6.3 Wildfire Smoke Risk Assessment

6.3.1 Wildfire Smoke History

The Oregon Department of Environmental Quality (DEQ) has been monitoring air quality year-round since 1985. Prior to 2015, the AQI ratings in the Portland area had zero days that measured unhealthy for sensitive populations or worse from wildfire smoke. Since then air quality in the County has reached those levels due to smoke from local or regional fires in 2015, 2017, 2018, 2020 and 2022.[81]

- **2022 Nakia Fire**

Figure 79 - Smoke from the Nakia Fire burning in Washington State drifts into Oregon

Fueled by strong winds and unseasonably hot temperatures, a human-caused wildfire in southwest Washington burned 1,918 acres in October 2022. Officials named this the “number-one priority fire in the nation” because of the potential risk to life safety and the resources needed to put it out.[82] Smoke blew into communities across Oregon.

Air quality during the Nakia Fire reached an unhealthy rating in North Portland extending along the I-5 area. Air quality in East Portland registered unhealthy for sensitive groups. As shown in Figure 3, air quality in the Pacific Northwest was among of the worst in the country on October 18th, 2022.

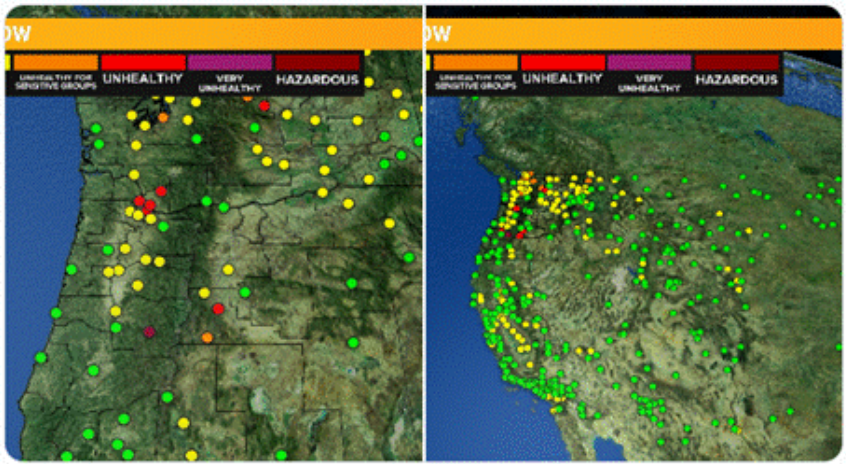

Figure 80 - Maps displaying AQI measurements on October 18, 2022, during the Nakia Fire, reported by KGW8 news.

[81] Wildfire Smoke Trends and the Air Quality Index, Oregon Department of Environmental Quality, 2022.
[82] Nakia Creek Fire (OR) is Now ‘No. 1 Priority Fire in Nation’ as Firefighters Ramp Up Efforts, Wait for Rain, *Wildland Firefighter*, 2022.

- **2020 Labor Day Fires**

In September 2020, a combination of hot and dry conditions ignited multiple wildfires across the region. Due to extremely high winds, wildfires multiplied throughout Oregon and Washington. Multnomah County was spared the flames, but not the toxic smoke.

Figure 81 - Smoke looming over downtown Portland in 2020 during the Labor Day Fires during which Multnomah County experienced the most hazardous air quality in the world

DEQ issued an air quality warning for the Portland Metro area due to wildfire smoke exposure. Hazardous conditions reached an AQI of 509 (Maroon, Hazardous - everyone is more likely to be affected). Portland experienced the most hazardous air quality in the world for a period of time and the worst ever recorded in the area. In Multnomah County the number of people reporting asthma-like symptoms jumped 88% over the average on smoke-free days. People reporting those symptoms accounted for 10% of all emergency department and urgent care visits." [83]

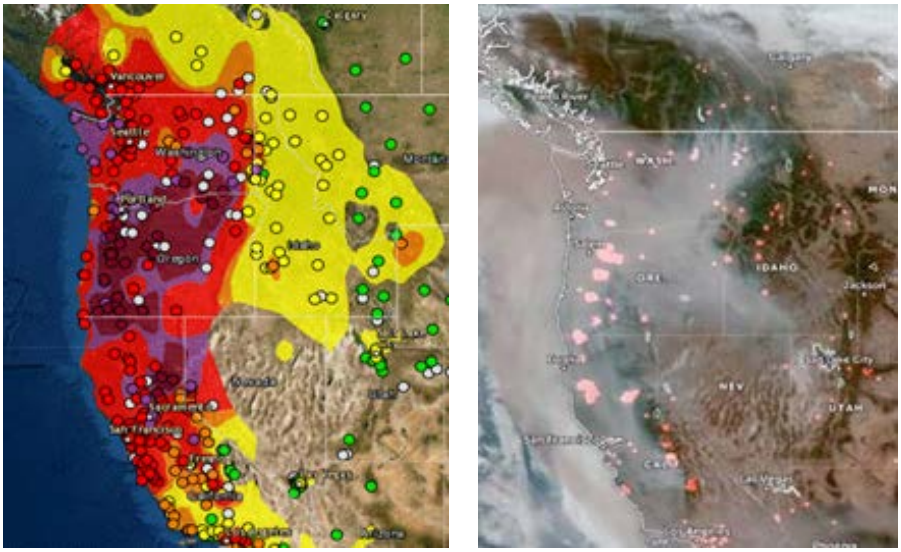

Figure 82 - A satellite image and snapshot from air quality monitors, on September 12, 2020, depict the air quality conditions along the West Coast of the United States

Preliminary data shows exposure to PM2.5 during the 2020 wildfire season was associated with increased risk of COVID-19 cases and deaths. One study published in *Science Advances* analyzed data from 92 counties in California, Washington and Oregon that were affected by the 2020 wildfires. "18 of 19 counties in Oregon reported an increase of COVID cases on days they were subject to wildfire smoke and higher PM2.5 values ."[84]

[83] Hazardous air is causing a jump in emergency department visits in Multnomah County, Multnomah County, 2020
[84] Excess of COVID-19 cases and deaths due to fine particulate matter exposure during the 2020 wildfires in the United States, *Science Advances*, Zhou, X., K. Josey, L. Kamareddine, M.C. Caine, T. Liu, L.J. Mickley, M. Cooper, and F. Dominici. August 13, 2021.

- **2018 Smoke Events**

In August 2018, east winds pushed heavy smoke and persistent haze into Northwest Oregon from wildfires burning in British Columbia, Washington and Eastern Oregon. Air quality plummeted. DEQ issued an air quality advisory for the Willamette Valley, including the Portland area[85], leading to media describing Portland as having "the dubious distinction of worst air quality for a major city on the planet"[86]

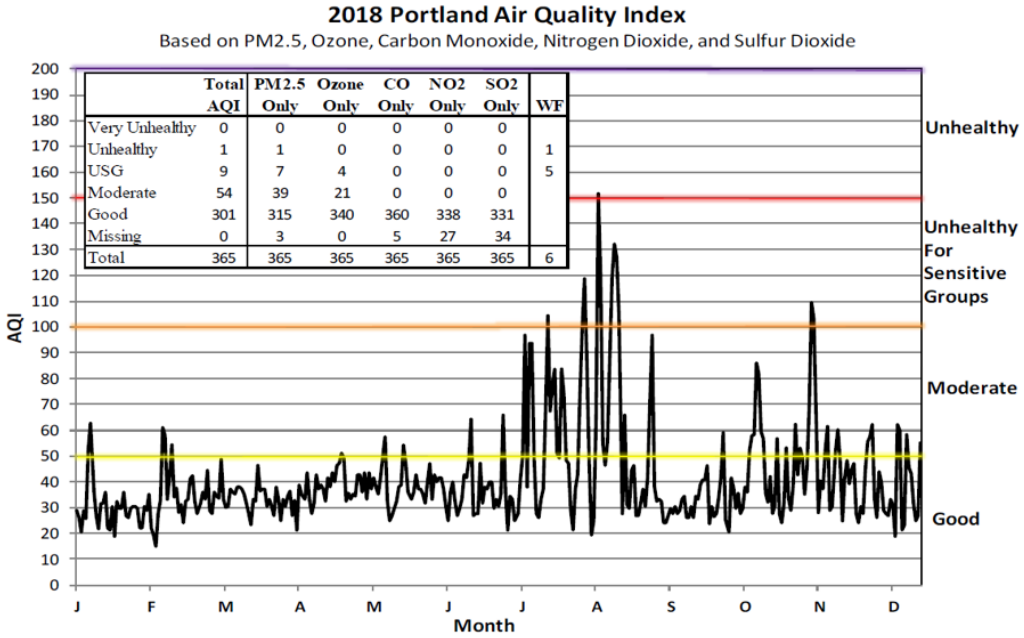

Figure 83 - In August 2018, DEQ reported air quality measurements reaching unhealthy levels from wildfires burning across the Pacific Northwest, as illustrated by this chart in the Oregon Air Quality Annual Report: 2018.

- **2017 Eagle Creek Fire**

Smoke from the Eagle Creek Fire blanketing the City of Troutdale in 2017

Smoke from wildfires in British Columbia drifted into the northern Willamette Valley in August 2017. Then, over Labor Day weekend, a human-caused fire ignited in the Columbia River Gorge. The fire grew quickly over the next few days and winds blew ash and smoke into communities across the Portland Metro Region.

The Eagle Creek Fire alone was responsible for moderate to very unhealthy air quality in early September. Particulate matter from distant fires coupled with the local Eagle Creek fire degraded the air for months. For 61 days, from August through

[85] Northwest Annual Fire Report, 2018, Northwest Interagency Coordination Center. 2018. Northwest Annual Fire Report 2018.
[86] Portland weather 2018: Record breaking heat, wildfire smoke, one massive snowstorm made news, *Oregon Live*. Grant Butler, December 30, 2018

September, approximately one of three days had moderate or worse air quality in the Willamette Valley.[87]

- **2015 Smoke Events[88]**

After two hot and dry months, an extended period of lightning strikes in early August 2015 ignited fifteen major fires in Oregon and Washington. Mid to late August winds transported smoke to Eugene, Portland, and Seattle.

This event led to the worst two-week air quality period across the Pacific Northwest during the 2015 wildfire season. For the first time in recorded history, wildfire smoke degraded air quality to AQI measurements of unhealthy for sensitive populations or worse.

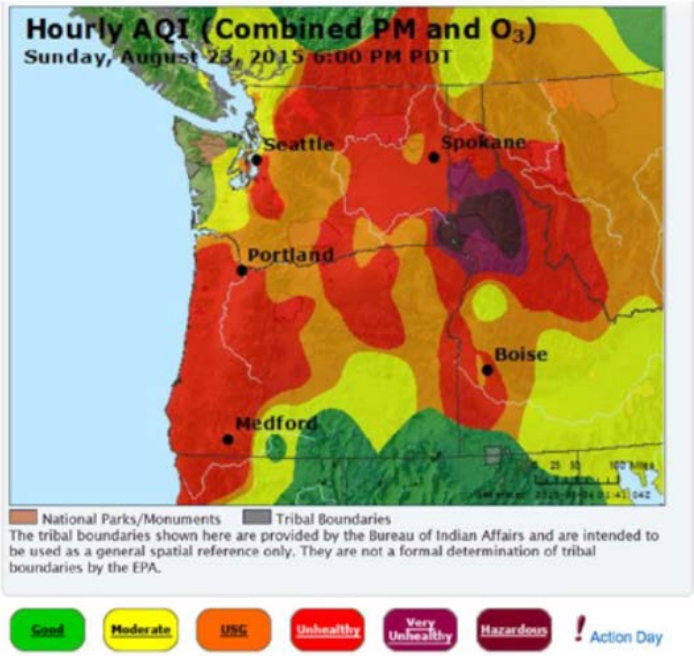

Figure 84 - EPA's AQI map for August 23, 2015 shows widespread degraded air quality conditions across most of the Pacific Northwest

6.3.2 Wildfire Smoke Location and Extent

All of Multnomah County is subject to wildfire smoke. Wind direction and other atmospheric effects are the main drivers in determining when and where wildfire smoke will spread. Risks from wildfire smoke are driven less by geographic factors, and more by exposure, lifestage, and certain situations experienced by populations[89].

Wildfire smoke plumes are getting taller and can spread father. Research indicates that larger fires in the western United States can generate taller plumes of smoke that can expand more easily and transport a greater volume of PM2.5 across wider distances. This long-range transport of hazardous air can pose health hazards to larger numbers of people, going from a more localized issue to a regional or continental problem.[90]

[87] 2017 Pacific Northwest Fire Narrative, USDA Forest Service and DOI Bureau of Land Management, 2017
[88] Air Quality Summary Report for the 2015 Pacific Northwest Fire Year, USDA Forest Service, 2016
[89] Which Populations Experience Greater Risk of Adverse Health Effects Resulting From Wildfire Smoke Exposure?, US Environmental Protection Agency. 2023
[90] Wildfire plumes in the Western US are reaching greater heights and injective more aerosols aloft as wildfire activity intensifies, *Scientific Reports*, Wilmot, T.Y., Mallia, D.V., Hallar, A.G. *et al.* July 20, 2022

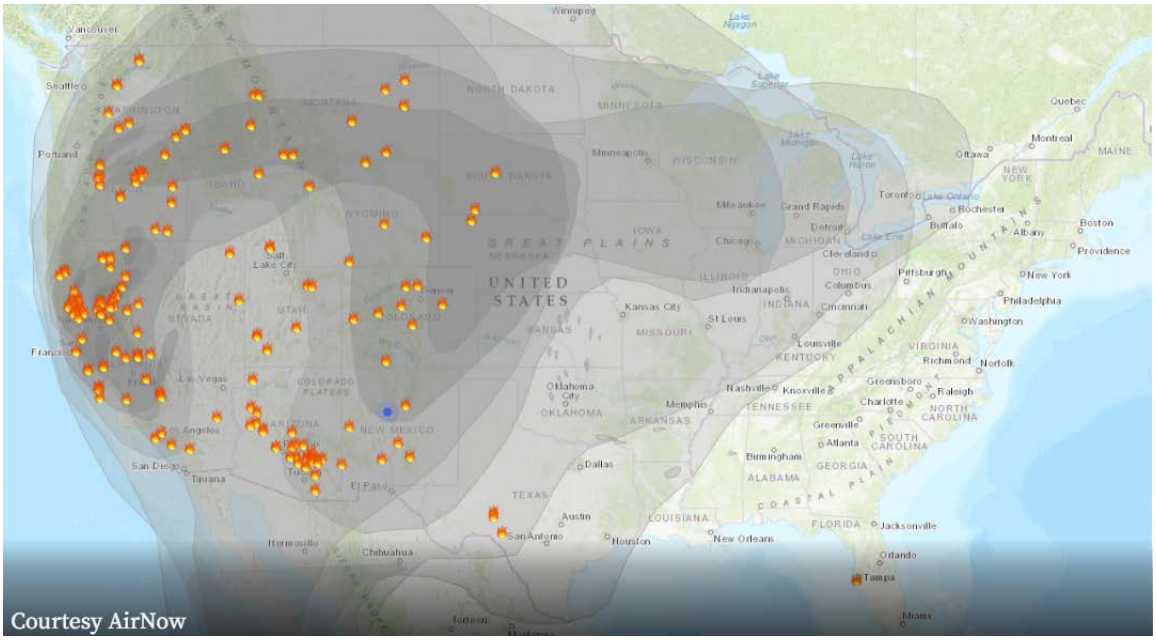

Figure 85 - Wildfires burning in the western U.S. in August 2020, and the resulting smoke plume shaded in gray, from AirNow.gov.

For example, during the local Eagle Creek Fire in 2017, AQI measurements in the county peaked at 157 (unhealthy/red). Those readings were much lower than air quality measurements reached in 2020 when smoke drifted into the county from fires burning across the Pacific Northwest. That year, AQI values in Multnomah County broke 500 (hazardous/maroon) and residents were exposed to the most hazardous air quality in the world.

While smoke can blanket the county with toxic particulate matter, not everyone is impacted equally. Section **6.3.4 on Wildfire Smoke Vulnerability** describes different health outcomes associated with length of exposure and how some populations are more sensitive to fine particulate matter found in smoky air.

6.3.3 Wildfire Smoke Probability

Multnomah County is susceptible to smoke from wildfires across the Pacific Northwest and has a greater likelihood of exposure to smoke than to wildfire. As the fire season is getting longer and smoke plumes are traveling further, the county is experiencing unhealthy air quality more frequently.

Between 1985 and 2014, Oregon DEQ measured zero days in the county with an AQI value that is unhealthy for sensitive populations or worse from wildfire smoke. From 2015 to 2021 the county experienced 23 days of unhealthy or worse air, an average of 3.3 days per year. All of the very unhealthy and hazardous days occurred in 2020.[91]

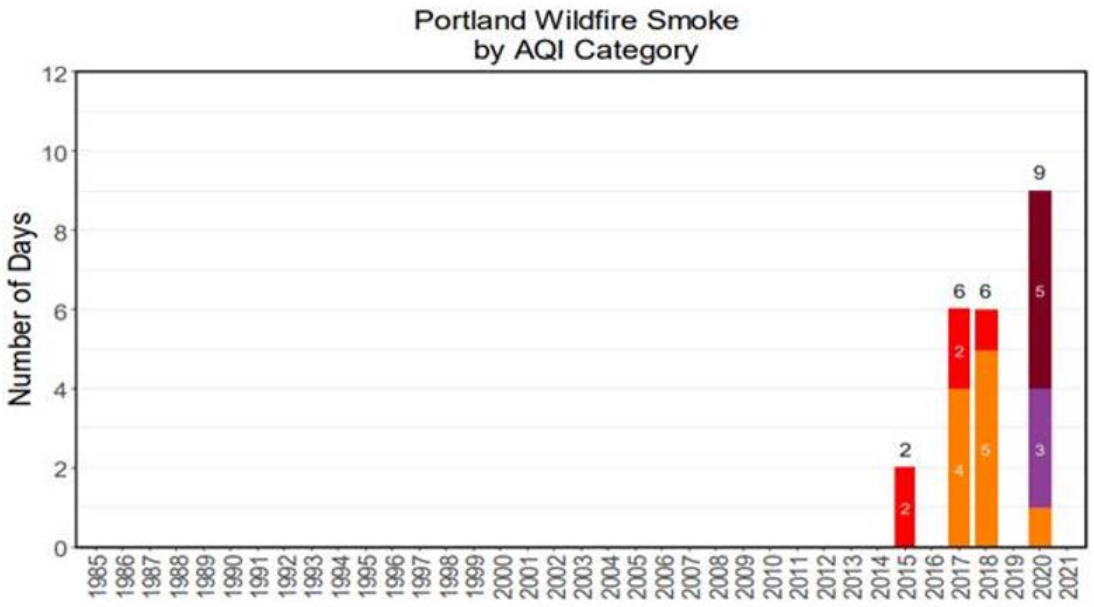

Figure 86 - *After 30 years with zero poor air quality measurements, Portland experienced five unhealthy, three very unhealthy, and five hazardous days from wildfire smoke between 2015 and 2021. Reported by the Oregon DEQ in the 2022 the Wildfire Smoke Trends Report.*

A longer fire season coupled with taller and wider reaching smoke plumes are resulting in more days per year with unhealthy AQI values or greater. If these trends continue, Oregon can expect to see an increase in the number of days with unhealthy air. This will include areas which have not typically seen significant smoke impacts, including the Willamette Valley and the Portland Metro area.

6.3.4 Wildfire Smoke Vulnerability

When smoke levels are high, even healthy people may have symptoms or health problems.[92] However, some people are at greater risk. The US Environmental Protection Agency has noted the ways that length of exposure to wildfire smoke and the sensitivity of specific lifestages and populations can lead to different health outcomes.[93]

[91] Wildfire Smoke Trends and the Air Quality Index, Oregon Department of Environmental Quality, May 2023
[92] Wildfire Smoke and Your Health, Oregon Health Authority.

[93] Health Effects Attributed to Wildfire Smoke, US Environmental Protection Agency. 2022

Length of exposure

Short-term exposure over a few days can result in:

- Irritation of the eyes and respiratory tract
- Respiratory symptoms
  - Coughing
  - Phlegm
  - Wheezing
  - Difficulty breathing
- Respiratory effects
  - Bronchitis
  - Reduced lung function
  - Increased risk of asthma exacerbation and aggravation of other lung diseases
  - Increased risk of emergency room visits and hospital admissions
- Cardiovascular effects
  - Heart failure
  - Heart attack
  - Stroke
  - Increased risk of emergency room visits and hospital admissions
  - Increased risk of premature death

Information on continuous exposures over multiple days or a few weeks is only available from studies of wildland fire fighters. Those studies indicated that continuous occupational wildland fire smoke exposure may have a cumulative effect on lung function.[94]

Populations with greater health risks

The EPA identifies certain lifestages, health conditions and situations that can lead to greater risk of complications from smoke exposure. The AQI refers to these groups as “sensitive populations”. These include:

- ❖ asthma and other respiratory diseases
- ❖ pre-existing heart disease
- ❖ childhood
- ❖ pregnancy
- ❖ older adulthood
- ❖ economic hardship
- ❖ working outdoors

The CWPP Smoke Subcommittee added *not having shelter* to the list of sensitive populations. Like outdoor workers, people without shelter may experience prolonged exposure to high

There's a lot of inequity in the way people encounter smoke. Vulnerable groups are often least able to control their own smoke exposure, underscoring the importance of community-level interventions

- Center for Wildfire Smoke Research and Practice, University of Oregon

[94] Which Populations Experience Greater Risks of Adverse Health Effects Resulting From Wildfire Smoke Exposure, US Environmental Protection Agency. 2022.

concentrations of unhealthy air during smoke events.

Listed below are the rationale and potential health effects for each population at greater risk, each as described by the EPA. Demographic information and statistics for each group is then described under *In Multnomah County*. This includes information about disparate impact among specific populations.

Asthma and other respiratory diseases

Rationale: Underlying respiratory diseases result in compromised health status that can result in the triggering of severe respiratory responses by environmental irritants, such as wildfire smoke.

Potential health effects: Breathing difficulties (e.g., coughing, wheezing, and chest tightness) and exacerbations of chronic lung diseases (e.g., asthma and COPD), leading to increased medication usage, emergency department visits, and hospital admissions.

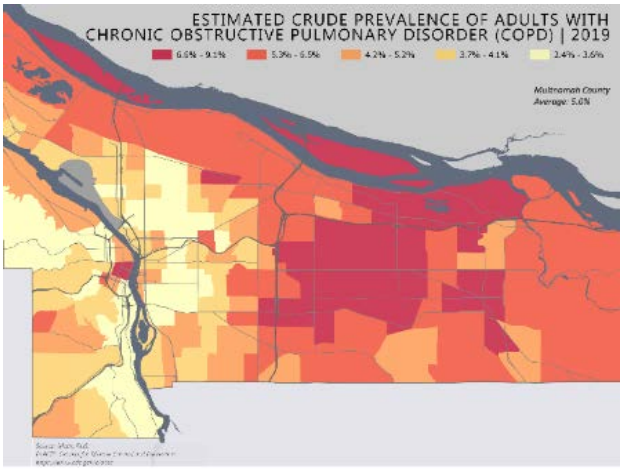

Figure 88 - Estimated number of adults in Multnomah County who report having COPD, based on 2019 CDC PLACES data.

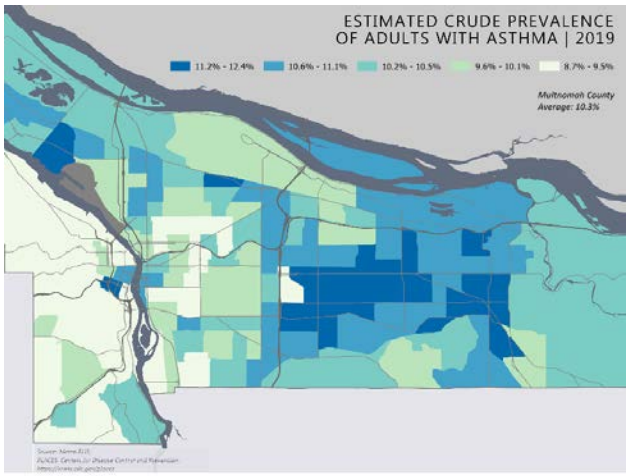

Figure 87 - Estimated number of adults in Multnomah County who report an asthma diagnosis, based on 2019 CDC PLACES data.

In Multnomah County: One in 10 adults report an asthma diagnosis, making it one of the most prevalent chronic illnesses in the county.[95] As shown in Figure 8, Parts of East County, pockets of North Portland, and an area in Southwest Portland around Interstate 405 have a higher prevalence of adults with asthma.

Nationwide, asthma disproportionately affects people of color. More specifically, Black, Hispanic and American Indian/Alaska Native people have the highest rates of asthma, and deaths and hospitalizations caused by asthma. [96]

[95] The Board of Commissioners briefed on the Public Health review of health risks posed by gas stoves, Multnomah County, November 10, 2022

[96] Asthma Disparities in America, Asthma and Allergy Foundation of America. 2023

Pre-existing heart disease

Rationale: Underlying circulatory diseases result in compromised health status that can result in the triggering of severe cardiovascular events by environmental irritants, such as wildfire smoke.
Potential health effects: Triggering of ischemic events, such as angina pectoris, heart attacks, and stroke; worsening of heart failure; or abnormal heart rhythms could lead to emergency department visits, hospital admissions, and even death.

In Multnomah County: Cancer and heart disease are the leading causes of death for Multnomah County residents.[97] Cardiovascular disease is diagnosed at higher rates in Black and African communities. In 2018, Black residents in Multnomah County died of heart disease at a rate more than 25% higher than white residents.[98]

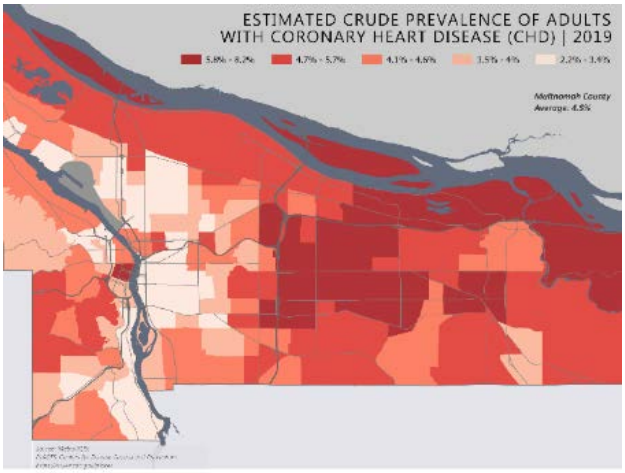

Figure 89 - Estimated number of adults in Multnomah County who report having heart disease, based on 2019 CDC PLACES data.

Childhood

Rationale: Children's lungs are still developing, and there is a greater likelihood of increased exposure to wildfire smoke resulting from more time spent outdoors, engagement in more vigorous activity, and inhalation of more air per pound of body weight compared to adults.

Potential health effects: Coughing, wheezing, difficulty breathing, chest tightness, decreased lung function in all children. In children with asthma, worsening of asthma symptoms or heightened risk of asthma attacks may occur.

In Multnomah County: Children make up 18% of residents.[99] In recent years, the share of children in the county has been decreasing. Between 2010 and 2021, the 0 to 4 age group declined the most, dropping by 18.8%.[100]

Pregnancy

Rationale: Pregnancy-related physiologic changes (e.g., increased breathing rates) may increase vulnerability to environmental exposures, such as wildfire smoke. In addition, during critical development periods, the fetus may experience increased vulnerability to these exposures.
Potential health effects: Limited evidence shows air pollution-related effects on pregnant people and the developing fetus, including low birth weight and preterm birth.

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[97] Heart Disease, Multnomah County. 2023.
[98] County mirrors nation in leading causes of death, and its glaring disparities, Multnomah County, November 14, 2018. s
[99] US Census. 2022
[100] Our Changing Population: Multnomah County, Oregon, USA Facts

In Multnomah County: The rate of Black infant mortality in Multnomah County is higher than any other race, and more than twice as high as non-Latinx white infants. Additionally, black infants in the county are born with a low birthweight at a rate of 75% higher and are born prematurely at a rate of 47% higher than non-Latinx white babies.[101] Despite a nationwide decline in low birth weight and infant mortality, racial disparities have persisted.[102]

Older adulthood

Rationale: Higher prevalence of pre-existing lung and heart disease and decline of physiologic process, such as defense mechanisms.
Potential health effects: Exacerbation of heart and lung diseases can lead to emergency department visits, hospital admissions, and even death.

In Multnomah County[103]: Older adults are among the fastest-growing populations in the county, and represent 18% of the county's population. One in every five older adults in the county identifies as a person of color (20%). People of Color are disproportionately represented among those 60+ living in poverty, particularly Black and Latino older adults.

[101] Healthy Birth Initiative supports healthier pregnancies and births for Black families, Providence Health and Services, December 16, 2020
[102] Infant Mortality and African Americans, US Department of Health and Human Services Office of Minority Health
[103] 2021-2025 Area Plan Year 1 Update ,Multnomah County Aging, Disability and Veterans Services Division. 2022

Economic hardship

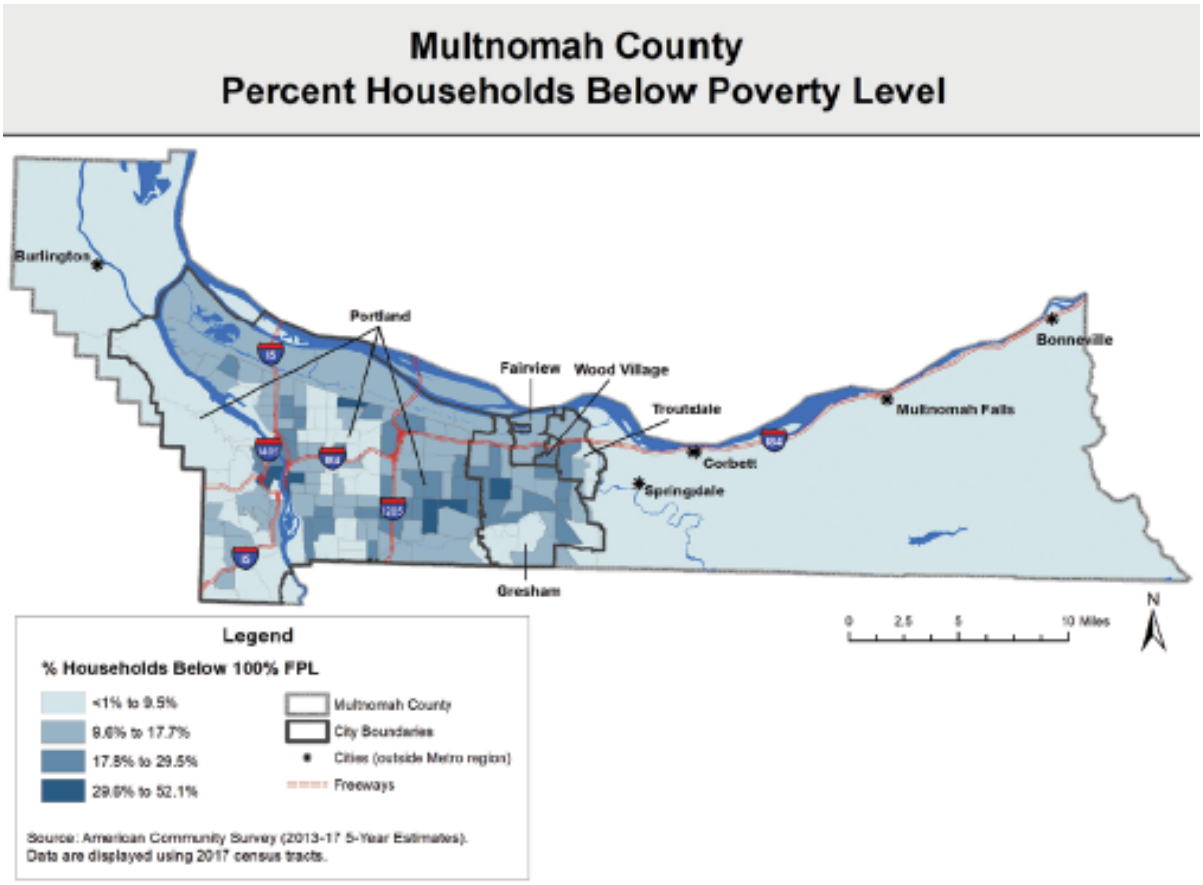

Figure 90 - Percent households below the federal poverty level, from the 2019 Poverty in Multnomah County Report.

Rationale: Less access to health care, could lead to higher likelihood of untreated or insufficient treatment of underlying health conditions (e.g., asthma, diabetes), and greater exposure to wildfire smoke resulting from less access to measures to reduce exposure (e.g., air conditioning).

Potential health effects: Greater exposure to wildfire smoke resulting from less access to measures to reduce exposure, along with higher likelihood of untreated or insufficiently treated health conditions could lead to increased risks of experiencing the health effects described above.

In Multnomah County[104]:

34% of households are unable to meet their basic needs. The highest poverty areas in the county are east of Interstate 205, Gresham, Northeast Portland, and near downtown. Poverty

[104] Poverty in Multnomah County Report, Multnomah County, 2019

rates for African Americans, Native Americans, and Latinxs are more than twice the rate as white residents.

Working outdoors or lacking shelter

Rationale: Extended periods of time exposed to high concentrations of wildfire smoke.
Potential health effects: Greater exposure to wildfire smoke can lead to increased risks of experiencing the range of health effects described above.

In Multnomah County: Industries with outdoor workers who could experience heightened exposure to high concentrations of wildfire smoke include agricultural workers, landscapers, utility workers, construction workers, and park personnel.[105] Additionally, people working outdoors in airport, marine, transportation, utility, public safety, emergency services and public transit sectors may have greater exposure to high concentrations of wildfire smoke in the county.

An estimated 3,057 people are experiencing unsheltered homelessness in Multnomah County This includes people living outside, in vehicles, in tents, and in other places not meant for human habitation. Between 2019 and 2022 the share BIPOC communities experiencing unsheltered homeless rose (from 36% to 38%), while the share of Non-Hispanic White people dropped (from 59% to 52.8%). The largest increase in share is among the Black or African American community. Females represent 60% of all unsheltered people in the county. Families with at least one adult and one child under 18 years old represent 15% of the unsheltered population. 22.5% reported having a chronic health condition.[106]

[105] Outdoor Workers Exposed to Wildfire Smoke, Centers for Disease Control. 2021.
[106] 2022 Point in Time County, Joint Office of Homeless Services. 2022 Point-in-Time Count.