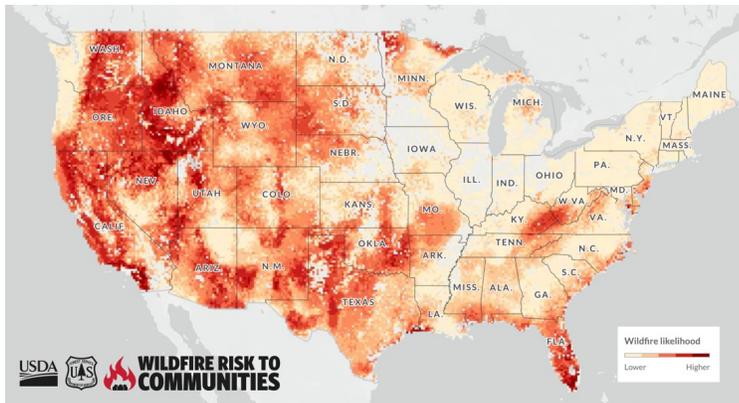


Wildfires and Health Providers

Wildfires and Climate Change

Wildfires have many effects on health, especially for individuals with certain chronic medical conditions, such as heart disease, chronic respiratory diseases (e.g., COPD and asthma), and neurodegenerative diseases (e.g., Alzheimer’s and Parkinson’s). Historically, wildfires and wildfire smoke were contained to certain western states. However, due to climate change, many more regions of the country are increasingly at risk.

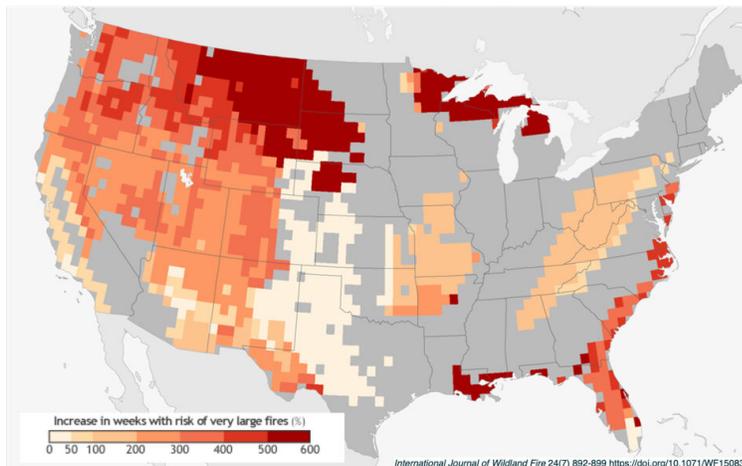
The map below shows where wildfires are likely to occur in the U.S. based upon where they have occurred over the past few decades.



Climate change has warmed temperatures, lengthened the fire season, and wildfire frequency and severity have increased every decade since the 1970s. Wildfire smoke has far-reaching impacts, affecting people who are far away from the fires themselves. Between 2008 and 2012, nearly 30% of the United States population lived in areas with moderate exposure to wildfire smoke.

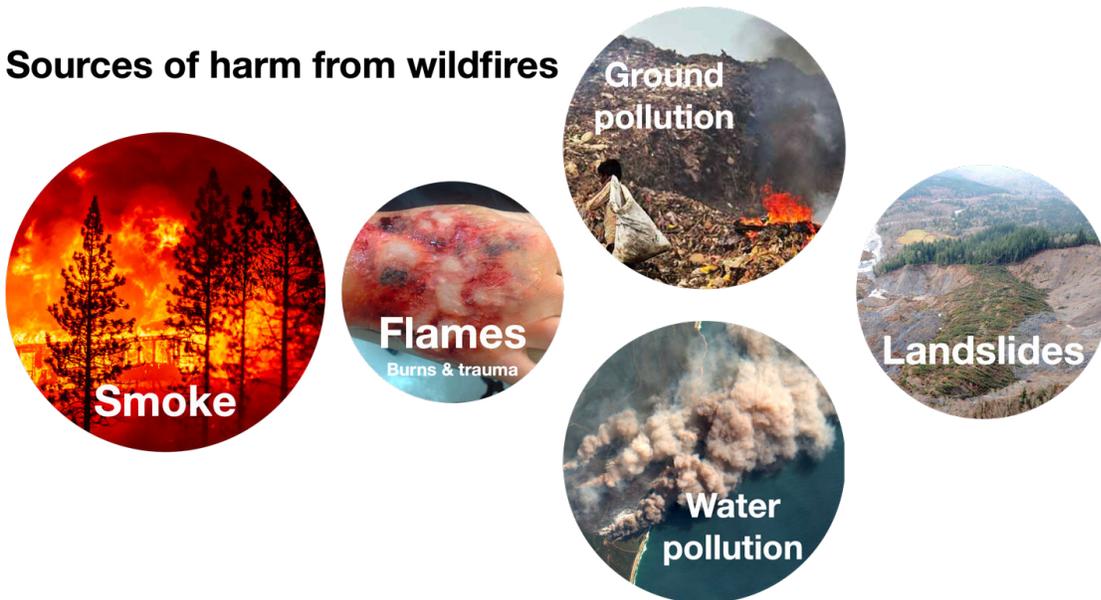
The map to the right shows that, by mid-century, climate change is expected to increase the chances that a very large fire occurs in places such as Montana, the upper Midwest, and parts of the southern U.S.

Percent increase in number of weeks with risk of very large fires (top 10%) in 2041-2070 compared to 1971-2020



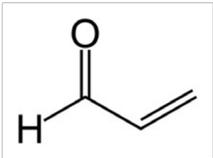
Wildfire Exposure Risks

Sources of harm from wildfires



Wildfire smoke

Smoke is the most pervasive risk from wildfires. Wildfire smoke contains many harmful substances. In the United States, wildfire-PM_{2.5} causes an estimated 6,300 deaths and between 1,300 and 5,900 ED visits per year. Because of increased population density, wildfire-PM_{2.5} causes a higher number of deaths in the eastern United States. Wildfire-related hazardous air pollutants, such as acrolein and formaldehyde, are estimated to cause 309 disability-adjusted life years annually.¹

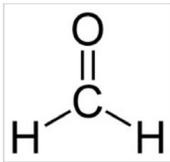


acrolein

Lung irritant

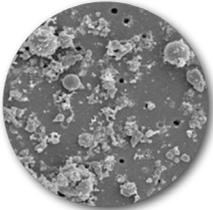
Wildfire source PM may be more toxic than PM in general

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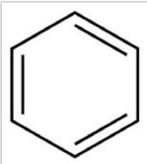


formaldehyde

Lung irritant
Carcinogen (long term exposure)



PM_{2.5}



benzene/PAHs

Leukemia & lymphoma
Anxiety, depression
ADHD

NOx

oxides of nitrogen

Asthma (causal)
Respiratory infections

Several studies have identified wildfires as a more toxic source of particulate matter than other sources. Wildfire smoke harms everyone's health, but certain individuals may be especially at risk.

Table: Populations at increased risk from wildfire smoke exposure.

Condition/Individual with Greater Sensitivity to Smoke Exposure	Potential Health Effects from Wildfire Smoke Exposure
Asthma, COPD, and other chronic respiratory diseases	Respiratory symptoms including breathing difficulties (e.g., coughing, wheezing, and chest tightness). Greater medication usage, emergency department visits, and hospital admissions. ⁵⁻⁷
Cardiovascular disease (CVD)	Ischemic events; worsening of heart failure; or arrhythmias. Excess emergency department visits, hospital admissions, and even death from CVD. ^{8,9}
Children	Coughing, wheezing, difficulty breathing, chest tightness, decreased lung function, pneumonia. ¹⁰
Chronic Kidney Disease	Excess same-day mortality for dialysis patients. ¹¹ Decreased renal function and progression to end-stage renal disease. ¹²
Low wealth individuals	Greater smoke exposure as well as lesser access to exposure reducing measures (e.g., air filtration) and healthcare. ¹³
Older adults	Increased vulnerability to smoke effects, and therefore higher rates of healthcare utilization and mortality, due to higher prevalence of chronic medical conditions. ⁵
Outdoor workers	Increased vulnerability to smoke effects due to extended periods of time exposed to high concentrations of wildfire smoke, possibly without adequate protection.
Pregnant women	May increase risk of low birth weight and preterm birth. ^{14,15}

Adapted from <https://www.epa.gov/wildfire-smoke-course/which-populations-experience-greater-risks-adverse-health-effects-resulting>

Racial inequities have been documented in wildfire-PM_{2.5} exposure and health effects. A study of 5 million Medicare enrollees in the western U.S. found that Black American enrollees were more likely to be exposed to high levels of wildfire-PM_{2.5} and had higher rates of hospital admission.^{13,16} These discrepancies may result from variability in health status, occupational exposures, indoor air quality, and access to other protective measures.

Flames

Fires can result in thermal burns, as well as physical trauma from falls, collapsing infrastructure, and auto accidents during evacuation. Real-time maps of fires and smoke plumes can be found at [fire.airnow.gov](https://www.fire.airnow.gov) and [inciweb.nwcg.gov](https://www.inciweb.nwcg.gov).

Ground and Water Pollution

Hazardous chemicals within buildings and homes get mobilized into air, water (including private drinking wells), and soil with fires. They are also spread in wildfire ash, which often covers surfaces in homes, as well as agricultural fields. The composition varies based upon the materials consumed in the fire and may contain heavy metals and toxic chemicals. Older buildings may contain asbestos and lead.

Landslides

Fires that burn vegetation, such as trees and shrubs, on hillsides can destabilize soil and increase landslide risk.

Additional Health Risks from Wildfires

Fires pose additional health risks even after they are extinguished. Individuals returning home after wildfire should be aware of these potentially harmful exposures:

- a. Hot spots can occur when a small area of material remains hot after a fire. Even after fires stop burning, hot spots can flare up without warning. Shoes should have thick soles that are resistant to melting.
- b. Power outages can result in electric medical devices (e.g., ventilators, nebulizers, infusion pumps) and electric water wells becoming inoperable.
- c. Downed power lines can lead to electrocution.
- d. Burned trees and utility poles can become unstable and fall on people and property.
- e. Individuals experiencing power outages may try to heat homes or cook food by burning fuels (e.g., wood or propane) indoors resulting in carbon monoxide exposure.

Wildfire Action Plans for Patients

We recommend that you familiarize yourself with the “Wildfire Action Plan for Patients” provided in the toolkit and review it with any patient at risk of experiencing a wildfire. The document can be provided during care visits for adolescents and adults and can be the basis for a discussion around a wildfire action and evacuation plan, especially for patients particularly vulnerable to wildfire smoke (see Table above). Wildfire planning should be done before fire season in your locale.

Anticipatory Guidance for Patients

Anticipatory guidance for wildfires may contribute to improved health outcomes. These strategies and resources are also covered in the accompanying patient-facing handout titled “Wildfire Tip Sheet for Patients”, which we encourage you to share with at-risk patients. The information below provides additional detail on the strategies to prepare you for patient conversations.

To reduce risks from fire exposure:

1. Create “defensible space” around the home

Defensible space is a buffer between a building and the grass, trees, shrubs, or any wildland area that surround it. This space is needed to slow or stop the spread of wildfire and helps protect buildings and homes from catching fire—either from embers, direct flame contact, or radiant heat. Proper defensible space also provides firefighters a safe area to work to defend the building.

Defensible space can be created by removing flammable material, including shrubs and trees, next to the building to lessen the potential of flames reaching it. Other steps to create defensible space can be found [here](#).

2. Evacuate when ordered to do so

Evacuation may be the best choice when wildfires are encroaching and cutting off roadways that might otherwise serve as evacuation routes.

Local authorities are charged with communicating evacuation orders to community members, but states vary in their rules around mandatory evacuations. California and Colorado law, for instance, prohibit forced evacuations, though failure to comply with an evacuation order can result in fines. If there are fires in your area, encourage patients to pay attention to local media outlets for evacuation orders (i.e., through newscasts, social media, or automated alerts on a smart phone).

Responsiveness to evacuation alerts has been found to vary by age, gender, and other factors. Men and full-time residents may be more likely to want to stay and protect their property, whereas homes with children, elderly individuals, pregnant women, individuals with health concerns, or part-time residents are more likely to evacuate early.¹⁷

Wildfires can spread quickly, and seemingly manageable conditions can deteriorate. See the evacuation planning section of “Wildfire Action Plan for Patients” for patient resources.

To reduce risks from smoke exposure:

1. Track air quality

Current fire related air quality conditions for U.S. locations can be found at fire.airnow.gov, and forecasts for future air quality conditions can be found at airnow.gov. Most phone weather apps also include air quality information.

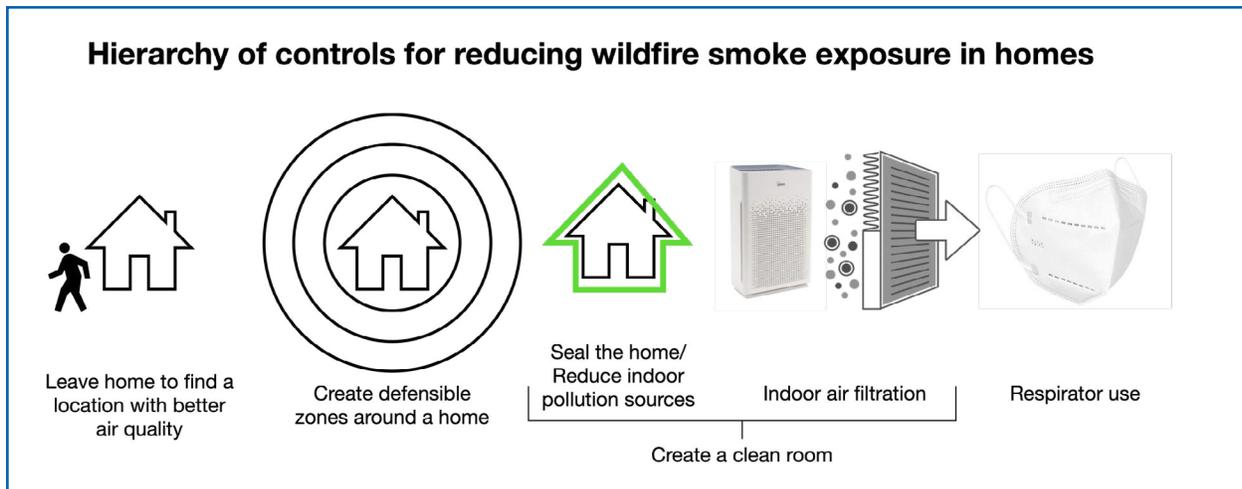
These sites and apps report the air quality index (AQI). The AQI is an integrated assessment of air quality based upon five pollutants (particulate matter (PM), ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide). The higher the number, the worse the air quality.

See the table below for more information on understanding AQI thresholds and alerts. To learn more about how the AQI is computed, see [here](#).

Alert Color	Level of Concern	Value of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. Most people are unlikely to be affected.
Red	Unhealthy	151 to 200	Some people may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: Everyone is likely to be affected.

2. Manage indoor air quality

To reduce exposure to air pollution indoors, several measures can be taken, including reducing introduction of outdoor air to the inside of the building, reducing indoor air pollution sources, and using air filters.



The hierarchy of controls framework above represents a series of actions that can reduce exposure to polluted air, including wildfire smoke. Some of these, such as creating a defensible zone, have previously been mentioned. Additional actions include:

A. Seal the home

Preventing polluted air from entering a home can reduce indoor exposure. Closing windows and doors should only occur when the AQI is elevated (over 50), as typical indoor air can be more polluted than outdoor air.

For an AQI 50 - 150, decisions to close windows and doors should be made based upon an individual's health status, ability to comply with closing windows, and availability and adequacy of indoor air filtration.

For an AQI > 150, windows and doors should be closed in all homes.

As the AQI can change quickly, especially with rapidly changing fires or wind directions, decisions about trying to seal a home from outdoor air should be regularly re-evaluated.

Sealing a room may also require taping duct tape around windows and door frames.

B. Reduce indoor air pollution sources

Indoor sources of air pollution should be minimized, especially for sensitive groups. Common sources of indoor air pollution include smoking, wood fires, candles, incense, and cleaning products.

Cooking can also release air pollutants, especially cooking with a gas range. Natural gas stoves, especially older ones, have been found to release many air toxins, including carbon monoxide, and oxides of nitrogen (which can cause flares of asthma and COPD).

Exhaust hoods for stoves should be used if available. If they are not present or not vented outdoors (many hoods recirculate air back indoors), cooking on a range should be avoided. Ovens can also generate smoke that is released into a home

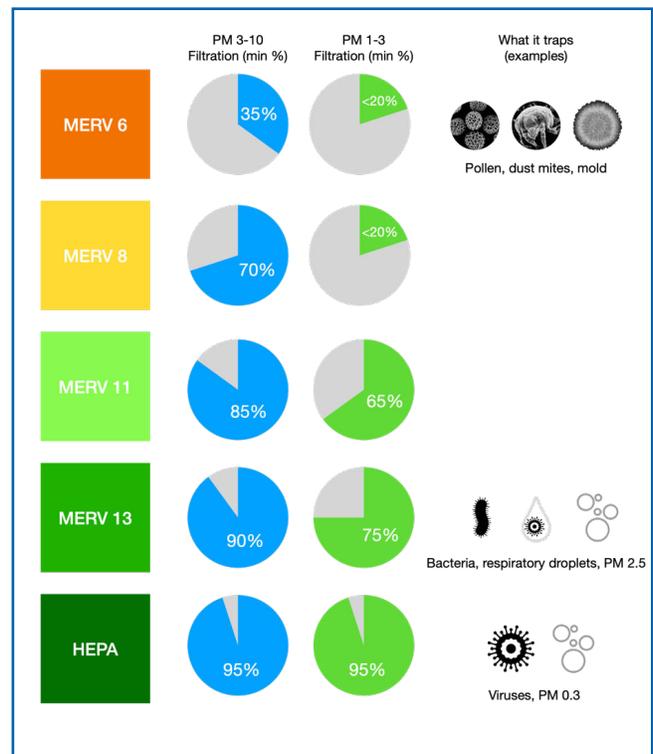


C. Manage indoor air filtration

Homes with forced air heating and cooling typically have replaceable air filters in their air handlers. These filters are given a MERV (minimum efficiency reporting value) rating. The higher the rating, the better the filters work.

Only MERV 13 and higher, or a high efficiency particulate air (HEPA) filter, will substantially remove PM_{2.5} (as well as bacteria and viruses attached to respiratory droplets). HEPA filters will remove a higher fraction of pollution and smaller particles. Few residential ventilation systems can accommodate a HEPA filter.

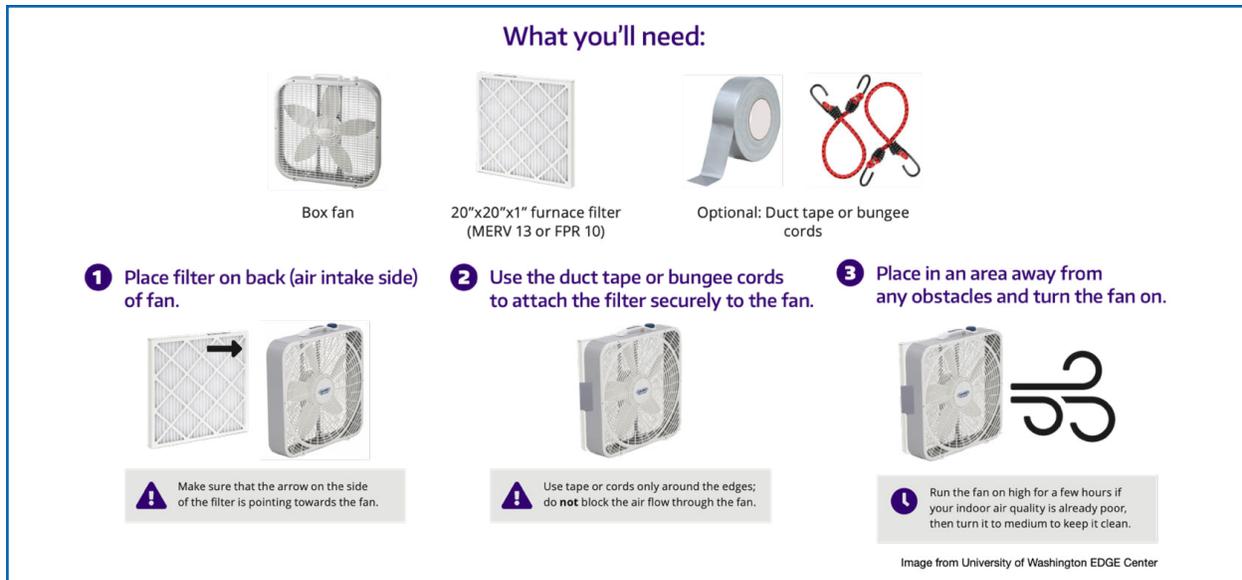
Portable air filters, however, which are designed for use in individual rooms, may have HEPA filters. How well these filters reduce air particle concentrations depends on their size, the area to be cleaned, the filter efficiency (i.e., MERV rating), and the fan speed.



Low-cost portable air filters can be made with a box fan, a MERV filter (ideally MERV 13 or higher), and some bungee cords or tape. A simple example of such a do-it-yourself filter can be found below.

D. Create clean rooms

Creating a clean room in a home involves many of the steps above: 1) find a room that can fit all the people living in the home, 2) seal it by closing windows and doors, 3) filter the air using a built-in filter in an HVAC system or a portable air filter. Ideally clean rooms have air conditioning as well.



3. Wear masks (respirators), if appropriate

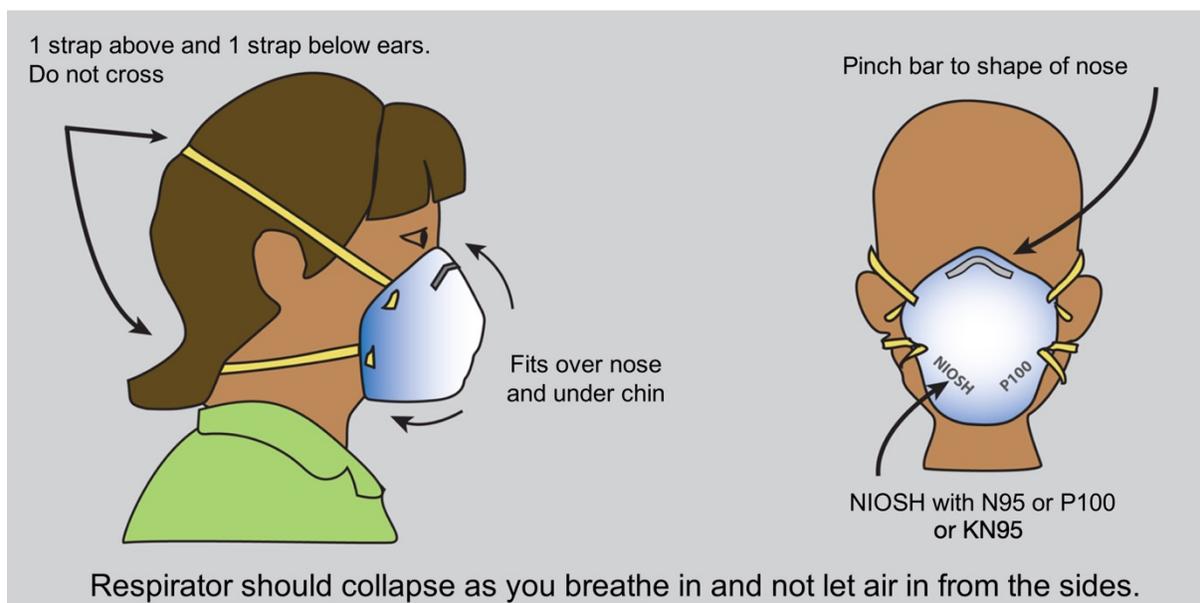
To filter wildfire smoke, masks must be rated as N95, KN95 or P100.

Patients can be instructed on how to properly fit and wear masks (see image below). Masks come in small and regular sizes and, if properly fit, should collapse when a person breathes in.

Children >2 years old can wear an appropriately sized surgical or cloth mask. Children over ~7 years old can wear small or extra small N95/KN95/P100 masks. Adults typically wear "regular" or small size. Children <2 years old should not wear a mask.

Respirators should be disposed of when dirty or when breathing through them becomes difficult.

Masks do not fully remove particulates and do not remove gaseous pollutants (e.g., oxides of nitrogen such as nitrogen dioxide or NO₂). A clean room can provide better protection from wildfire smoke.



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