

# >> Climate and Health in Oregon

2021–2022 Report



Oregon  
Health  
Authority

PUBLIC HEALTH DIVISION  
Climate and Health Program

The Oregon Health Authority (OHA) developed this annual report in response to Executive Order (EO) 20-04. That order directed OHA to provide annual reports on the public health impacts of climate change in Oregon to the Governor, the Oregon Global Warming Commission and the Environmental Justice Council. Due to OHA's pandemic response and staffing, OHA was unable to complete a report for 2021 and is issuing a combined 2021–2022 report.

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# Executive summary

## In 2021 and 2022 Oregon experienced severe climate change impacts, all while battling the ongoing global COVID-19 pandemic.

- Heat was the sole cause of more than 100 deaths in summer 2021: 102 from the June heat dome event and six from the August heat wave. [1] Most who died were elderly, isolated and living with low incomes.
- In 2021 and 2022, Oregon did not experience the extreme statewide smoke impacts seen after the 2020 Labor Day fires. However, people in Central and Southern Oregon experienced cumulatively greater smoke exposures in recent fire seasons. For example, in 2021 people in Bend, Klamath Falls and Medford (combined) experienced 83 days with air at or above an unhealthy level for sensitive groups (USG) compared to 41 days in 2020 and 11 days in 2022. [2]
- During the 2022 wildfire season, the small community of Oakridge experienced 37 days at or above USG due to the Cedar Creek Fire. Many of these days were consecutive, resulting in Oakridge being severely affected almost without respite from mid-September to late October. [3]
- Nearly every county in Oregon experienced severe to exceptional drought, with long- term implications for growing food, drinking water and other systems that sustain health.

## Data show more emergency department visits during 2021's climate change-related events, with some Oregonians disproportionately affected.

- From May 2021 to August 2021, Oregon recorded 242 percent more heat-related illness (HRI) visits to emergency departments and urgent care centers than in 2020. [4] Fifty-nine percent of patients seen for HRI visits in 2021 were from ZIP codes with a median household income below \$50,000.
- During the 2021 wildfire season, smoke especially affected Central and Southern Oregon, with several counties experiencing 20 percent higher asthma-like illness visits compared to 2020. [4]

## The state and Oregon communities made ground-breaking investments in climate resilience, prioritizing communities most at risk.

- The state has made a historic commitment to our public health system: For the first time, the Oregon Legislature funded resources for OHA, Tribal and local public health partners and community-based organizations to build climate and health resilience over the 2021–2023 biennium.
- The Governor and the 2021 and 2022 legislatures also invested in and directed agencies to address specific climate-related threats in various contexts. For example, the Legislature directed OHA to establish a new Healthy Homes Grant Program to fund home weatherization and building retrofits for low-income households and communities experiencing environmental injustice. It will support housing retention, increase climate resilience and decrease energy costs; the grant program will also help Oregon reach our greenhouse gas reduction goals. Other bills dedicated funding to cover air filtration devices, air conditioners and heat pumps for priority populations whose health conditions and income status expose them to greater health risks from wildfire smoke and excessive temperatures.

## Looking ahead: spotlighting communities and highlighting solutions.

- Since 2010, OHA's Climate and Health Program has worked to describe and increase awareness of the growing health risks of climate change in Oregon. This helps us better anticipate and take steps to reduce harm.
- Predicted impacts became devastating realities in 2020 and 2021, with the 2020 Labor Day wildfires, the heat dome in 2021 and regional chronic wildfire smoke. Community-based organizations, local jurisdictions, Tribes, and the state and federal governments have started making large investments in reducing climate and health impacts and building climate resilience.
- Going forward, future annual “Climate and Health in Oregon” reports will spotlight the communities most affected by climate disruptions and the innovative ways communities, government agencies and Tribes are protecting the health of people in Oregon and the planet.

# Letter from State Public Health Director Rachael Banks

Being born and raised in Oregon, I could not imagine the “heat dome” event in June 2021 would be possible. It seemed unthinkable that cities such as Portland and Salem — or even typically warmer places such as Medford and The Dalles — could get above 110 degrees, much less surpass 115 degrees.

The reality is that such excessive and deadly conditions may be here to stay. In the last five years, Oregon has recorded its hottest years in state history. Unfortunately, climate models predict this trend toward more frequent and severe heat waves will continue in our beautiful state.

Heat waves occur from time to time as a result of natural variability. However, human-caused climate change, mainly from the burning of fossil fuels, is contributing to the intensity of extreme weather events here and around the globe. Due to climate change, nearly the entire state will need to prepare for steady increases in extreme heat over the next several decades.

The 2021 heat wave is part of a web of climate risks, including worsening drought conditions, more wildfires and flooding events. Although these hazards increase the likelihood of deaths and hospitalizations in our state, we can — and must — act now to prevent the worst.

The Governor’s Executive Order 20-04 on climate change [specifically directed the Oregon Health Authority](#) to regularly report on health impacts of climate change. The order also directed OHA to work with partners to enact protections, including new safety standards that protect outdoor workers from wildfire smoke and extreme heat.

It is overwhelmingly clear that not all people have equal access to life-saving protections. Individuals and communities that are already economically or socially marginalized or suffer greater health difficulties experience worse health impacts from climate and weather events. We can do something about this injustice.

Legislation in 2021 and 2022 established grant programs to ensure more Oregonians can have safe refuge during extreme weather events. These include OHA's Healthy Homes Grant Program and multi-agency wildfire response actions. More fundamentally, thanks to the Governor's and Legislature's commitment to modernizing Oregon's public health system, the state is making foundational investments in environmental justice and health equity. Oregon is prioritizing building climate resilience in communities across the state. OHA is providing resources to Tribal and local health authorities and community-based organizations to carry out this work. This allows us to work together toward the goal of eliminating health inequities in Oregon by 2030. It is a bold goal, but the facts are before us and lives are on the line — we simply cannot aim for anything less.



Rachael Banks, Public Health Director  
Oregon Health Authority

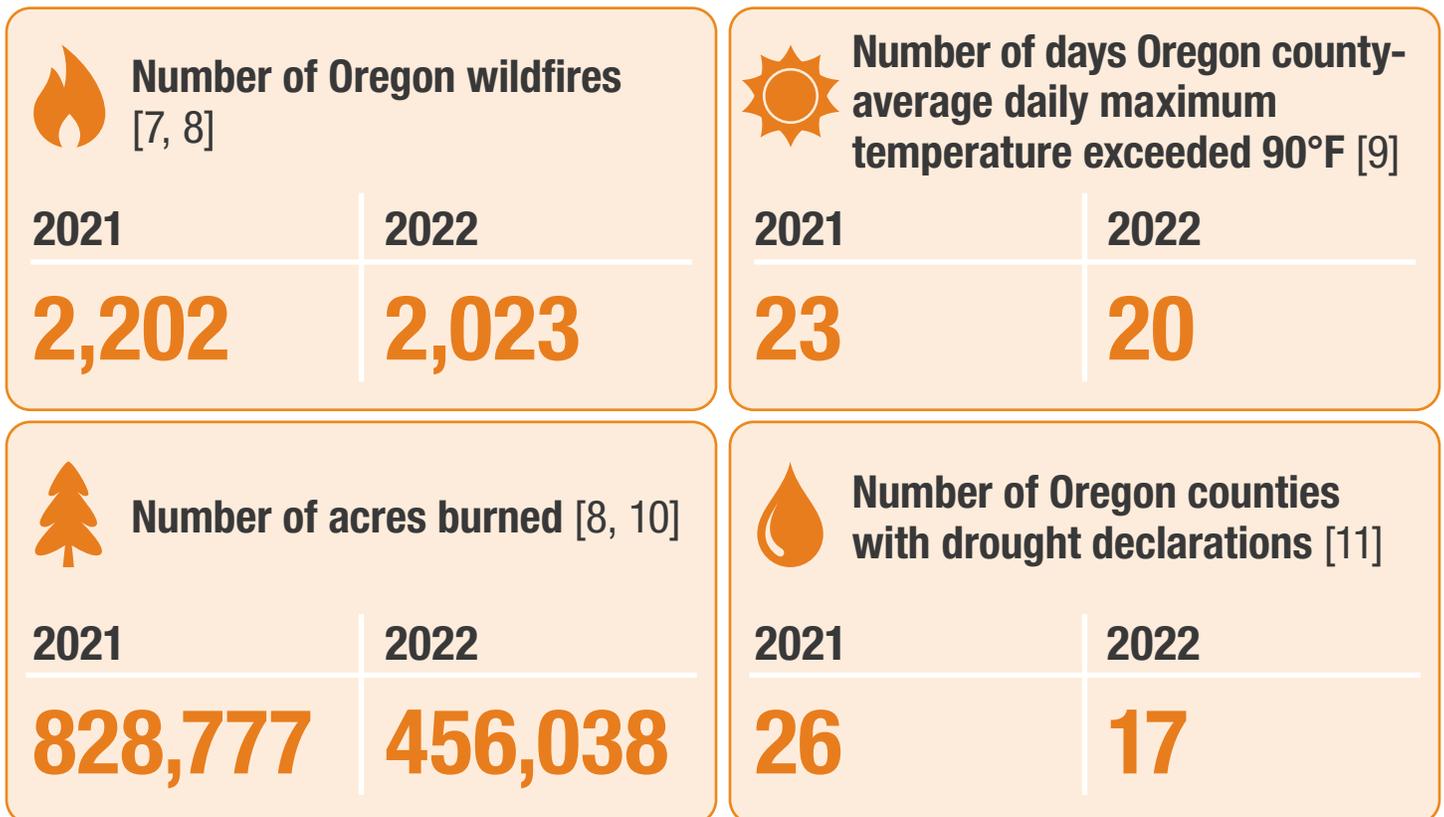
# Introduction

## Climate change crises during a pandemic

Throughout 2021 and 2022, Oregon continued to experience dual crises of climate change and a worldwide viral epidemic. Climate change from a buildup of human-generated greenhouse gases in the atmosphere has not slowed, contributing to increases in weather-related and climate-related extreme events. [5] This report covers both weather-related extreme events, such as severe short-term incidents (for example, heat domes and winter storms), and longer-term climate-related events (for example, environmental conditions such as drought and wildfire from multi-year precipitation changes). [6]

In late 2020, OHA released its [2020 Oregon Climate and Health Report](#) in response to Governor Kate Brown’s Executive Order [EO 20-04](#) that directed state agencies to prioritize climate action. The 2021–22 report updates what we know about the health impacts from climate and weather events from late 2020 through 2022.

Figure 1: Snapshot of select climate and health hazards in 2021 and 2022



In 2021 and 2022, Oregon experienced severe climate change impacts, all while battling the ongoing global COVID-19 pandemic. In 2021, Oregon experienced disasters of unprecedented scale and magnitude including wildfires, [12] ice storms, [13] drought, [11] an early and extreme heat wave, [14] and severe storms, slides and flooding. [15]

These record-breaking events compounded existing health inequities and the effects of the pandemic. Oregon Emergency Management's [online disaster stories series](#) spotlights the [2021 Bootleg fire](#), the [2021 Winter Storms](#) the [2020 February Flooding](#) and the [2020 Oregon Wildfires](#). The “Climate and health hazards data” section of this report details some associated health effects.

The combined effects of the COVID-19 pandemic and climate disasters intensified specific communities' pre-existing inequities in accessing resources. Stressed infrastructure, such as a surge in the use of urgent care or emergency departments from a pandemic, can increase the risk of not treating people sick from excessive heat and other health conditions. [16, 17]

From the pandemic's outset, OHA enlisted partner agencies to warn the public that smoke could both exacerbate the severity and increase the risks of contracting respiratory diseases such as COVID-19. [18] Recent research determined that fine particulate matter (PM2.5) from smoke inhalation during the country's 2020 wildfires resulted in increased COVID-19 cases and deaths. [19] In Oregon, exposure to wildfire smoke was associated with additional COVID-19 cases in 15 of 20 counties with high particulate matter (PM2.5) from wildfires during the 2020 wildfire season. High levels of PM2.5 on wildfire days accounted for up to 15 percent of total COVID-19 cases. [19]

In Oregon, American Indian/Alaska Native, Black/African American, Latino/a/x/e, and Pacific Islander communities experienced higher rates of COVID-19 cases, hospitalizations and deaths than their white peers from April 2020 to April 2022. [20] Members of the Latino/a/x/e community faced a vaccination gap; many were essential workers and at higher risk of being exposed to the virus. [21] Latino/a/x/e, Black/African American and American Indian/Alaska Native communities were two to three times as likely to be hospitalized or die from COVID-19 than their white peers. Native Hawaiian/Pacific Islanders were three to five times as likely to be hospitalized or die from COVID-19 as their white peers based on age-adjusted data. [20] Many of these communities have less access to livable wages, drinkable water, nutritious food, adequate housing or sound water infrastructure. [22, 23] Investments in both COVID-19 response and climate change resilience will help address the inequities experienced by communities made vulnerable from historical under- or dis-investment.

# Climate and health hazards data

This section summarizes climate and weather events' health and equity impacts from late 2020 through 2022, based on available data. Each climate or weather-related event and its impact on people's health adds strain to the medical system, including urgent care and emergency response.

## Heat wave impacts and recovery

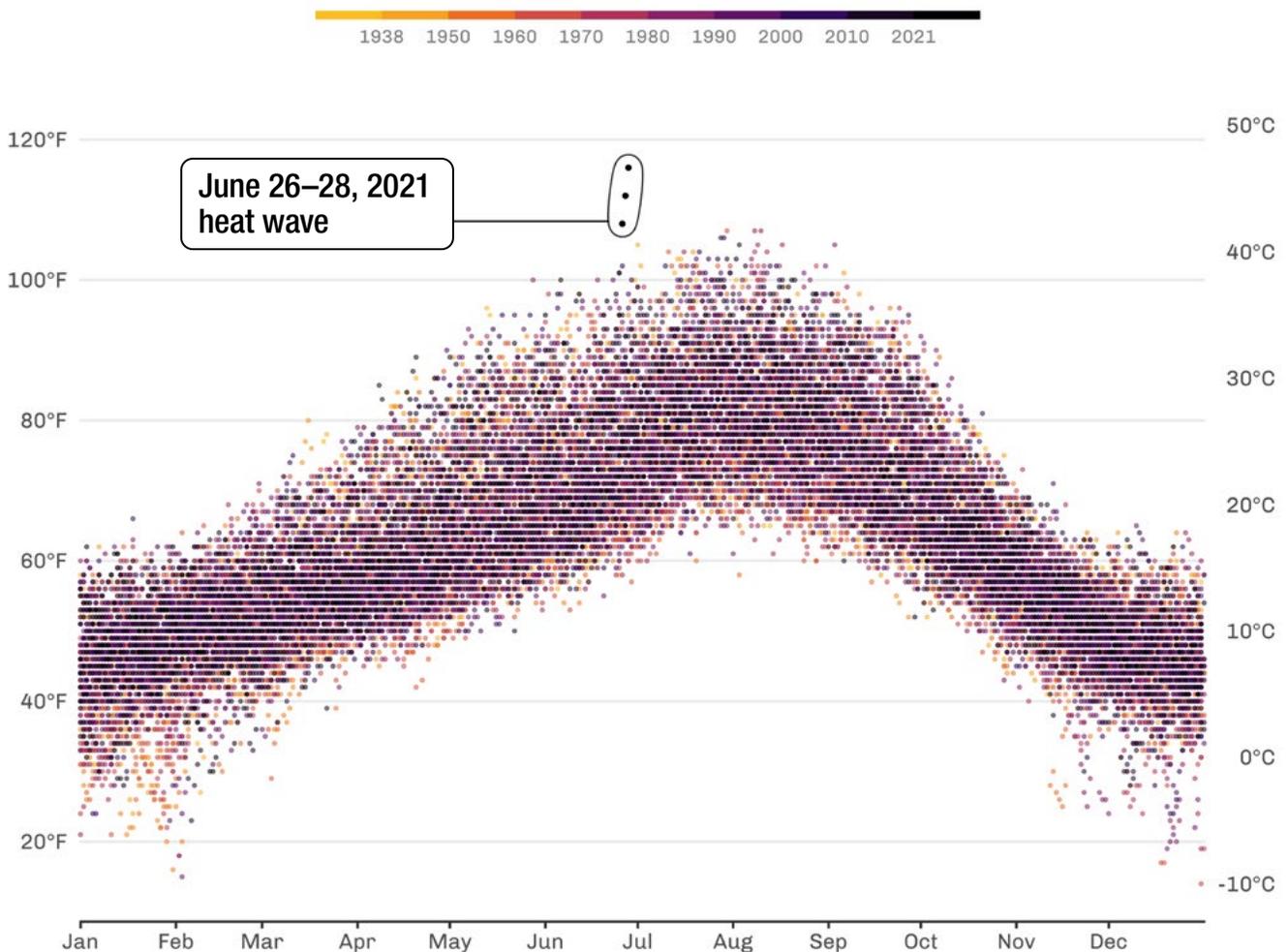
Extreme heat events, or heat waves, are a leading cause of weather-related deaths in the United States. The number of extremely hot days is rising across the nation. [14] Oregon recorded its hottest years in state history during the last five years, and this trend is expected to continue. Climate models show it is extremely likely the heat waves' severity will increase across our state. [24] For the first time, these predictions led to Oregon including extreme heat as a hazard in the [2020–2025 Oregon Natural Hazards Mitigation Plan \(NHMP\)](#) (see NHMP 2020, page 237).



From June 26 to June 28, 2021, Oregon, experienced an excessive heat event, called a “heat dome,” where hot air was trapped at low elevations across the state. A statewide drought, urban heat island effects in some areas, and an active wildfire season worsened the heat dome. It is rare for 100-degree days to happen in June (see Figure 2). The heat dome surpassed records by double digits in some locations in the Pacific Northwest (see Figure 2). [14] Climate risk assessments acknowledge that Oregon will need to prepare for more frequent, longer duration and more intense heat days over the next few decades. [24]

**Figure 2: Heat dome surpasses previously recorded temperature highs, 1938–2021; June 26–28, 2021 heat wave indicates abnormally high, early temperatures (NOAA data in graphic from Cédric Scherer of OregonLive)**

### Daily maximum temperatures in Portland (Oregon), 1938–2021



Data: National Oceanic and Atmospheric Administration via Oregon Live • Graphic: Cédric Scherer

The following groups are among those most likely to experience heat exhaustion, heat stroke or heat complications of other health conditions [25, 26]:

- People without proper ventilation
- People living in urban areas with less tree canopy
- Unsheltered people
- People living in poverty and in ZIP codes with a lower median income (see Figure 3)
- People with chronic conditions, and
- Outdoor workers.

OHA examined health data in different contexts, revealing excessive heat effects in Oregon, including:

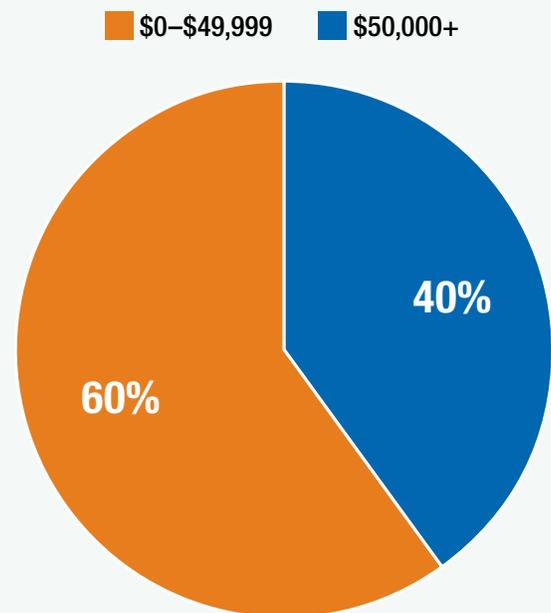
- **Increased heat-related illness visits to emergency departments.**

Oregon saw an increase in emergency department and urgent care heat-related illness visits during the heat dome event in 2021 (see Figure 4) and again during a significant heat event in early August. [4] OHA documents these findings in statewide surveillance summary reports that track heat-related emergency department visits. (See Appendix A and Appendix B, the Summer 2021 and Summer 2022 Oregon ESSENCE Summer Hazards reports.)

- **A spike in deaths attributable to extreme heat.** Heat was the sole cause of more than 100 deaths in summer 2021: 102 from the June 2021 heat dome event and six during the August heat wave. [1] Illustrating the elevated risks to outdoor workers, at least two of the heat dome deaths occurred on the job — to an agricultural worker in St. Paul on June 26 and a construction worker in Hillsboro on June 28. [27]

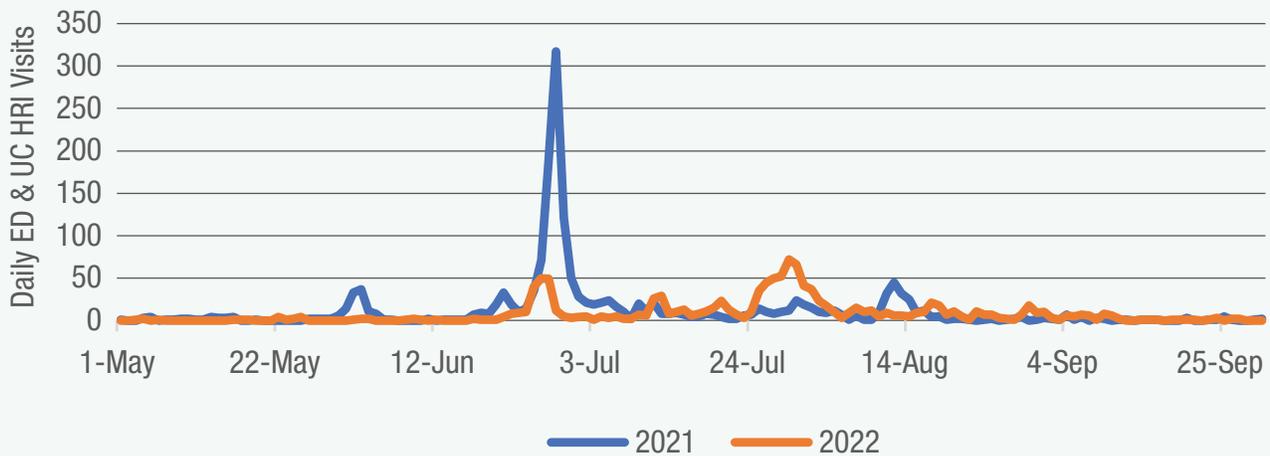
- **Excess deaths attributed to other causes worsened by heat.** Hot temperatures can contribute to other causes of death such as heart attacks and strokes. [28] In the week following the extreme heat event (June 27 to July 3, 2021), Oregon recorded 251 excess deaths when compared to the average for that week from 2017–2019; these do not include 20 COVID-related deaths. Increases in excess deaths were also observed in summer 2022 during and after periods of extreme heat. For the week of Aug. 14–20, 2022, when many areas of the state experienced several days of temperatures near

**Figure 3: Heat-related illness emergency department (ED) and urgent care visits by ZIP code median income of patient residence (2021–2022)**



or above 100 degrees, there were 145 excess deaths (plus 34 COVID-related deaths) compared to the 2017–2019 three-year average. [29] This shows that many more people died than we would expect based on historical averages. While these excess deaths have not been attributed to “hyperthermia” (excessive heat), we need to assess whether they could have been related to other conditions worsened by heat.

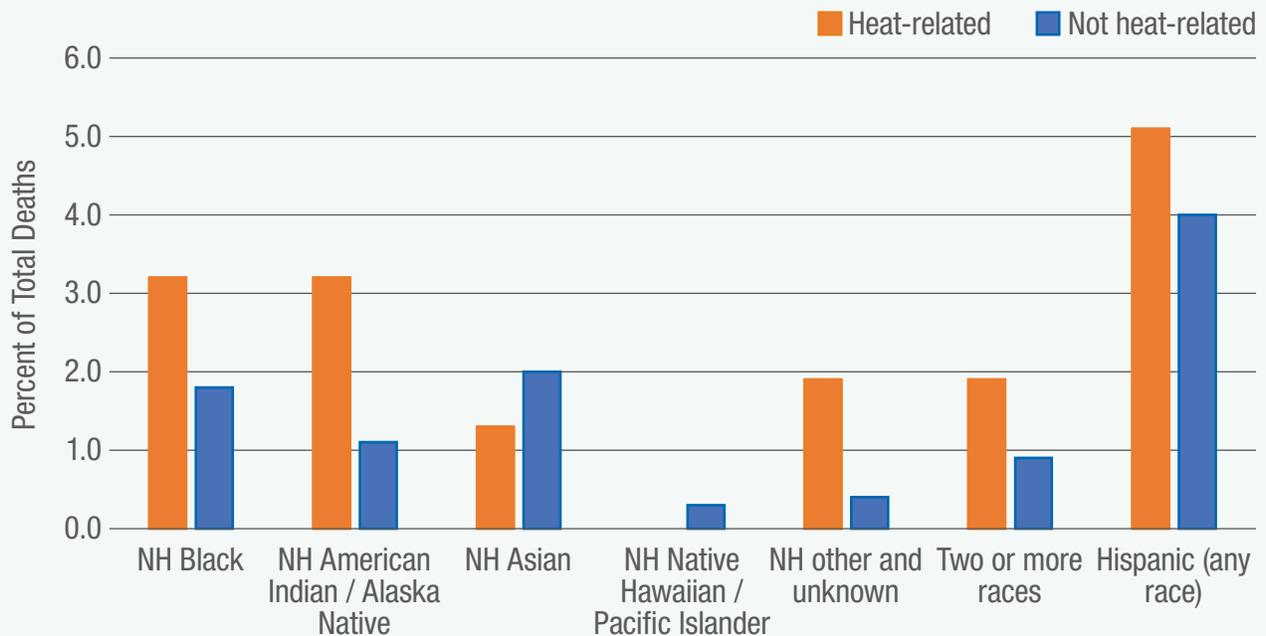
**Figure 4: Heat-related emergency department and urgent care visits in Oregon, May–September, 2021 and 2022.**



*Note: Extreme spike in 2021 is related to heat dome in late June.*

- **Disproportionate heat-related deaths among people of color.** The high number of heat-related deaths in 2021 (134) and 2022 (23) prompted a comparison of heat-related and non-heat-related deaths in Oregon. For 2021 and 2022 combined, non-white (non-Hispanic: Black/African American, American Indian/Alaska Native, two or more races) and Hispanic (any race) populations had a disproportionately high percentage of heat-related deaths compared to non-heat-related deaths. See Figure 5 for details. For comparison, non-Hispanic white populations accounted for a larger proportion of non-heat-related deaths among all races (90 percent) compared to heat-related deaths among all races (83 percent). [30]
- **Disproportionate heat-related illnesses impact among people with lower incomes.** The pie chart (Figure 3) shows statewide Oregonian Emergency Department (ED) visits and urgent care visits from May through September for 2021 and 2022 combined. The orange area shows 60% of patients with heat-related illness lived in areas with a median household income below \$50,000. [31] The 2021 median household income in Oregon was \$71,562, indicating a disproportionate number of cases among Oregonians living with lower incomes. [16]

Figure 5: Comparison of heat-related and non-heat-related deaths in Oregon, by non-white race or ethnicity, 2021-2022. Data for 2022 are preliminary and subject to change.



- Heat deaths concentrated in Multnomah County in 2021.** Heat-related deaths occurred in 28 different cities across Oregon. Most of those who died lived in Multnomah County. Of the 72 people in Multnomah County whose cause of death was confirmed as hyperthermia, 69 of those deaths were associated with the heat dome event during the last week of June. In [Multnomah County’s Final Report on Health Impacts from Excessive Heat Events](#) published June 2022, 71 percent lived alone, 68 percent had only a fan or no source of cooling, and 58 percent of deaths occurred in Census tracts that had the highest urban heat island index value.
- Increased strain on emergency medical systems.** Hospitals across Oregon faced high emergency medical services (ambulance) and hospital emergency department volumes during a time of constrained capacity due to COVID-19. [16]

## Drought impacts

Heat is also compounding the challenges of Oregon’s elevating drought-levels (see Figure 6). Precipitation levels from October 2020 to August 2021 were 50 percent to 70 percent of normal in some areas of Central, North Central and Northeast Oregon. [11] The lack of precipitation combined with higher heat contributed to parched soils. Drought was particularly bad in 2021; in September, 72 percent of Oregon land experienced extreme drought or worse, compared to 31 percent in September 2022 (Figure 6). [32]

Figure 6. Drought conditions, September 2021–September 2022

*Drought conditions (percent area)*

	None	D0–D4	D1–D4	D2–D4	D3–D4	D4
<b>Current</b>	<b>0.42</b>	<b>99.58</b>	<b>68.05</b>	<b>52.42</b>	<b>30.73</b>	<b>1.40</b>
<b>Last week</b> <i>09-20-2022</i>	<b>11.67</b>	<b>88.33</b>	<b>68.05</b>	<b>52.22</b>	<b>30.73</b>	<b>1.40</b>
<b>3 months ago</b> <i>06-28-2022</i>	<b>24.60</b>	<b>75.40</b>	<b>66.49</b>	<b>52.71</b>	<b>31.72</b>	<b>1.77</b>
<b>Start of calendar year</b> <i>01-04-2022</i>	<b>4.16</b>	<b>95.84</b>	<b>89.75</b>	<b>75.37</b>	<b>50.84</b>	<b>17.27</b>
<b>Start of water year</b> <i>09-28-2021</i>	<b>0.00</b>	<b>100.00</b>	<b>100.00</b>	<b>96.47</b>	<b>72.10</b>	<b>26.95</b>
<b>One year ago</b> <i>09-28-2021</i>	<b>0.002</b>	<b>100.00</b>	<b>100.00</b>	<b>96.47</b>	<b>72.10</b>	<b>26.59</b>

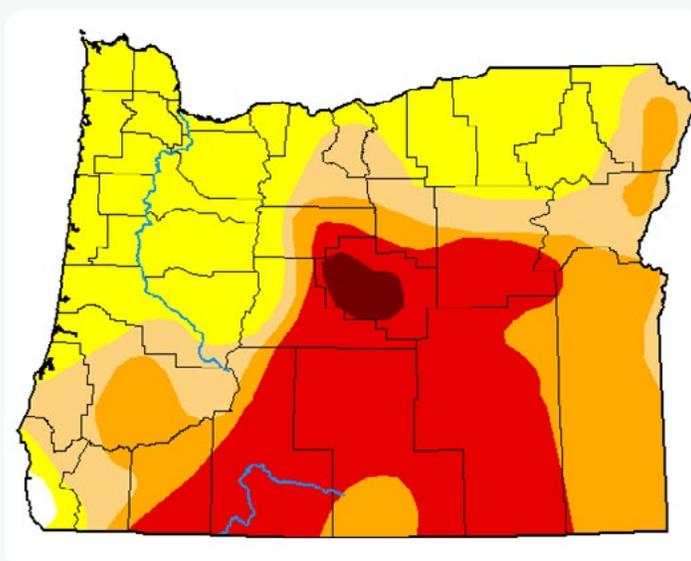
**Intensity**



*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/about.aspx>*

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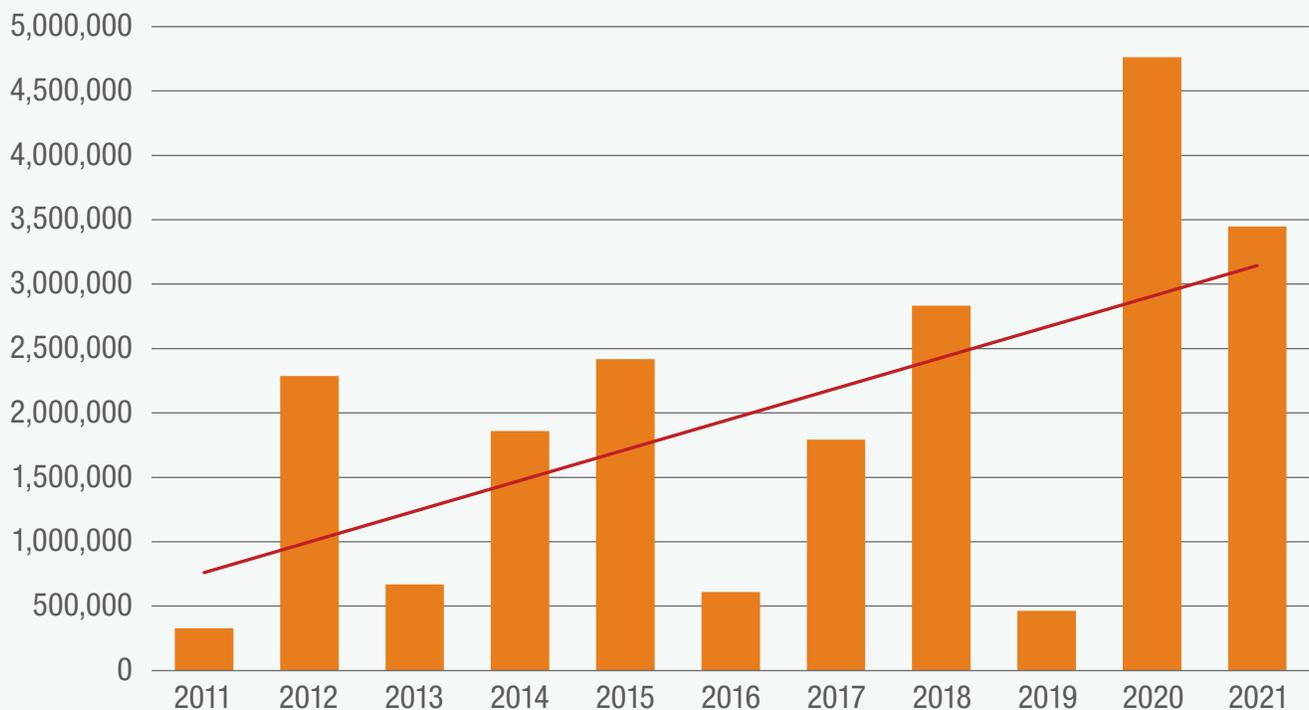
As of September 2022, all Oregon counties had some area in the abnormally dry to extreme drought range, with more than a quarter of the state having experienced exceptional drought conditions at some point in the last year (see Figure 6). In Klamath County, 461 domestic wells were reported dry or very slow to recharge as of November 2022, leaving many homes with no running water. [33] In 2021 alone, 13 public water systems experienced low water supply, compared to eight in the five-year period from 2016 to 2020. This trend continued in 2022, when 14 public water systems experienced low water supply. [34]

Reduced access to water and bad water quality are detrimental to health. Water shortages can lead to food and nutrition insufficiency, acute and chronic respiratory complications and reduced sanitation and hygiene. [35] During times of water scarcity, aquatic life and waterway health are stressed as the hot, dry conditions are perfect for harmful algal blooms that can release toxic cyanobacteria to recreational waters and drinking water sources, posing a risk to humans and pets during recreational activities.

## Wildfire impacts

Recent years have seen increases in wildfire acres burned in the Northwestern United States (Figure 7). Though there is year-to-year variation in the number of acres burned, the last decade's trend has been upward. Across Oregon, smoke from these wildfires increased days with poor air quality and associated health effects.

**Figure 7: Acreage burned by wildfires in Oregon, Washington and Northern California, from the National Interagency Coordination Center Wildland Fire Summary and Statistics Annual Report 2021**



Below are some of the key findings from the Oregon Department of Environmental Quality 2023 report, [Wildfire Smoke Trends and the Air Quality Index](#): [2]

- Communities near Bend in Eastern Oregon had a 24-fold increase in the number of days with PM<sub>2.5</sub> levels Unhealthy for Sensitive Groups or higher ( $\geq$ USG days) a year. From 1989 to 2016 there were, on average, 10 of these poor air quality days a year; from 2017 to 2020 there were, on average, 35 poor air quality days a year.
- Southern Oregon near Klamath Falls had a jump from 1.4  $\geq$ USG days a year during 1989–2016 to 13.2  $\geq$ USG days a year during 2017–2020.

On Labor Day 2021, Bend’s Air Quality Index reached hazardous levels, one of the worst in the United States. [36]

The devastating September 2020 wildfires were among the state’s most destructive on record, with affected Oregon communities still recovering as new fires emerged in 2021. [12] The 2020 wildfires burned more than a million acres, destroyed 4,000 residences and blanketed the entire state in hazardous levels of smoke, with most of the impacts occurring within 10 days in September. See [Oregon Office of Emergency Management’s 2020 Oregon Wildfire Spotlight](#) for more details on the ongoing recovery processes including cleanup of hazardous waste from 2020 fires.

The 2021 wildfire season burned 829,000 acres and destroyed 166 residences over the summer. Based on the wildfire season monitoring network, which collects data from state monitors in 24 communities across Oregon, there were fewer days where the Air Quality Index (AQI) was at or above unhealthy for sensitive groups ( $\geq$ USG) in 2021 (226 days) compared to 2020 (266 days). However, for people living in Central, Eastern and Southern Oregon, the cumulative smoke impacts of 2021 equaled and sometimes exceeded 2020. Three Oregon communities (Bend, Klamath Falls and Medford) had twice as many USG days in 2021 as compared to 2020 where the AQI was  $\geq$ USG. [2]

Data for the 2022 wildfire season show the Willamette Valley experienced 72 days with the AQI  $\geq$ USG; this was primarily due to the persistent smoke from fires near Oakridge where there were 37 days with the AQI  $\geq$ USG. [37] Bend, Klamath Falls and Medford had fewer days  $\geq$ USG (11) in 2022 than in 2021 (83). Smoke affected air quality in 2022 later in the season than in 2021 (Figure 8). The wildfire season in Oregon starts earlier and lasts longer than in previous years. The May 2021 start in Southwest Oregon (Jackson and Josephine counties) and the widespread wildfires in October 2022 are notable examples.

Comparatively, in 12 Oregon counties identified as having high or moderate smoke impact, the proportion of emergency department and urgent care visits in the oldest age group (65+) was higher than the proportion of the population in the same age group for all races, including American Indian/Alaska Native, Asian, Black/ African American, Native Hawaiian or Other Pacific Islander,

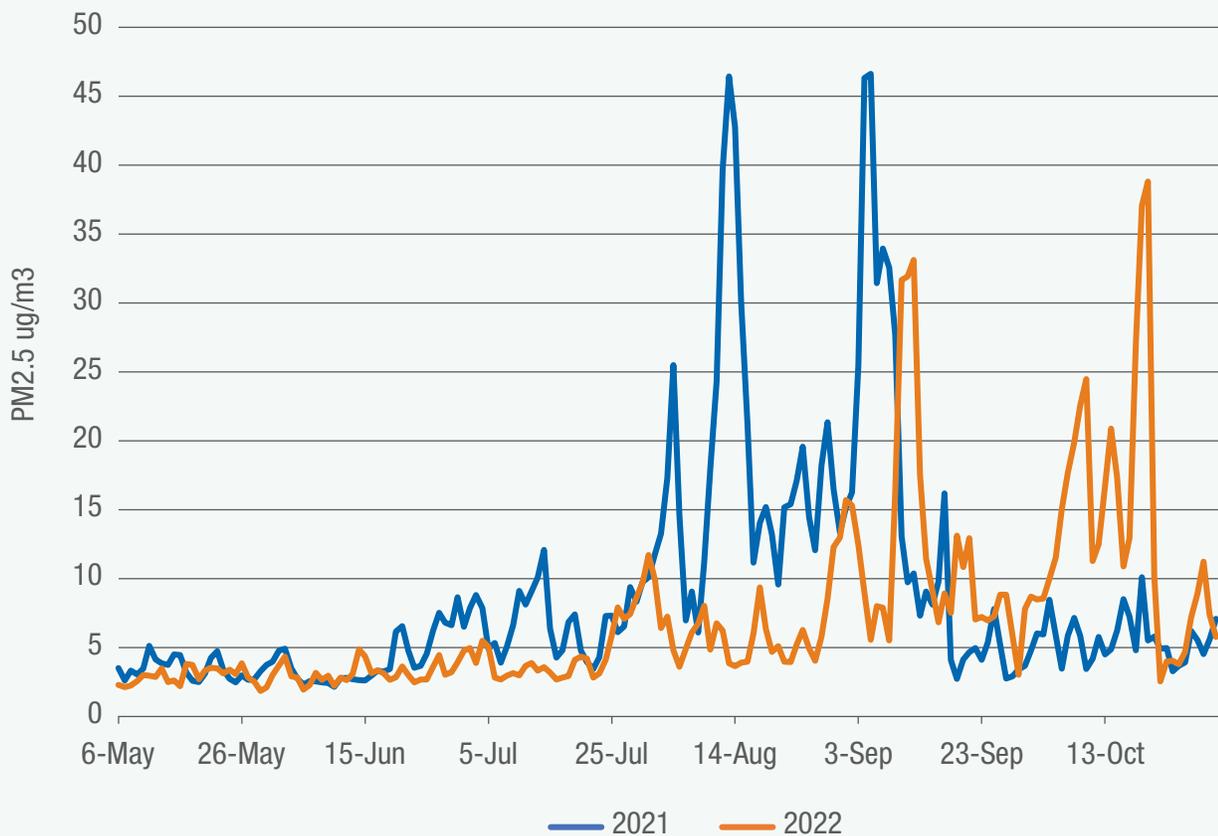
and non-Hispanic white populations in 2020, 2021 and 2022; this could indicate smoke's disproportionate effect on the oldest age groups.

Research including 95.1 percent of the population across Oregon, California and Washington indicated that in some counties, high levels of PM 2.5 increased risks of COVID-19 cases and deaths. [19] The following populations are at higher risk of negative effects from wildland fires and poor air quality exposures:

- People lacking shelter
- People with chronic conditions
- People with disabilities
- People working outdoors
- People serving as front line responders
- People with limited savings or low incomes, and
- People without insurance or who are under-insured.

Many of the populations listed above also may experience barriers to accessing air filtration devices or other residential or community cleaner air spaces.

**Figure 8: Statewide 24-hour average PM2.5\* from May 1 to Oct. 31, 2021 and 2022**



\*PM2.5 = fine particulate matter

## Clackamas, Washington and Multnomah counties' climate and health monitoring partnership

In fall 2021 Clackamas, Multnomah and Washington counties released their [second Regional Climate and Health Monitoring Report](#), updating [the 2019 Regional Climate and Health Monitoring Report](#) with additional data for 2018–2020. The report documents the health impacts of extreme weather, disease and poor air quality — indicators affected by the climate crisis that threaten the health and mental well-being of the region's 1.8 million residents.

The report:

- Documents events through December 2020 and discusses connections between mental health and climate change
- Emphasizes that systemic racism and discrimination unjustly distribute the impacts and burdens of climate change among people living on low incomes and communities of color, and
- Explores how our environmental conditions combined with individual factors determine community vulnerability and resiliency.

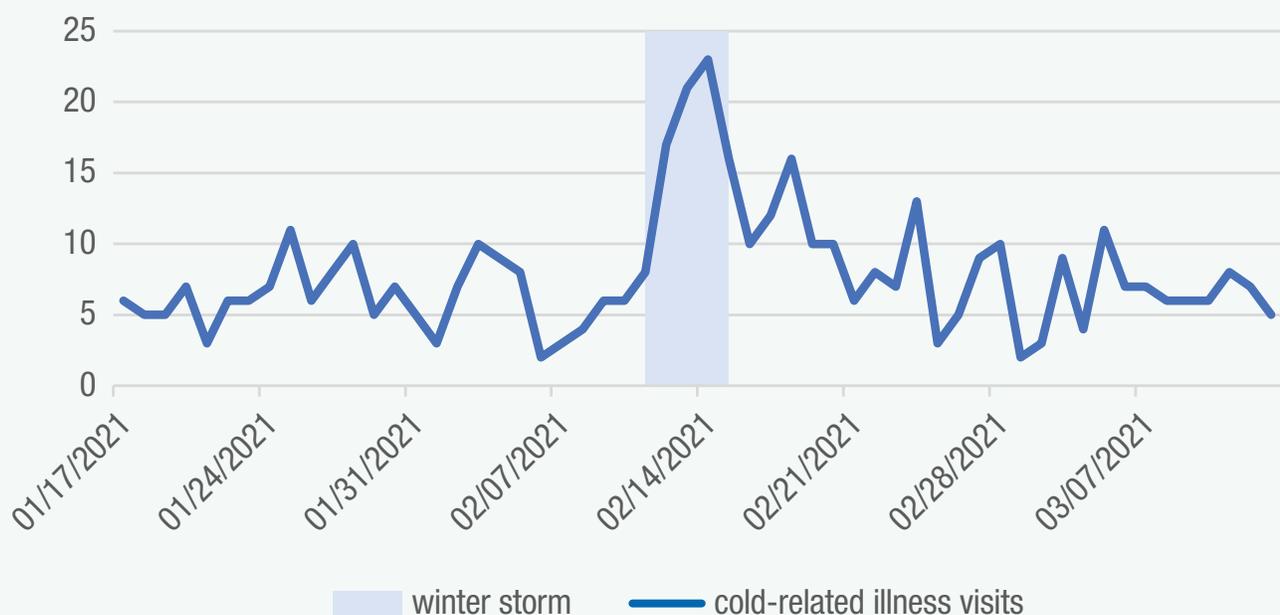
One of the report's key takeaways: Asthma-related emergency room visits in the Portland-Metro region increased by nearly one-third in the four weeks during and after wildfires in summer and fall 2020.



## 2021 winter storm impacts

In February 2021, a five-day winter storm (Feb. 11–15) brought snow (more than six inches in some locations), sleet, freezing rain, wind, below freezing temperatures and ice (more than an inch in some areas) across at least nine counties in Oregon. [38] This created multiple days of power outages affecting more than 330,000 Oregonians, road closures and frozen water pipes. The Governor declared a state of emergency on Feb. 13 in nine counties due to the storm ([Executive Order 21-02](#)). Estimated property damage from ice, particularly to trees, was more than \$26 million. [39] This storm was also declared a federal disaster, which made federal aid available for state, Tribal and local recovery efforts. See 2021 [February Winter Storm Spotlight](#) for more details. Emergency department and urgent care visits for hypothermia and frostbite increased during the winter storm (Figure 9). To prevent negative health impacts to our community’s most vulnerable, many cities kept warming centers open during the storm weekend. Evidence shows winter storms in the United States have increased in frequency and intensity since the 1950s. The role of climate change in this trend is still being studied. [24] Given historical trends, the projected increase of severe winter storms in the United States, and our current experience of severe storm impacts in Oregon, this event is worth noting as an environmental hazard in this report. [40]

**Figure 9. Hypothermia and frost bite visits to emergency departments and urgent care centers, mid-January through mid-March, 2021**



# Groundbreaking investments in environmental health, community resilience and equity

Unprecedented events have required groundbreaking responses. Oregon has responded to the pandemic and ongoing climate challenges with new adaptations and resilience-building efforts. Many of these efforts have come from collaboration within and across communities. They have involved community-based organizations and local and regional government agencies. In this report, we highlight Oregon’s investments and initiatives during 2021 and 2022. These are summarized in Figure 10 and described in more detail in the sections below. In future reports, we will highlight the outcomes of these local and community-based adaptation efforts.

**Figure 10: Summary of selected state climate resiliency investments and initiatives**

Climate-related stressor	State level resiliency investment or initiative
<b>Cross-climate threats</b>	<ul style="list-style-type: none"> <li>• Public health modernization: Climate and health adaptation and planning funding for community-based organizations, Tribes and local public health authorities*</li> <li>• Funding for households to make their homes more resilient to climate impacts<sup>†</sup></li> <li>• Obtaining federal approval of Oregon’s Medicaid waiver allowing use of funds to address climate risks to people on the Oregon Health Plan<sup>‡</sup></li> <li>• Strengthening water infrastructure<sup>§</sup></li> <li>• New rules that protect workers from extreme heat and wildfire smoke<sup>  </sup></li> <li>• Investments in behavioral health</li> <li>• New environmental justice mapping tool to inform state agency decision-making<sup>¶</sup></li> </ul>
<b>Wildfire and wildfire smoke</b>	<ul style="list-style-type: none"> <li>• Building code and defensible space requirements, wildfire risk mapping, increased forest management resources, land use zoning, electric utility systems requirements<sup>††</sup></li> <li>• Increasing housing supply in communities affected by wildfire</li> <li>• Air filtration devices for residential and community cleaner air spaces<sup>††</sup></li> <li>• Community response planning for smoke events<sup>††</sup></li> </ul>
<b>Extreme heat</b>	<ul style="list-style-type: none"> <li>• Air cooling devices for residential and community cleaner air spaces<sup>**</sup></li> </ul>

\* Public health modernization funding provided in the OHA budget by the 2021 Legislature

† House Bill 2842 Healthy Homes Grant Program enacted by the 2021 Legislature

‡ Oregon 1115 Medicaid waiver

§ Water infrastructure funding the 2021 Legislature provided to various agencies in House Bill 5006

|| Governor’s Climate Executive Order 20-04, implemented by Oregon Occupational Safety and Health with support from OHA

¶ House Bill 407 Environmental Justice enacted by the 2022 Legislature

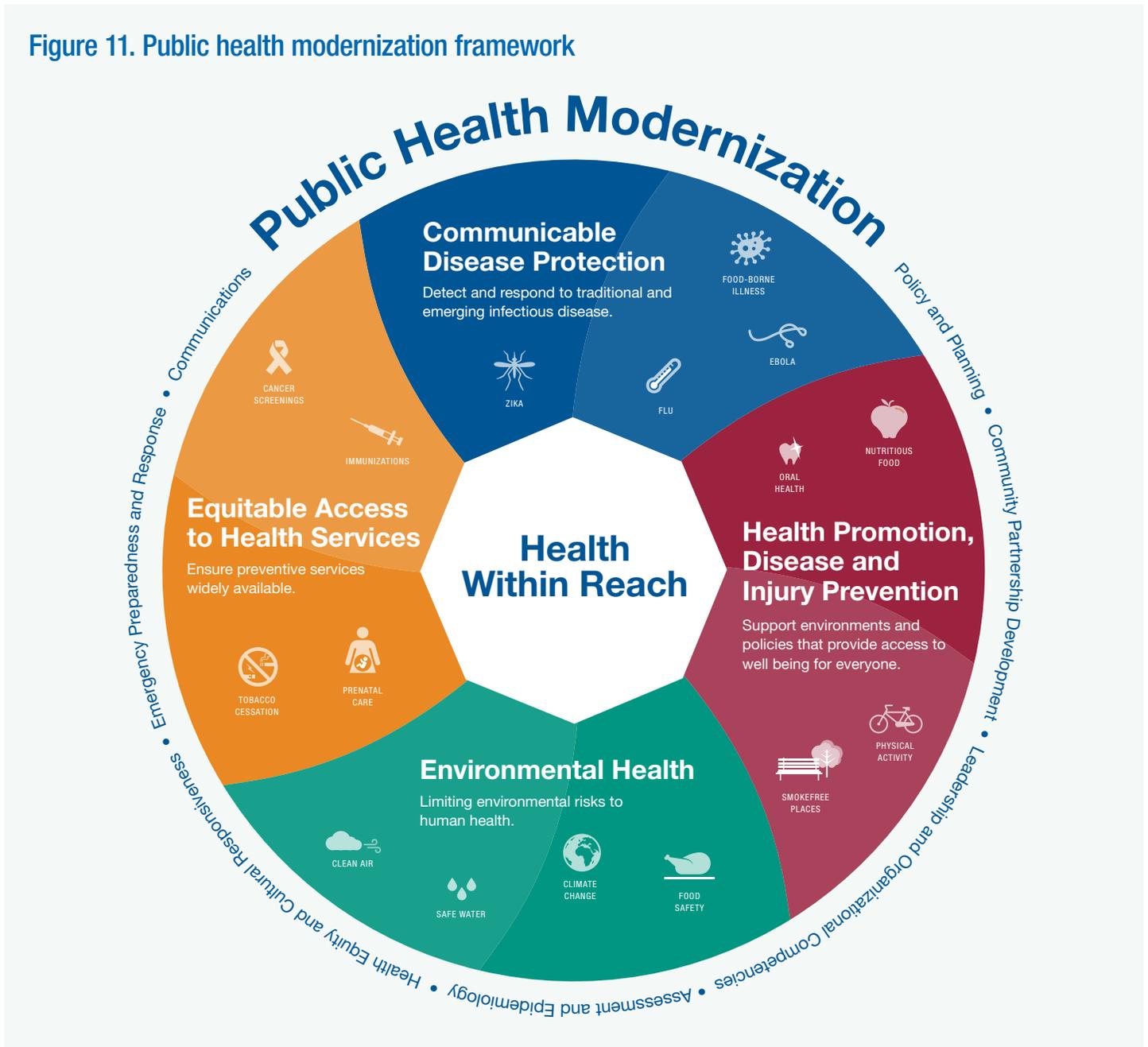
†† House Bill 1536 Emergency Heat Relief Act enacted by the 2022 Legislature

\*\* Senate Bill 762 Omnibus Wildfire Bill enacted by the 2021 Legislature

# Public health modernization

The Oregon Health Authority received a \$60.6 million investment of general funds for public health modernization over the 2021–23 biennium. Public health modernization supports OHA’s goal to eliminate health inequities by addressing complex public health problems. Modernization recognizes and funds health equity, community partnership development, emergency preparedness, communicable disease control and environmental health as foundational areas in public health, as shown in Figure 11. This modernization framework includes preventing disease and injury, the spread of illness, equitable access to health services and investing in environmental health work that includes our climate, air, water and food systems. [41]

Figure 11. Public health modernization framework



The 2021 Legislature appropriated public health modernization funds to the following groups to address community-identified priorities including environmental health risks and climate adaptation strategies:

- Oregon’s nine federally recognized Tribes (\$4.4 million)
- Community-based organizations (\$10 million), and
- Local public health authorities (\$33.5 million).

OHA received \$12.8 million to strengthen state-level programs and technical support capacity, with a portion of those funds supporting environmental public health capacity with a climate focus. This includes:

- Supporting partnerships across communities and agencies for promoting environmental health benefits, preparedness planning, community engagement and response capacity
- Identifying top health risks and those most exposed to those risks in order to develop comprehensive environmental health strategies
- Co-creating local solutions to environmental hazards that support equitable climate adaptation, and
- Identifying opportunities to maximize health benefits in land use, transportation, housing, energy, food and other systems shaped by public policies and investments.

These investments are supporting ongoing community efforts responding to multi-layered crises. As part of Oregon’s COVID response, OHA engaged more than 170 CBOs statewide to reach community members. These investments supported organizations linking community members with resources and increasing social resilience, or the capacity to manage a crisis such as the global pandemic.

**Community-based organizations (CBOs).** The Oregon Health Authority’s (OHA’s) Public Health Division is currently funding 157 CBOs with a total of \$31,008,318 to lead community-driven, culturally responsive public health interventions to help eliminate health inequities. This new program is momentous; it reflects a coordination of eight different OHA programs coming together to center health equity and community priorities in one centralized funding opportunity. Modernization represents an opportunity for OHA to invest in community partnerships and recognize CBOs as part of Oregon’s public health system. CBO award decisions were made with an equity lens and resulted in a distribution across geographies among CBOs serving culturally specific communities and people with disabilities.

Of the 157 CBOs, OHA awarded 35 to carry out climate resilience and emergency preparedness work in their communities. The climate-funded projects are wide ranging — from urban tree planting to developing youth leadership programs. Most CBOs incorporated elements of community resilience into their climate projects. These elements included needs assessments, listening sessions, storytelling, coalition building or other types of relationship-building. Many crafted their projects to address the impacts of climate disasters and address gaps in inclusive risk messaging and risk reduction strategies for their communities.

**Local public health authorities (LPHA).** Local public health authorities (county health departments) received \$33.4 million and Tribal health departments received \$4.3 million in modernization funding. These grants supported a range of public health activities including climate and health resilience work and emergency preparedness. LPHAs are using funds to develop local or regional climate adaptation plans or incorporate climate and health components into their community health assessments and plans.

While the LPHAs have historically received public health modernization funding to implement foundational public health capabilities, this is the first time the Legislature has explicitly asked them to integrate climate adaptation planning in this way. This is new work to many of our county partners. Recognizing a growing need, LPHAs have begun convening a community of practice to share resources and ideas, to learn from one another's successes and challenges, and to open the door for regional collaborations.

**Nine Federally Recognized Tribes of Oregon.** Federally recognized Tribes, the Urban Indian Program and the Northwest Portland Area Indian Health Board (NPAIHB) received \$4.8 million to modernize public health systems that serve Tribes and Native people in Oregon. Public health modernization funding in the prior biennium helped Tribes assess their public health system and identify their respective priorities and action plans. Priorities and plans are unique to each Tribe and based on the needs identified in their assessment. In this biennium, some of the modernization funds went toward bolstering capacity in environmental health, emergency preparedness and traditional ecological knowledge. Specific accomplishments include establishing an alert system to notify Tribal members during an emergency and distributing individual and family emergency preparedness kits.

## Healthy Homes Grant Program

In 2021 the Oregon Legislature established a Healthy Homes Grant Program within the Oregon Health Authority with \$10 million in funding. The goal is to help Oregonians make their homes more resilient to climate and weather impacts (see [House Bill 2842](#) and the Wildfire recovery section, below) and carry out

home repairs and rehabilitation. The Legislature also invested \$9.5 million in the Agriculture Workforce Tax Credit Program and housing repairs to ensure essential workers have safe, affordable housing (see [House Bill 2433](#)).

## Medicaid waiver

In 2022, Oregon received approval for a Medicaid waiver renewal application to increase support for people most affected by climate and weather events. This makes Oregon the first state in the country to cover climate change expenses for certain low-income patients under its Medicaid Program. Beginning in 2024, Medicaid will cover payment for devices such as air conditioners and air filters for Oregon Medicaid members with health conditions who live in an area where the federal government or the Governor has declared an extreme weather emergency.

## Water infrastructure

Over the 2021–23 biennium, Oregon will invest more than \$530 million in water infrastructure to support access to clean water and to make the infrastructure safer and more resilient (see [House Bill 5006](#)). More than half, \$275.7 million, is for improvements to drinking water, wastewater and stormwater infrastructure. The remaining funds focus on repairs, regional and basin-specific projects, planning, modernizing data collection and technology for monitoring, water quality improvements and community support, and more. Details can be found on pages [26 to 29 of House Bill 5006](#). The federal 2021 Bipartisan Infrastructure Law funding for public drinking water supply and quality will supplement the state's investment to build resilience to climate-driven hazards. [42]

## Worker protections for extreme heat and smoke

Governor Kate Brown's Executive Order 20-04 directed OHA to support Oregon Occupational Safety and Health (OR-OSHA) in developing rules to protect outdoor workers from wildfire smoke and excessive heat. The agencies, informed by a rulemaking advisory committee, developed standards requiring employers to do the following:

- Provide outdoor workers training about heat and smoke risks
- Provide supplies (for example, respirators, shade, cool water), and
- Implement administrative measures (for example, altered work schedules) to reduce risk of health impacts from smoke and excessive heat.

OR-OSHA adopted permanent rules that took effect in June (heat) and July (smoke) 2022. These rules make Oregon the country's leader in protecting outdoor workers from these climate change-driven hazards. [43]

## Mental health and behavioral health

Even before the pandemic, the United States, and Oregon in particular, was experiencing a growing mental health crisis. COVID-19 dramatically intensified this crisis. The 2021 Legislature invested \$15 million for mobile mental health crisis intervention teams and behavioral health supports including a crisis center for calls, texts, chats and suicide prevention (see [House Bill 2417](#)). These investments are not specific to climate change. However, they help address mental health impacts of these increasingly frequent climate-related events. Governor Kate Brown's 2020 climate EO 20-04 directed OHA to prepare a study of climate change and youth mental health and depression. OHA worked with mental health professionals, educators and youth organizations to highlight these impacts and issued the "Climate Change and Youth Mental Health in Oregon" study in June 2022.

## Environmental Justice Council and mapping tool

In March 2022, the Oregon Legislature passed HB 4077, which strengthens and diversifies the state's Environmental Justice Task Force, now called the Environmental Justice (EJ) Council. This bill directs the EJ Council to oversee creating an environmental justice mapping tool to provide geospatial information about environmental justice impacts and provide guidance for state agencies when adopting rules and policies. This type of tool increases state agencies' capacity to prioritize populations that experience disproportionate risks of environmental exposures. It may inform where to focus state climate resilience investments (see "Public health modernization" section) and programming.

## Wildfire recovery: risk reduction, clean air spaces and water systems

The 2021 Oregon Legislature invested more than \$600 million across multiple state agencies for wildfire prevention, mitigation and recovery in wildfire-prone areas (see [Senate Bill 762](#)). This included strengthening electric utility systems, mapping wildfire risk, establishing requirements for defensible space around structures, resilient land use zoning and building, emergency planning, forest treatments to reduce wildfire risk, and more. Of this investment,

- OHA received \$4.7 million to provide residential smoke filtration devices to those with lower incomes and/or people with high-risk medical conditions.
- Oregon Department of Human Services received \$5.1 million for grants to equip public buildings with smoke filtration systems so they can become emergency clean air stations, and

- The Oregon Department of Environmental Quality received \$3.3 million to help local jurisdictions develop community response plans for smoke from wildland fires.

As of 2019, Oregon had 3.5 times more people lacking shelter and experiencing houselessness than the national average. [44] Because these communities are among those most vulnerable to extremes from fires and temperatures, any investment in shelter and housing may reduce climate-related health impacts. The 2021 Legislature invested \$27 million to increase shelter capacity statewide (see [House Bill 2004](#) and [House Bill 2006](#)) to improve services to Oregonians experiencing houselessness. The Legislature invested the following related specifically to impacts from the 2020 wildfires:

- \$100 million for housing development needs and direct survivor assistance (see summary, [House Bill 5006](#) and [Senate Bill 5534](#))
- \$30 million to increase housing supply in wildfire-affected communities (see summary, [House Bill 5006](#) and [Senate Bill 5534](#))
- \$20 million for land acquisition in wildfire-affected communities (see summary, [House Bill 5006](#) and [Senate Bill 5534](#)), and
- \$375,000 to OHA to fund continued testing of [wildfire-affected domestic wells](#) and small water systems (see [House Bill 5024](#)).

In 2022, The Oregon Legislature approved [Senate Bill 1536](#), also called the Emergency Heat Relief Act. The bill invests millions for OHA, the Oregon Department of Human Services and the Oregon Department of Energy to establish grant programs that help people most vulnerable to extreme heat, cold and poor air quality. It establishes or expands grant programs that help pay for cooling systems, provide portable air conditioners, and promote community shelters for cooling and heating.



# Looking ahead

Starting in 2010, OHA's Climate and Health Program has worked to describe and increase awareness of Oregon's growing climate change health risks. The program's goal is to better anticipate and take steps to reduce harm. Over the last several years, communities and decision-makers across the state experienced many of these health effects directly due the 2020 Labor Day wildfires, the heat dome in 2021 and regional chronic wildfire smoke impacts.

This report describes the investments community-based organizations, local jurisdictions, Tribes and the state are making to reduce climate and health impacts and build climate resilience. Beginning in 2023 and through the next five to 10 years, Oregon anticipates receiving significant federal funding for measures that both reduce greenhouse gas emissions and provide significant economic and health benefits. These measures include weatherization and electrification of homes and vehicles to increase indoor and outdoor air quality and protection from extreme temperatures.

Going forward, OHA plans to develop annual "Climate and Health in Oregon" reports to spotlight the communities most affected by climate disruptions. The reports will also highlight the innovative actions communities, government agencies and Tribes are taking to protect the health of people in Oregon and the planet.



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# Appendix A: Summer 2021 ESSENCE Hazard Report

For more information on syndromic surveillance and the purpose of seasonal hazard reports, please see the last page of this report.

## HOW TO READ THESE CHARTS

Visit counts for each day are color-coded in the charts to the right.

Blue dots indicate normal visit counts. Yellow or red dots mean the counts for that week are higher than expected. A warning or alert does not necessarily indicate an event of public health significance. We are looking for sudden or sustained increases in visits.

Declines in current-day data are expected as data are not yet finalized.

**TOTAL VISITS QUERY** includes all visits to EDs and participating urgent care centers across the state. This query shows the total burden to the Oregon healthcare system and provides context for the queries and syndromes shown below.

**Published: August 16, 2021**

## SUMMARY:

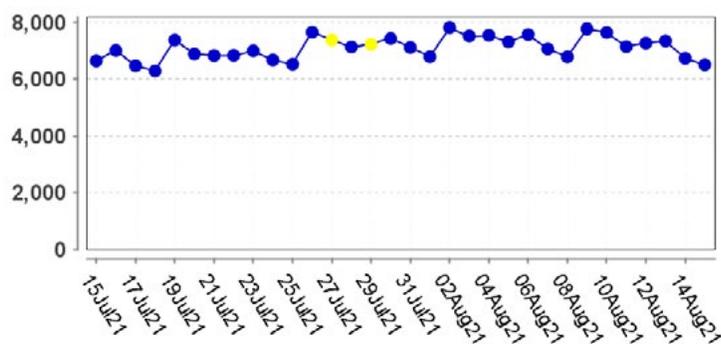
This report includes total daily counts of ED and urgent care visits in Oregon and counts for heat-related illness, asthma-like complaints, submersion events, and harmful algal bloom exposures through August 15, 2021.

## WHAT ARE YOU SEEING?

- Visits for heat-related illness have returned to expected levels.
- No increases for total visits or asthma-like visits, submersion events, and visits related to cyanobacteria blooms.

Summer hazard-related visits can be associated with outdoor conditions, extreme weather events, or recreational activities. The charts below show visit counts matching each query. See the left sidebar for more information on how to read the charts.

## TOTAL VISITS QUERY



## FINDINGS

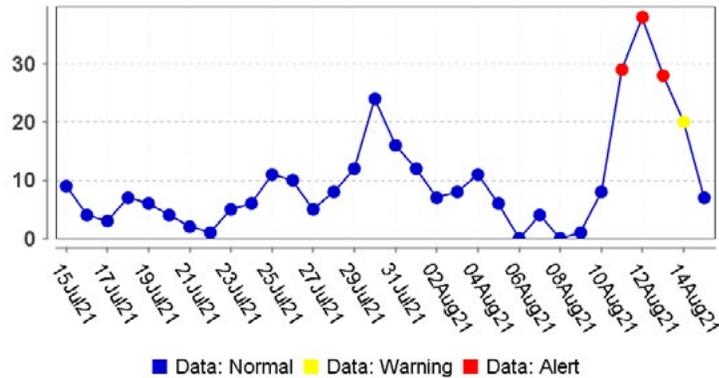
■ Data: Normal ■ Data: Warning

In this chart, we see that total visits are currently at expected levels.



## HEAT-RELATED ILLNESS (HRI) QUERY

**HEAT-RELATED ILLNESS (HRI) QUERY** looks for the codes for HRI (including ICD-9 code 992 and ICD-10 code T67) or words like “heat,” “sun stroke,” and “hyperthermia.”

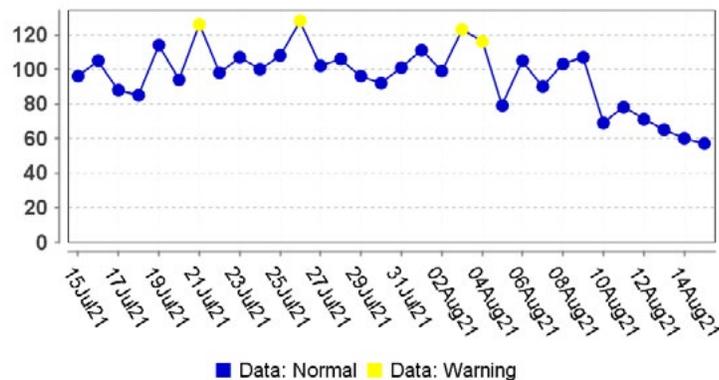


### FINDINGS

In this chart, we see that HRI visits have returned to expected levels after a recent peak. This is probably due to warmer weather experienced in some parts of the state during those time periods. To reduce the risk of HRI, drink plenty of fluids, wear light colored clothing and sunscreen, and schedule outdoor activities during cooler times of the day.

## ASTHMA-LIKE QUERY

**ASTHMA-LIKE QUERY** looks for the code for asthma (ICD-10 code J45) or words like “asthma” and “reactive airway disease.”



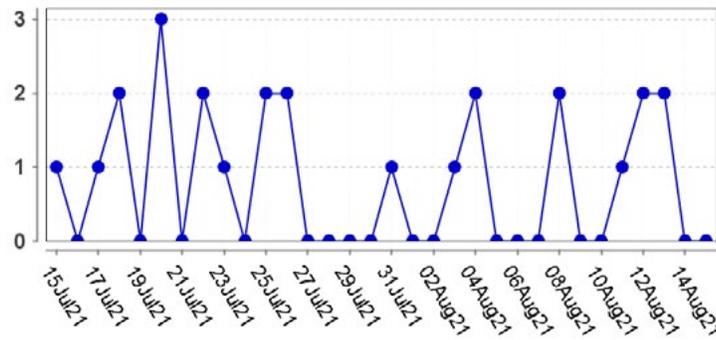
### FINDINGS

In this chart, we see that visits for asthma-like complaints are currently at expected levels. Summer hazards such as poor air quality, smoke, extreme heat, and even thunderstorms can trigger asthma attacks. Avoid outdoor activities when air quality is unhealthy.



## SUBMERSION AND NON-FATAL DROWNING QUERY

**SUBMERSION AND NON-FATAL DROWNING QUERY** looks for the codes for “non-fatal drowning” (ICD-9 code 994.1 and ICD-10 code T751) or words like “drown” or “under water” as long as the patient doesn’t say it “feels like drowning.”



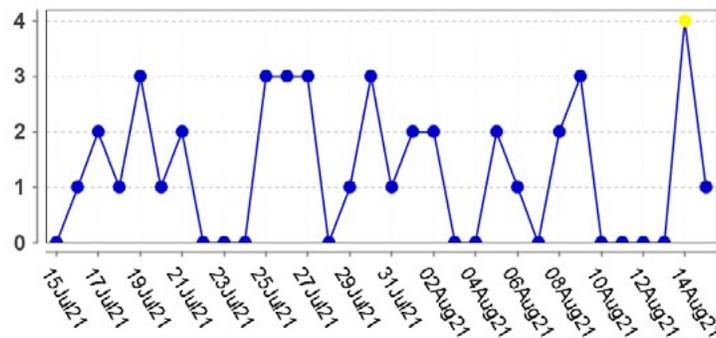
### FINDINGS

■ Data: Normal

In this chart, we see that visits for submersion events are currently at expected levels. Most drowning deaths and injuries are preventable. Many visits were for children. Always supervise children when they are in or near water, including bathtubs. Wear personal flotation devices when out on boats, near open bodies of water or participating in water sports. Learn how to swim and how to perform CPR. Never swim alone, and always wear a personal flotation device when boating.

## CYANOBACTERIA BLOOMS (HARMFUL ALGAL BLOOMS)

**CYANOBACTERIA BLOOMS** looks for the GI syndrome along with words like “lake” or “swim” or “river”. This query does not look for diagnosis codes.



### FINDINGS

■ Data: Normal ■ Data: Warning

In this chart, we see that visits related to cyanobacteria exposure are currently at expected levels. This query looks at visits that include a subset of symptoms that may be related to recreational exposure to cyanobacteria exposure. Be on the watch for cyanobacteria blooms when recreating in Oregon lakes, rivers and reservoirs.



**VISIT INFORMATION** is collected from EDs and urgent care centers across the state. Currently, all 60 eligible hospitals are sending ED data every day for syndromic surveillance. Some urgent care centers are currently reporting, and we are in the process of onboarding more.

**SEASONAL HAZARDS** for summer include elevated temperatures and dry conditions, which can lead to wildland fires and unhealthy air quality in the Pacific Northwest. Water-related activities include the risk of submersion, drowning, or exposure to harmful algal blooms.

**MONITORING** Oregon ESSENCE provides key information on population health during seasonal hazard events. ESSENCE users can now reproduce these queries themselves and look at regional health effects not captured in the statewide view by following instructions posted at [www.healthoregon.org/essence](http://www.healthoregon.org/essence)

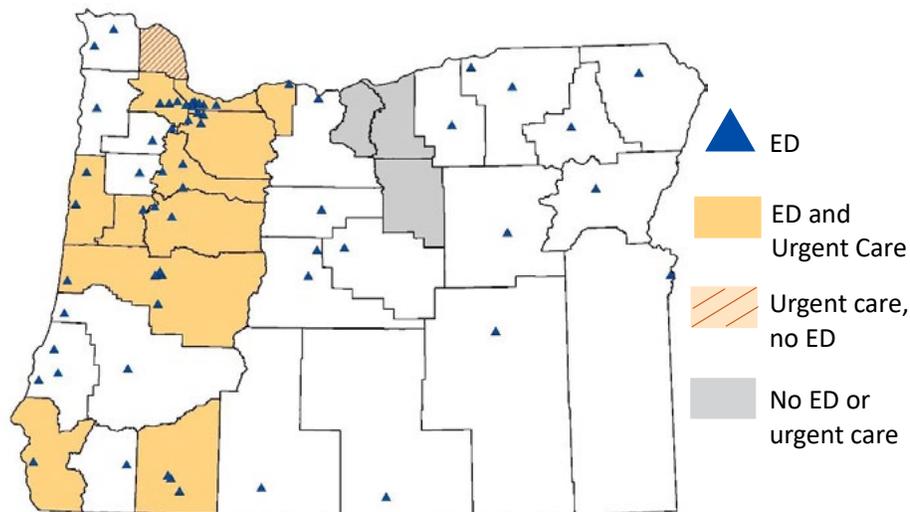
**SYNDROMIC SURVEILLANCE** is the near real-time monitoring of key health indicators in emergency department (ED) and urgent care visits. Oregon’s syndromic surveillance project (Oregon ESSENCE) tracks the number of visits for specific patient symptoms using chief complaints (what the patient says is the reason for their visit) and discharge diagnosis codes. We look at symptoms associated with known health effects of seasonal hazards.

**SIMILAR SYMPTOMS** are grouped together into “syndrome” categories. For example, “wheezing” and “difficulty breathing” are grouped into the asthma-like query. By comparing the counts we see against those we would expect to see, we can identify trends in visits.

### HEALTH EFFECTS OF SUMMER HAZARDS

- Extreme heat makes many groups, including people with chronic disease, young children, older adults, and outdoor workers, vulnerable to heat-related illness (HRI). HRI refers to a variety of conditions resulting from elevated body temperatures such as heat stroke, heat syncope (fainting), heat exhaustion, and heat cramps.
- Wildfire smoke, air pollution, and pollen can exacerbate respiratory conditions such as asthma.
- Recreational activities in pools and natural waterways can lead to an increase in submersion and near-fatal drownings.
- As temperatures heat up during spring and summer, algae blooms may form in lakes, rivers, and reservoirs. Exposure to cyanobacteria can result in symptoms including skin rash, diarrhea, cramps, vomiting, numbness, and fainting.

**SYNDROMIC COVERAGE** by county is detailed in the map below.



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# Appendix B: Summer 2022 ESSENCE Hazard Report

For more information on syndromic surveillance and the purpose of seasonal hazard reports, please see the last page of this report.

## HOW TO READ THESE CHARTS

Visit counts for each day are color-coded in the charts to the right. Blue dots indicate normal visit counts. Yellow or red dots mean the counts for that week are higher than expected. A warning or alert does not necessarily indicate an event of public health significance. We are looking for sudden or sustained increases in visits. Data are considered preliminary and are subject to change.

**TOTAL VISITS QUERY** includes all visits to EDs and participating urgent care centers across the state. This query shows the total burden to the Oregon healthcare system and provides context for the queries and syndromes shown below.

**Published: August 9, 2022**

## SUMMARY:

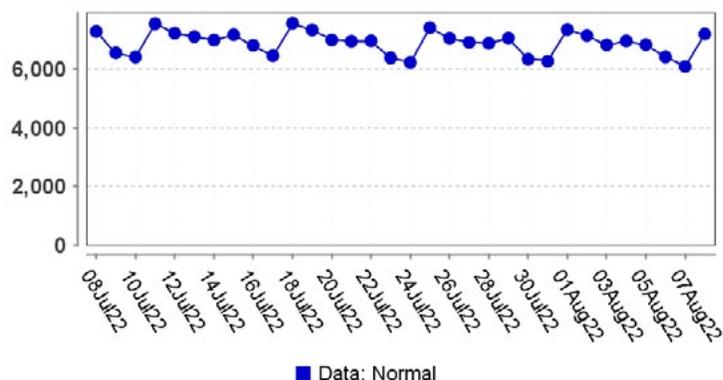
This report includes total daily counts of ED and urgent care visits in Oregon and counts for heat-related illness, submersion events, wildfire-related smoke inhalation, and air quality-related respiratory illness.

## WHAT ARE YOU SEEING?

- Visits for heat-related illness (HRI) remain steady despite recent increases in temperatures.
- No increases for total visits or visits related to submersion events, smoke inhalation, or air quality-related respiratory illness.

Summer hazard-related visits can be associated with outdoor conditions, extreme weather events, or recreational activities. The charts below show visit counts matching each query. See the left sidebar for more information on how to read the charts.

## TOTAL VISITS QUERY



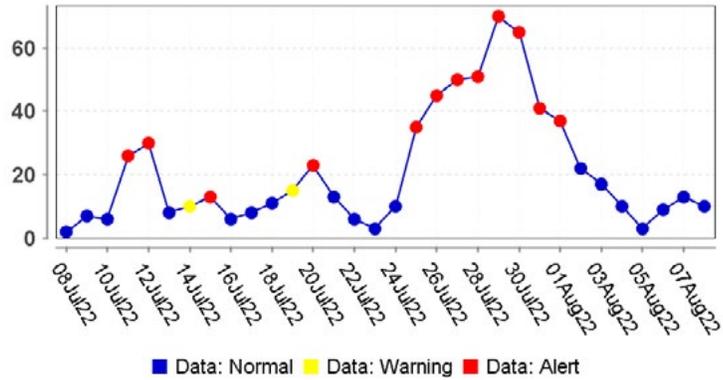
## FINDINGS

In this chart, we see that total visits are currently at expected levels.



**HEAT-RELATED ILLNESS (HRI) QUERY** looks for the codes for HRI (including ICD-9 code 992 and ICD-10 code T67) or words like “heat,” “sun stroke,” and “hyperthermia.”

## HEAT-RELATED ILLNESS (HRI) QUERY

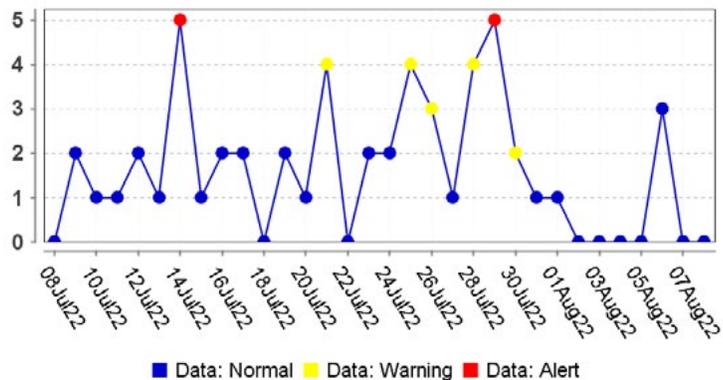


### FINDINGS

In this chart, we see a steady amount HRI visits, despite slightly warmer weather experienced in some parts of the state during those time periods. To reduce the risk of HRI, drink plenty of fluids, wear light colored clothing and sunscreen, and schedule outdoor activities during cooler times of the day. For more information, see the [Oregon Health Authority's HRI prevention website](#).

**SUBMERSION AND NON-FATAL DROWNING QUERY** looks for the codes for non-fatal drowning (ICD-10 code T751) or words like “drown” or “under water,” as long as the patient doesn’t say it “feels like drowning.”

## SUBMERSION AND NON-FATAL DROWNING QUERY



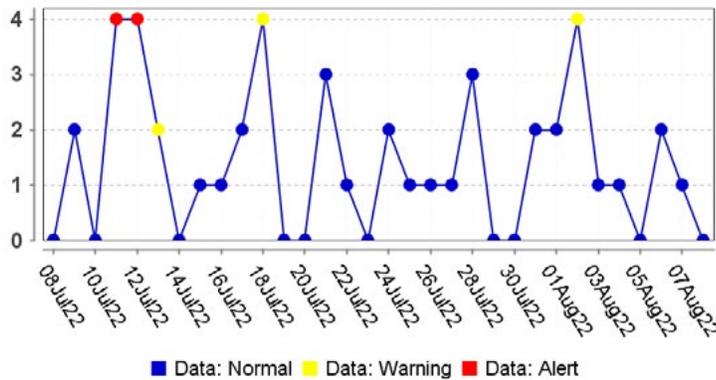
### FINDINGS

In this chart, we see that visits for submersion events are starting to rise, which usually occurs as people begin spending more time outside engaging in water activities. Most drowning deaths and injuries are preventable. Many visits were for children. Always supervise children when they are in or near water, including bathtubs. Wear personal flotation devices when out on boats, near open bodies of water or participating in water sports. Learn how to swim and how to perform CPR. Never swim alone, and always wear a personal floatation device when boating.



## FIRE AND SMOKE INHALATION

**FIRE AND SMOKE INHALATION QUERY** looks for the codes for smoke inhalation (ICD-10 code J70.5) or words like “wildfire.”

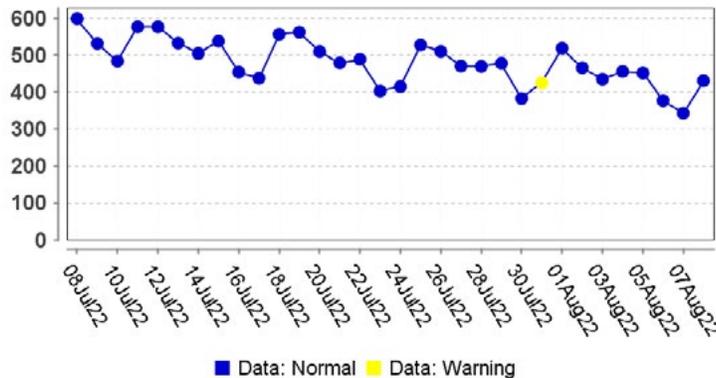


### FINDINGS

In this chart, we see that smoke-related visits are currently at expected levels. Avoid outdoor activities when the air quality is unhealthy. Check the Department of Environmental Quality (DEQ) Air Quality Index. If there is an air quality monitor near you, the website can give you information about what time of day the smoke levels are lowest. The DEQ Air Quality Index can be found on the Oregon Smoke Blog: <http://www.oregonsmoke.blogspot.com/>.

**AIR QUALITY-RELATED RESPIRATORY ILLNESS QUERY** looks for the codes for words and codes for respiratory illnesses that can be exacerbated by worsening air quality, including asthma and chronic obstructive pulmonary disease, as well as or words like “wheezing” and “shortness of breath.” This query does not include search terms for air quality.

## AIR QUALITY-RELATED RESPIRATORY ILLNESS



### FINDINGS

In this chart, we see visits for respiratory illnesses that may be related to or exacerbated by air quality conditions are currently at expected levels. Persons with asthma or other chronic respiratory diseases are more likely to have health effects from wildfire smoke. Additionally, persons with cardiovascular disease, infants, young children and the elderly, pregnant women, smokers and persons with COVID-19 are particularly sensitive to air pollution, including wildfire smoke.



**VISIT INFORMATION** is collected from EDs and urgent care centers across the state. Currently, all 60 eligible hospitals are sending ED data every day for syndromic surveillance. Some urgent care centers are currently reporting, and we are in the process of onboarding more.

**SEASONAL HAZARDS** for summer include elevated temperatures and dry conditions, which can lead to wildland fires and unhealthy air quality in the Pacific Northwest. Water-related activities include the risk of submersion, drowning, or exposure to harmful algal blooms.

**MONITORING** Oregon ESSENCE provides key information on population health during seasonal hazard events. ESSENCE users can now reproduce these queries themselves and look at regional health effects not captured in the statewide view by following instructions posted at [www.healthoregon.org/essence](http://www.healthoregon.org/essence)

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**SYNDROMIC SURVEILLANCE** is the near real-time monitoring of key health indicators in emergency department (ED) and urgent care visits. Oregon’s syndromic surveillance project (Oregon ESSENCE) tracks the number of visits for specific patient symptoms using chief complaints (what the patient says is the reason for their visit) and discharge diagnosis codes. We look at symptoms associated with known health effects of seasonal hazards.

**SIMILAR SYMPTOMS** are grouped together into “syndrome” categories. For example, “wheezing” and “difficulty breathing” are grouped into the asthma-like query. By comparing the counts we see against those we would expect to see, we can identify trends in visits.

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- Extreme heat makes many groups, including people with chronic disease, young children, older adults, and outdoor workers, vulnerable to heat-related illness (HRI). HRI refers to a variety of conditions resulting from elevated body temperatures such as heat stroke, heat syncope (fainting), heat exhaustion, and heat cramps.
- Wildfire smoke, air pollution, and pollen can exacerbate respiratory conditions such as asthma. Wildfires occur every year in Oregon and are projected to increase in frequency and magnitude. Oregon Health Authority’s [Climate and Health Program](#) is working to study and plan for the health effects of climate change in Oregon.
- Recreational activities in pools and natural waterways can lead to an increase in submersion and near-fatal drownings.

**SYNDROMIC COVERAGE** by county is detailed in the map below.

