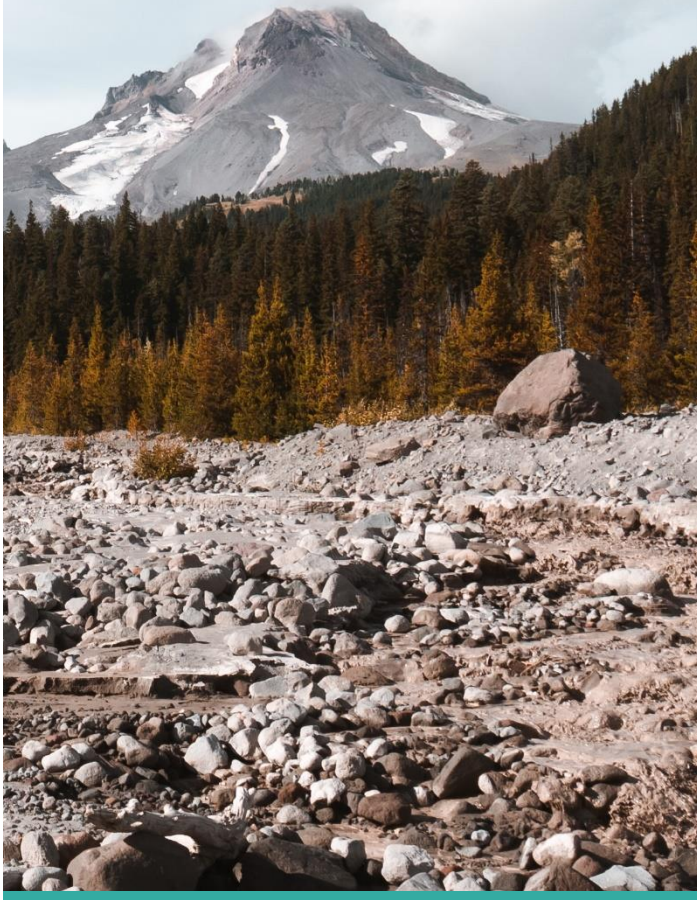
Regional Climate and Health Monitoring Report



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Health, Housing & Human Services
CLACKAMAS COUNTY

Multnomah County
Health Department

Washington County Oregon

Public Health
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Key Takeaways

- This report establishes baseline measurements of health conditions that can be influenced by climate change. It compiles data from multiple sources to capture a broader view of climate change and health.

- Climate change events likely to impact health in the tri-county region include heat waves, extreme weather events, conditions that promote the spread and growth of disease-causing insect and bacteria populations, and poor air quality.

- The effects of climate change harm some in our communities more than others. Physical, social, and work environments, as well as individual factors play important roles in determining community vulnerability and resiliency to health impacts related to climate change.

- Among the health conditions in this report, those related to poor air quality, asthma-like symptoms and allergic disease affect the greatest number of people in the region.

- Health conditions related to extreme heat are of growing concern with increasingly warmer days.

- Cross-sector partnerships and engaging communities most vulnerable to climate change are essential to strengthening regional resilience.

"Tackling climate change could be the greatest global health opportunity of the 21st century"

– The Lancet Commission

Introduction

Climate change is a major public health concern impacting the health and well-being of people living in the region. The 2018 National Climate Assessment found that the Pacific Northwest has warmed about two degrees Fahrenheit since 1900, resulting in warmer winters, declining snow pack, and more instances of high heat, drought, and wildfires. The same report found health impacts related to heat illness, infectious diseases, and drinking water quality issues.

Addressing the cause of these environmental conditions and slowing future warming rates will depend on finding ways to reduce greenhouse gas emissions.[1] Addressing the health impacts caused by climate change will require a collaborative and comprehensive approach involving health care, public health, community-based organizations, civic groups, private industry, and local and state elected officials.

The first step is understanding the ways health is impacted by climate change in the region.
The tri-county metro area is diverse, encompassing wild forest land, rich farmland, numerous rivers and lakes, and rural, suburban, and urban communities. Clackamas, Multnomah, and Washington counties operate as a contiguous region where community members cross county borders to work, live, attend school, and recreate. The three counties are the three most populous counties in Oregon. Since 2010 the regional population has increased by 11%. Regional population is not an indiciator in this report, but is an important consideration when evaluating climate change health impacts. Increases in residents create a greater burden on our transportation, health care, utility, and social service systems.

Projected impacts for Clackamas, Multnomah, and Washington counties include more extreme heat days, poorer air quality days, larger wildfires, and heavier rainfall increasing the risk of floods and landslides. Changes in our regional climate are already impacting health from deteriorated water and air quality, heat waves, and increased allergens.

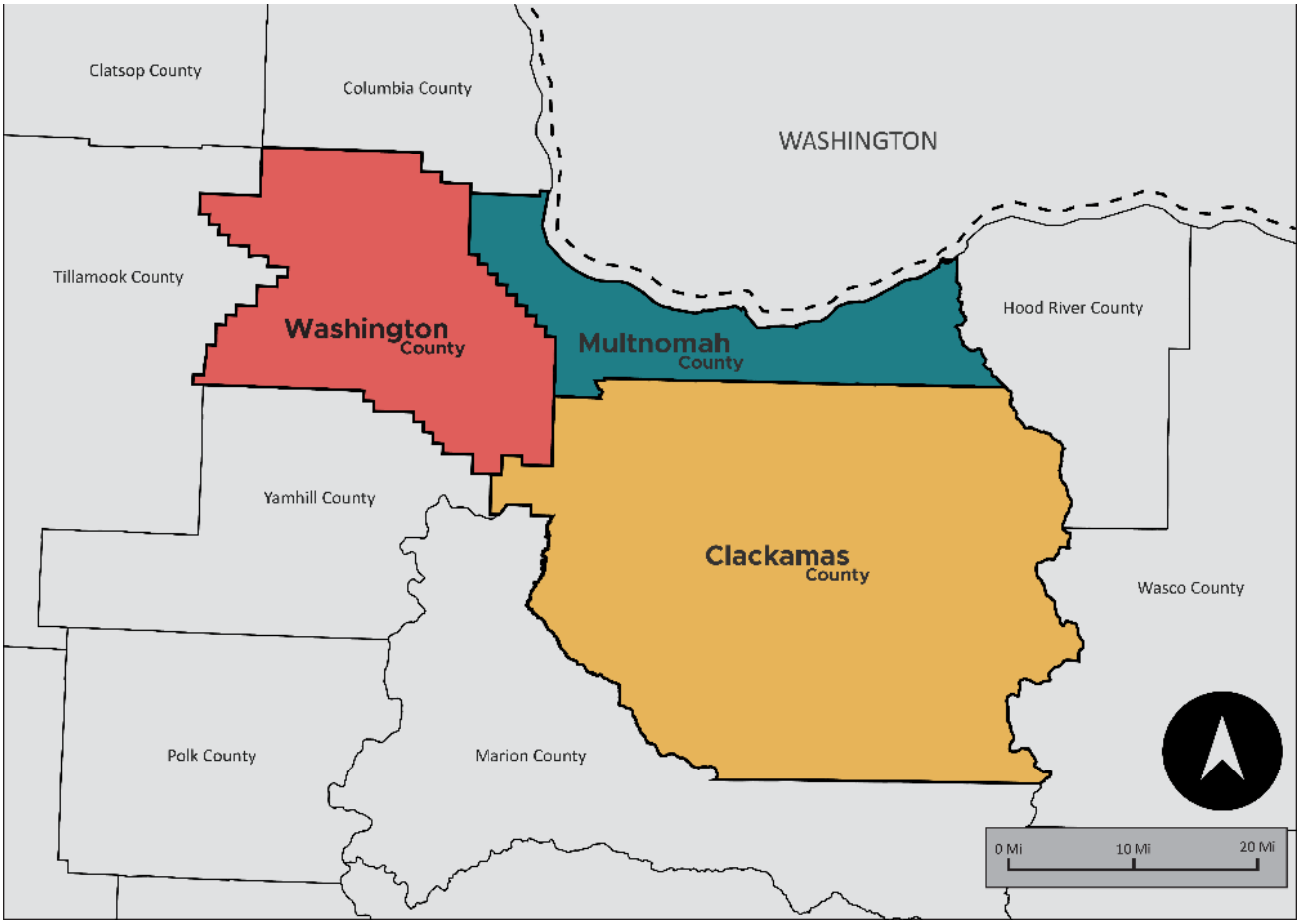


Figure 1. Tri-county regional study area.

About this Report

To date, the majority of climate and health assessment work has focused on how to address potential or future impacts. With the increased occurrence of extreme heat, flooding, and wildfires in Oregon, the need to identify the climate-related health impacts of today is urgent. **This report provides a baseline data on 12 health conditions within five environmental areas that climate change is known to affect. This data will help guide current mitigation efforts and provide a benchmark for future measurement.**

Identifying climate-related health impacts is the first step toward implementing effective preparedness and response. The region faces similar challenges that can be addressed more efficiently and effectively by working together; shared resources and infrastructure (e.g., transportation, hospitals, media) will be used collectively to prevent and respond to health concerns.

Climate Change and Health Equity

The conditions we live , learn , work , and play in are some of the strongest predictors of our overall health and well-being, including access to and availability of safe and affordable housing, jobs with fair pay, quality education, health care, and safe neighborhoods. These conditions are also shaped by current and historical forces like structural racism, including state and local policies, which favor white communities. While there has been some progress, these events have left some communities of color without social or political power to build intergenerational health, leading to and reinforcing persistent health inequities.[23]

The impacts of climate change on health vary significantly by individual characteristics and community conditions. Often, populations most vulnerable to climate change impacts are the same communities that experience health inequities.

Society has limited control over some individual characteristics like life stage or physical and cognitive ability status. Other characteristics, like housing status or some health conditions, are products of larger structural inequities and can be addressed through policy and systems changes. For low-income communities and communities of color,

Key Definitions

Health Equity
Everyone has a fair opportunity to live a long, healthy life. It implies that health should not be compromised or disadvantaged because of an individual or population group's race, ethnicity, gender, income, sexual orientation, neighborhood or other social condition.

Climate Change Vulnerability
The degree to which people are at risk from the impacts of climate change based on the intersection of individual and community characteristics, and also takes into account how well they can cope with those impacts.

Climate Change Resilience
The ability to survive, recover from, and even thrive in changing climatic conditions.

Baltimore Public Health Commission, 2017
Climate Change, Health, and Equity: Opportunities for Action. Public Health Institute, 2015.

power and resource imbalances have created unhealthy living, working, and learning conditions that put people at great risk for exposure and limits the ability of a community to recover from climate change events.[4]

The intersection of individual characteristics and community conditions is where we see the most profound health impacts of climate change. **It is essential that low-income communities, communities of color and other historically disenfranchised communities participate in climate adaptation planning as they best understand their needs and full range of health impacts. Throughout this report, the groups most impacted, either due to individual or community vulnerability, are outlined for each health impact area.**

Reporting Methods

Indicator Selection

Indicators for this benchmark were selected by a panel of public health professionals based on guidance from national organizations, regional relevance, data availability, and previous climate change work in Oregon. Table 1 below shows each indicator in this report and the database from which it was sourced.

Benchmark Period

The study period for this report is from 2010 through 2017 for all indicators except emergency department visits related to heat, asthma-like sytmptoms, and allergic disease. The collection range for these indicators is May through September of 2016-2018 due to changes in data collection methodology in the Oregon Health Authority (OHA) Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE) system.

Data Presentation

For each environmental area we provide a description of how climate change creates conditions that impact health and the groups that are most vulnerable to those impacts. These narratives are based on academic literature and local data sources. Regional counts for each indicator are the sum of cases in Clackamas, Multnomah, and Washington counties. We report a rate per 100,000 population as well as a count. We do not report rates based on five or fewer events for individual counties or for the region as a whole.

Table 1. Indicator Data Sources and Benchmark Period

	Indicator	Data Source	Time Period
Extreme Heat *(page 9)*	Heat-related Emergency Department (ED) Visits	Oregon Health Authority (OHA), Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE)	May-September of 2016-2018
	Heat-related Hospitalizations	Oregon Inpatient Hospital Discharge Data	2010-2017
	Heat-related Deaths	OHA, Center for Public Health Practice, Oregon Death Certificates	2010-2017
Extreme Weather *(page 17)*	Extreme Weather-related Injury	National Oceanic and Atmospheric Administration (NOAA) Storm Event Database	2010-2017
	Extreme Weather-related Deaths	NOAA Storm Event Database	2010-2017
Vector-Borne Disease *(page 22)*	West Nile Virus	OHA, Public Health Division	2010-2017
	Lyme Disease	OHA, Public Health Division	2010-2017
Communicable Disease *(page 27)*	Salmonellosis	OHA, Public Health Division	2010-2017
	Campylobacterosis	OHA, Public Health Division	2010-2017
	Tuberculosis	OHA, Public Health Division	2010-2017
Air Quality *(page 35)*	Asthma-Like ED Visits	OHA, ESSENCE	May-September of 2016-2018
	Allergic Disease ED Visits	OHA, ESSENCE	May-September of 2016-2018

Extreme Heat

Climate Change Connection

One of the most direct health impacts of climate change is increased exposure to higher temperatures. Extreme heat events can cause loss of internal temperature regulation and conditions including heat cramps, heat exhaustion, heat stress, heat stroke, and death.[5] Researchers estimate that extreme heat causes more deaths annually than all other weather events combined[6], and that investments to mitigate temperature increases can reduce heat-related mortalities.[7]

The Pacific Northwest has seen an increase in average annual temperatures of 1.5°F compared to the first half of the 20th century, and a further increase of 4-9°F is expected by the end of this century.[8] In 2016, the Portland region saw 13 days over 90°F, increasing to 22 days in 2017 and 29 days in 2018. Climate scientists project that most communities in Oregon will experience an increase of more than 30 days over 86°F by mid-century compared to the recent past.[9]

Groups Most Vulnerable

Exposure to heat varies with social and environmental conditions, which determine both how likely exposure is and what resources are available to adapt. In a comprehensive study of health impacts from heat, the U.S. Global Change Research Program synthesized evidence on populations especially at risk.[10] The study found evidence that the following groups face higher risk from extreme heat:

- Older adults, especially those over age 65, have an increased risk of respiratory and cardiovascular death because of reduced thermoregulation and underlying chronic illness
- People with chronic medical conditions that reduce thermoregulation (like cardiovascular disease or poor blood circulation)
- Children, who are vulnerable because they depend on others to reduce risk
- Pregnant people
- People living, working, or going to school in an urban heat island
- Communities of color are affected by structural environmental racism and decreasing access to protective factors which contribute to greater vulnerability to temperature extremes.
- Outdoor workers (Construction, road crews, farm workers)

- People with mental, behavioral, or cognitive disorders that are exacerbated by heat, or who rely on medications that interfere with thermoregulation
- People with no access to cooling systems at home
- People who are experiencing houselessness

Air conditioning is protective from heat exposure, but access is uneven and many households in the region do not have any form of air conditioning.[11] About 30% of housing units in the region do not have air conditioning.[12] Reliable county-level estimates of the prevalence of air conditioning were not available for this report, but would enhance future efforts to understand risk factors.

Indicator 1. Heat-Related Emergency Department Visits

Data Description

This indicator measures the number of visits by people seeking care at an emergency department or urgent care clinic for symptoms of heat-related illness resulting from prolonged exposure to hot weather, dehydration, and lack of acclimation.

This indicator was collected from a statewide data system (ESSENCE)[13] for analyzing visits to urgent care clinics and hospital EDs. This indicator documents ED visits for heat stress during the warm season — May through September — for the years 2016 through 2018.

Data from ESSENCE are subject to several limitations. Complete data became available beginning in the 2016 season, meaning that comparisons to earlier years are not reliable. Records are for visits, not patients, meaning that one person could be counted multiple times if they visited the emergency department more than once for the same complaint or for different complaints. Missing or incomplete records could result in undercounting.

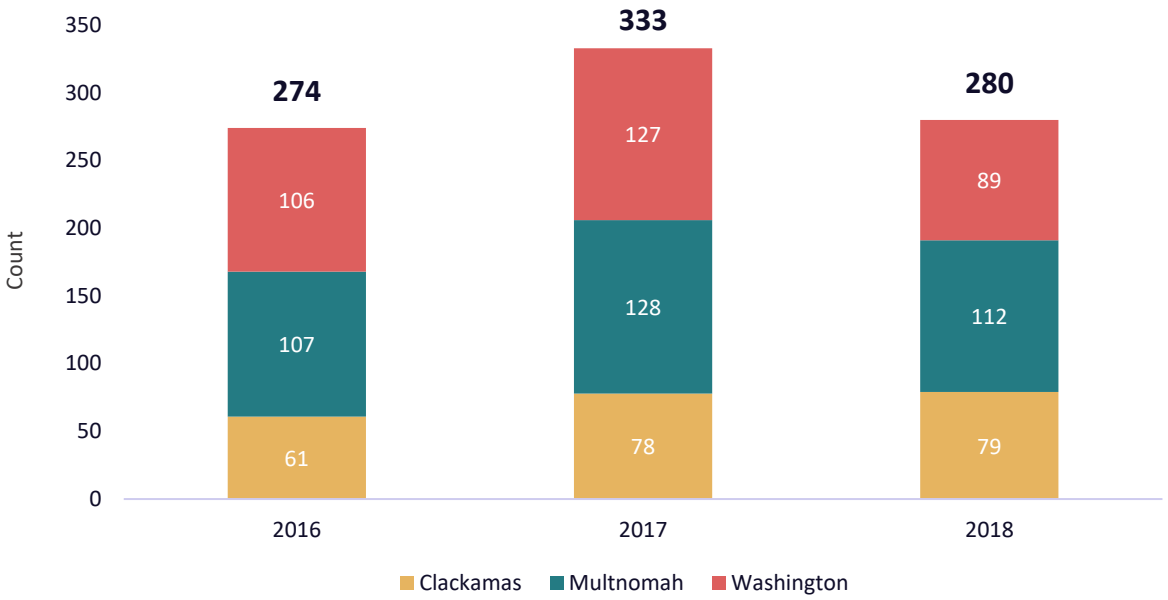
What is happening in the region

Regionwide visit counts were higher in 2017 and 2018 compared to 2016. These higher counts coincided with a greater number of high heat days over 90°F. The regional rate per 100,000 population changed from 13.5 in 2016 to 18.1 in 2018, suggesting an increase over time. On average there were about two visits each day during the warm season across the region in the three-year period of 2016-2018.

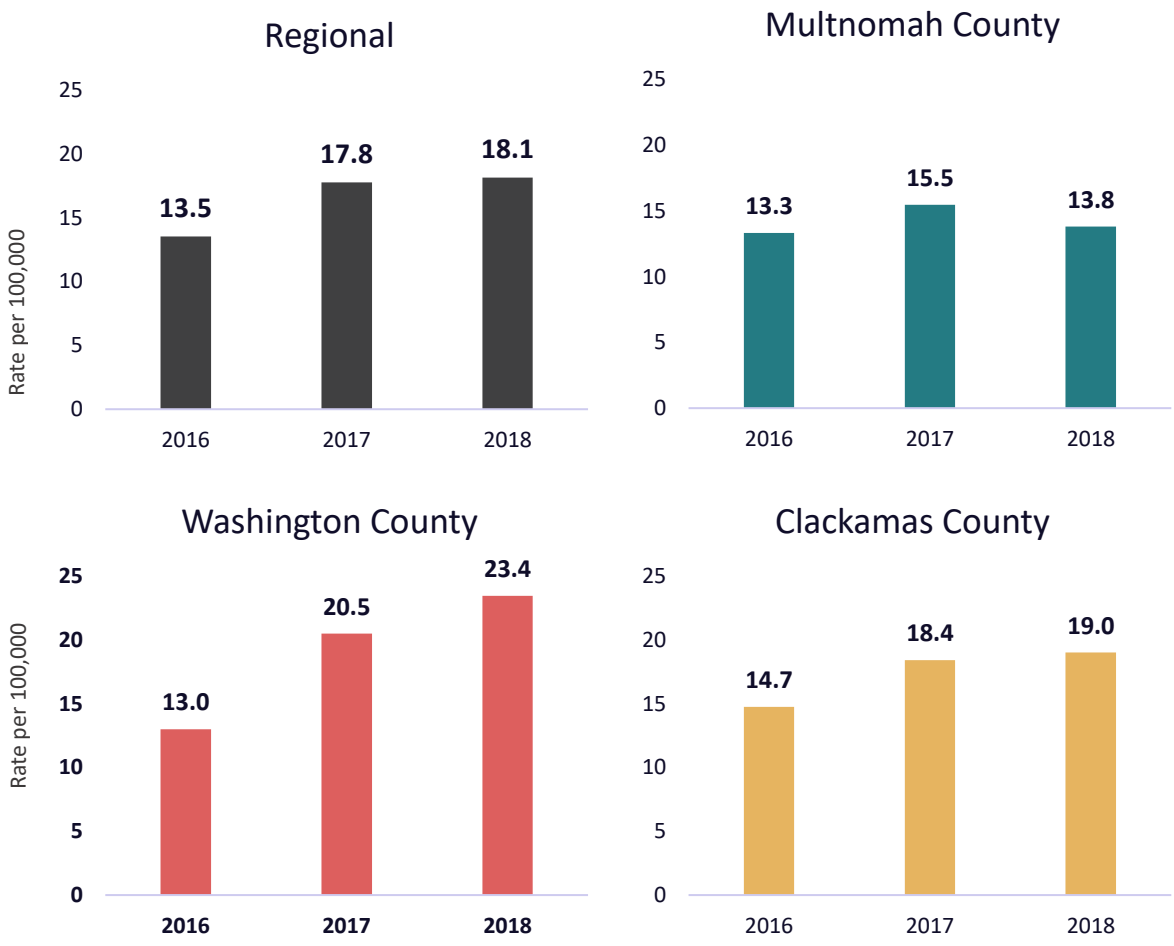
Table 2. Regional heat-related emergency room visit counts, 2016-2018, ESSENCE

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	n/a	n/a	n/a	n/a	n/a	n/a	61	78	79
Multnomah	n/a	n/a	n/a	n/a	n/a	n/a	107	128	112
Washington	n/a	n/a	n/a	n/a	n/a	n/a	106	127	89
Regional Total	n/a	n/a	n/a	n/a	n/a	n/a	274	333	280

Heat-Related Emergency Room Visit Counts



Heat-Related Emergency Room Visit Rates per 100,000



Indicator 2. Heat-Related Hospitalizations

Data Description

These records exclude out-of-state residents, admissions to federal facilities, and transfers from other hospitals. This indicator measures the number of hospitalizations with patients diagnosed of heat stress or a related condition. These cases are *in-patient* hospitalizations, reflecting health impacts from heat that are more severe or more complicated than the emergency department visits described above, and require a longer term of care.

Compiled by the Oregon Environmental Public Health Tracking Program, this indicator documents hospitalizations for heat stress during the warm season, May through September, for the years 2010 through 2017.

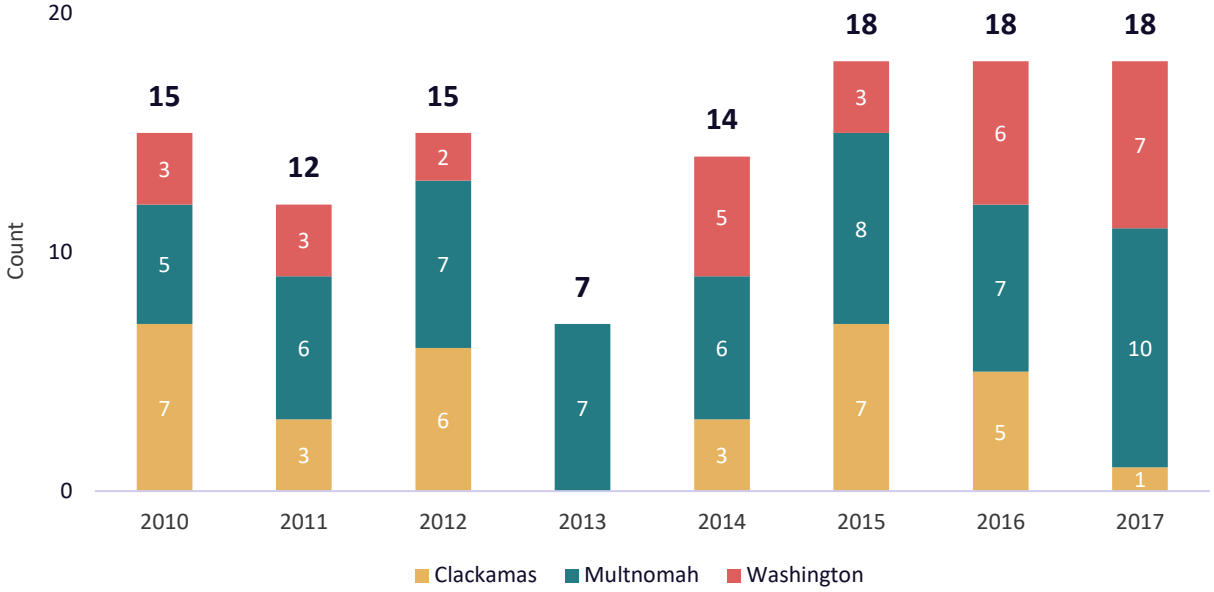
What is happening in the region

Between 2010 and 2018, there were 15 heat-related hospitalizations on average annually. Regionally, roughly one person per 100,000 was admitted for heat-related health conditions every year.

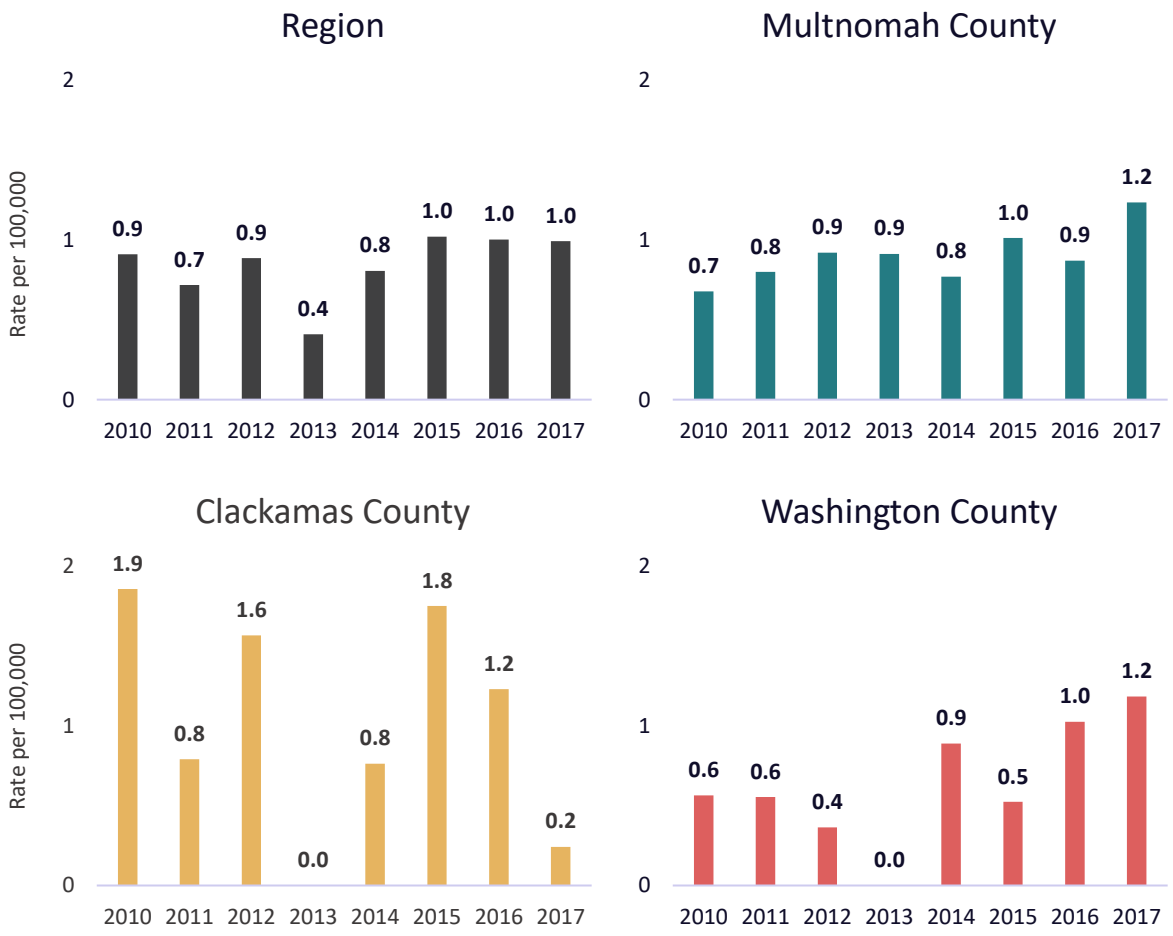
Table 3. Regional heat-related hospitalization counts, 2010-2017, OR Inpatient Hospital Discharge Data

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	7	3	6	0	3	7	5	1	n/a
Multnomah	5	6	7	7	6	8	7	10	n/a
Washington	3	3	2	0	5	3	6	7	n/a
Regional Total	15	12	15	7	14	18	18	18	n/a

Heat-Related Hospitalization Counts



Heat-Related Hospitalization Rates per 100,000



Indicator 3. Heat Deaths

Data Description

This indicator measures the count of deaths with heat exposure identified as a cause. Exposure to extreme heat can cause serious, life-threatening health effects. Examples of heat-related deaths include those from heat stroke, heat exhaustion, or dehydration.

Heat deaths are defined in death records by ICD-10 Code X30: "Exposure to excessive heat-hyperthermia," identifying heat as the main underlying cause. The data presented here are from Oregon death records for the years 2010 through 2017 by county of residence. The data presented here are unlikely to capture all deaths associated with extreme heat, only those with heat as a primary underlying cause. Heat can be associated with deaths from other heat-related mechanisms, such as drowning or violence.

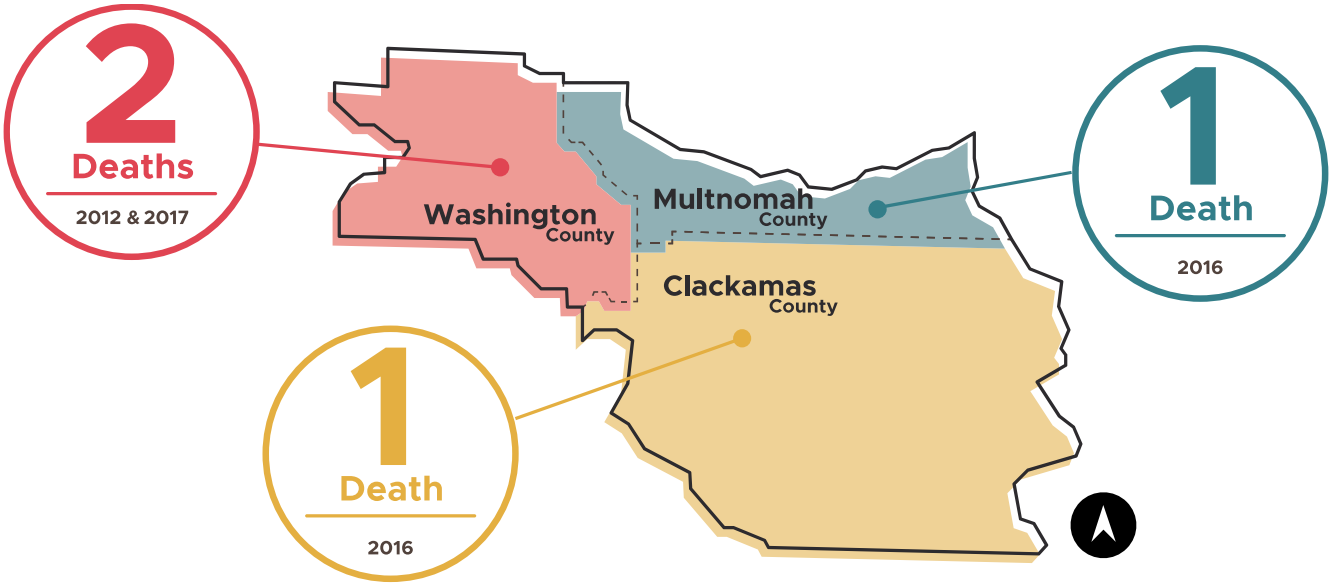
What is happening in the region

There have been very few documented heat deaths in the region within the study period. Between 2010 and 2017, no county in the region recorded more than two heat deaths.

Table 4. Regional deaths (count) caused by heat, 2010-2017, OHA

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	0	0	0	0	0	0	1	0	n/a
Multnomah	0	0	0	0	0	0	1	0	n/a
Washington	0	0	1	0	0	0	0	1	n/a
Regional Total	0	0	1	0	0	0	2	1	n/a

Heat Death Counts



Heat Death Rates

Not calculated due to small numbers

Extreme Weather Events

Climate Change Connection

Extreme weather is one of the most visible consequences of climate change. Extreme weather is a broad term that encompasses severe storms and weather-related events that cause damage and destruction. Extreme weather events could be a thunderstorm, tornado, heat wave, hurricane, hail storm, blizzard, flood, landslide, or lightning strike.[14] Changing climate conditions in Oregon are expected to create more extreme weather events in the future, likely in the form of floods, heatwaves, wildfires, and storms.[15]

Damage from extreme weather events can restrict access to essential services, including clean water, food, basic sanitation, and health care.[16,17] Trauma from the loss of friends, family, and community also creates stress and impacts mental health. This stress can grow over time if limited resources are available for mental and physical care, recovery, and reconstruction efforts.[18]

Groups Most Vulnerable

Climate change-driven extreme weather can have greater impacts on some people and communities based on their ability to prepare for, withstand, and recover from events. Learning from previous extreme weather events,[19, 20] the following groups face higher risks in extreme weather events:

- Older adults, children, people who use mobility devices, and people with disabilities who are unable to find protection from a storm
- People who have less capacity or fewer resources to gather supplies for extreme weather events, as well as to cover costs related to post-storm recovery
- People experiencing houselessness or with no access to transportation and do not have means to shelter from extreme weather events
- Immigrants and communities who are culturally or linguistically isolated and may not have access to emergency communications
- Communities of color that have experienced historic redlining, structural exclusion, or lived in areas that have not been prioritized for public works enhancements
- Communities that are geographically isolated or do not have backup systems for essential services like water, power, or travel routes damaged by extreme weather
- People living in geographically vulnerable areas such as steep slopes, flood plains, or where urban areas meet wilderness areas

Indicator 4. Extreme Weather-Related Injuries

Data Description

This indicator measures the number of injuries directly or indirectly attributed to extreme weather events. Increases in flooding, storms, and wildfires lead to more instances where people may become trapped and unable to escape. Damage to homes, workplaces, and roads increases the risk of injuries during travel or disaster recovery.

Data on injuries related to extreme weather is collected by the National Weather Service. The data is only collected for events that cause a significant level of disruption to commerce, destruction of property, or draw media attention, and therefore may not represent the full impacts from all extreme events. Some weather injuries may also be counted as heat-related illness in this report, but data sources do not contain sufficient information to identify duplicates.

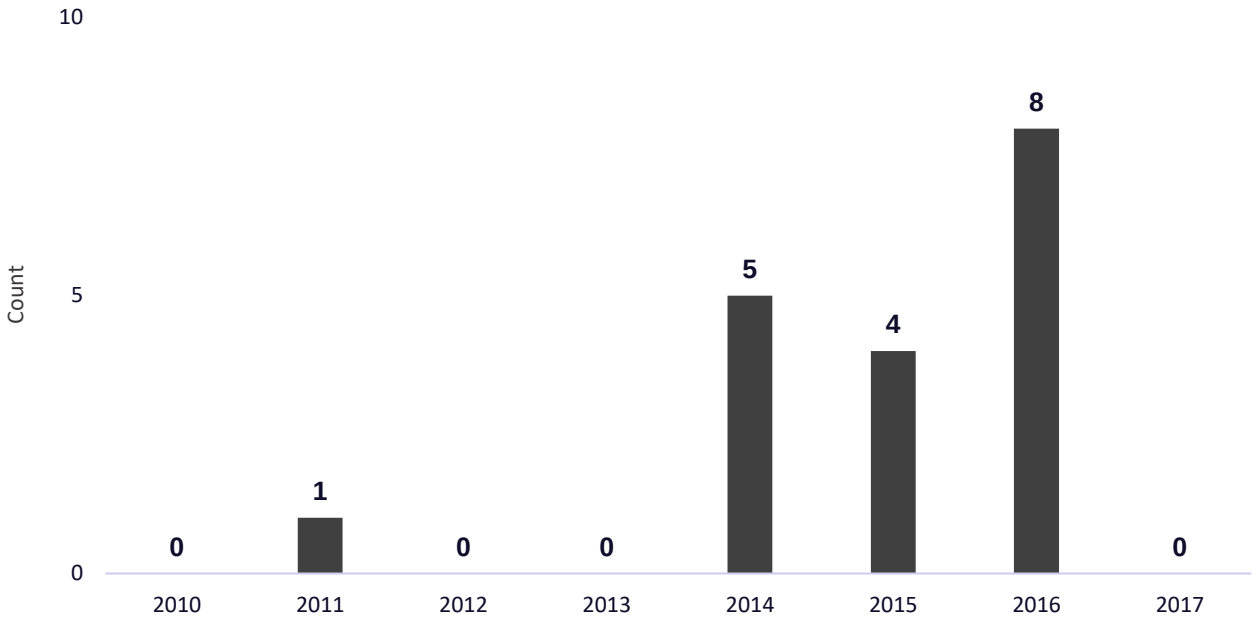
What is happening in the region

Most extreme weather injuries in the region are related to high winds or extreme heat. Five of the cases within the study period were related to high, strong winds in the area. In 2017, eight injuries were attributed to heat in the region.

Table 5. Regional injuries (count) from extreme weather, 2010-2017, NOAA

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	0	1	0	0	1	0	0	0	n/a
Multnomah	0	0	0	0	4	2	8	0	n/a
Washington	0	0	0	0	0	2	0	0	n/a
Regional Total	0	1	0	0	5	4	8	0	n/a

Regional Extreme Weather-Related Injuries Counts



Regional Extreme Weather-Related Injuries Rates per 100,000

Not calculated due to small numbers

Indicator 5. Extreme Weather-Related Deaths

Data Description

This indicator measures the number of deaths directly or indirectly attributed to extreme weather events. Extreme weather can cause death when hazards occur suddenly or when safe shelter is unavailable. Examples of hazards that can lead to extreme weather-related deaths include flooding, landslides, and flying or falling debris.

Data on deaths related to extreme weather is collected by the National Oceanic and Atmospheric Association. The data is only collected for events that cause a significant level of disruption to commerce, destruction of property, or draw media attention, and therefore may not represent and impacts from all storms.

Counts from the National Weather Service may be inconsistent with those reported from other data sources that use different data collection methods. In at least one instance, Multnomah County documented a different number of deaths attributable to extreme weather during this time period.[21]

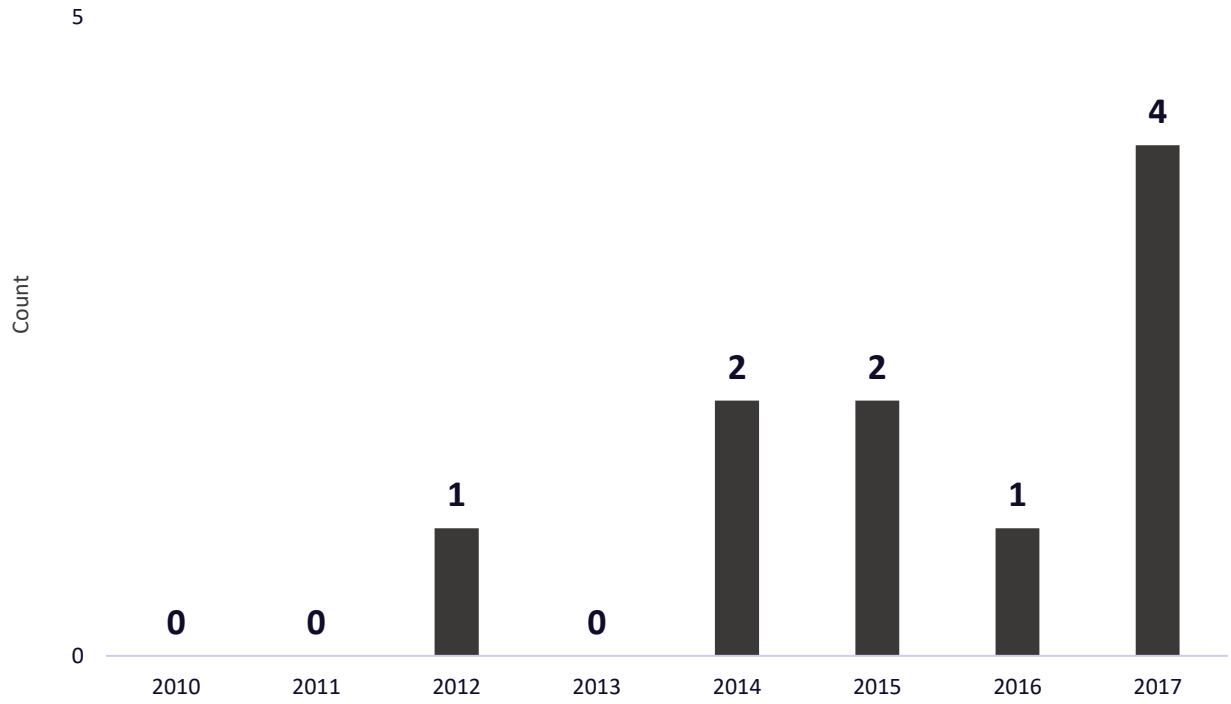
What is happening in the region

Strong winds were a factor in deaths that occurred in 2012, 2014, 2015, and 2016 in the greater Portland Metro area. One death occurred in Clackamas County in 2014 when a flash flood washed out a bridge near Ramona Falls by the Sandy River.[22] Both extreme heat and extreme cold have caused deaths in the region. The National Weather Service attributed one death to extreme heat in the Portland Metro area in 2016. In January 2017, four people died in Multnomah County during a period of freezing temperatures.

Table 6. Regional deaths (count) from extreme weather, 2010-2017, NOAA

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	0	0	1	0	2	2	0	0	n/a
Multnomah	0	0	0	0	0	0	0	4	n/a
Washington	0	0	0	0	0	0	1	0	n/a
Regional Total	0	0	1	0	2	2	1	4	n/a

Regional Extreme Weather-Related Deaths Counts



Regional Extreme Weather-Related Deaths Rates per 100,000

Not calculated due to small numbers

Vector-Borne Disease

Climate Change Connection

Vector-borne diseases can be transmitted by insects. Mosquitoes and ticks are the main concern in the Portland metro area. Climate change influences the habitat, survival, and seasonality of these insects. Expanding the habitat and seasons when mosquitos and ticks thrive can lead to new cases of disease where they have not been observed previously.

Mosquitoes reproduce more in hotter and more humid conditions. Warmer weather expands mosquito habitat ranges and extends their season of activity earlier in the summer and later into the fall.[23] Mosquitoes bite more in warmer temperatures, increasing the risk of vector-borne disease transmission.[24]

The life cycle of the tick is guided by changes in seasons. Ticks begin looking for a host during the spring and throughout the summer. As spring and winter temperatures increase, ticks begin to look for a host earlier, increasing the length of the Lyme disease season and number of potential cases.[25]

Groups Most Vulnerable

Exposure and vulnerability to the risk of insect bites is largely the outcome of social and environmental factors.[26] Groups that are at a higher risk of vector-borne disease include:

- Outdoor workers near habitats supporting insect breeding (e.g., construction, landscape design, landscaping, agriculture)
- People without means to purchase personal protective repellants or access to education resources around insect bite prevention
- People experiencing houselessness, no shelter from insect exposure, and limited means to bathe
- People living in housing without window or door screens and other sufficient barriers to exclude insects, including renters without tenant protections and landlords who allow unsafe conditions
- Youth, older adults, and people with immune conditions are more susceptible to severe illness from vector-borne diseases

Indicator 6. West Nile Virus

Data Description

This indicator measures the number of human cases of West Nile virus diagnosed in each county, even if the disease was acquired outside the county. West Nile virus is a mosquito-transmitted infection. Most people infected with the virus do not show any signs or symptoms; roughly one in five people develop a fever, headache, and body aches. Less than 1% of all West Nile virus cases develop severe symptoms affecting the nervous system through inflammation of the brain, spinal cord, and surrounding tissues.[27, 28]

Data are for 2010 through 2017, the most recent year available.

What is happening in the region

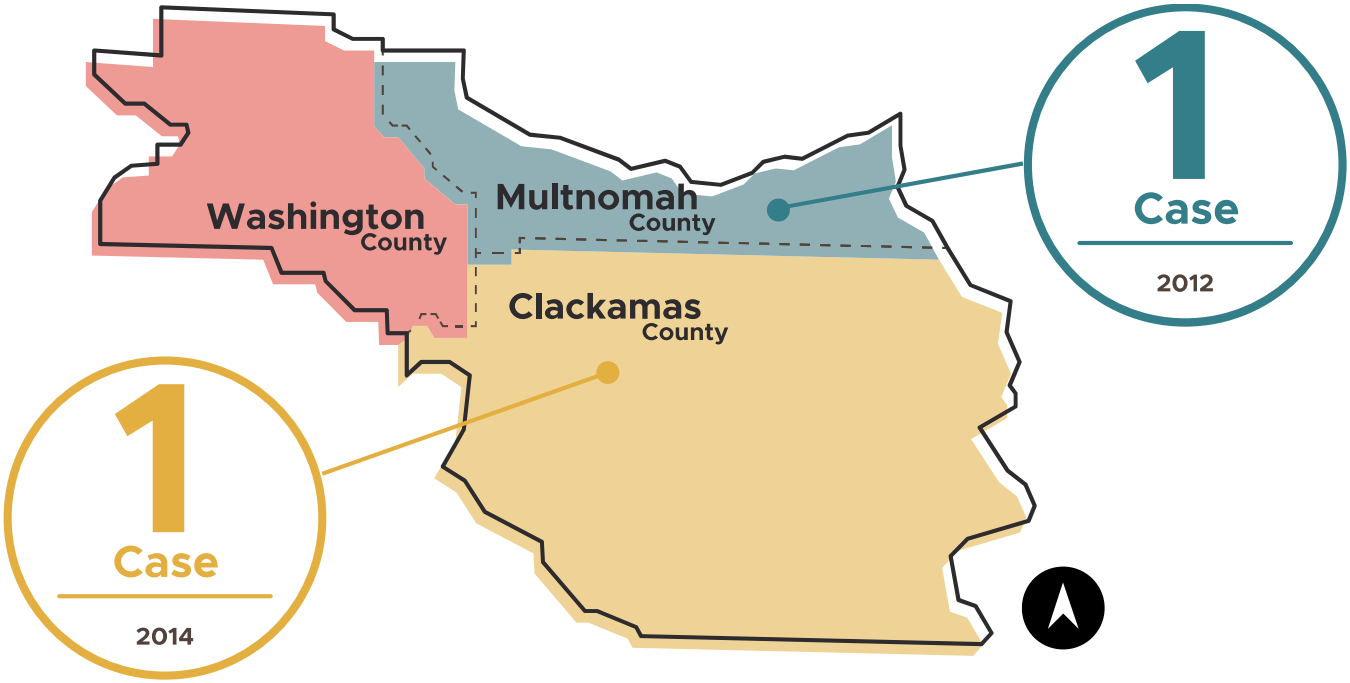
Two cases of West Nile virus have been documented in the region since 2010, one in Multnomah County in 2012 and one in Clackamas County in 2014. Both cases were acquired outside of the tri-county region, but local transmission is possible.

Cases of West Nile virus in the region, regardless of where they were acquired, are a burden on local health care systems. Tracking cases acquired nearby is necessary to monitor the region. With zero cases originating in the region, even one case originating in the tri-county area is reason for concern. Including this indicator provides a baseline for future evaluation.

Table 7. Regional cases (count) of West Nile, 2010-2017, OHA

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	0	0	0	0	1	0	0	0	n/a
Multnomah	0	0	1	0	0	0	0	0	n/a
Washington	0	0	0	0	0	0	0	0	n/a
Regional Total	0	0	1	0	1	0	0	0	n/a

West Nile Virus Case Count



West Nile Virus Case Rates per 100,000

Not calculated due to small numbers

Indicator 7. Lyme Disease

Data Description

This indicator measures the number of cases diagnosed with Lyme disease in each county, even if the disease was acquired outside the county. Lyme disease is caused by a bacterium called *Borrelia burgdorferi*, most commonly carried by blacklegged ticks. When someone is bitten by an infected tick, disease symptoms may include fever, headache, fatigue, and a bullseye-like rash called an *erythema migrans*. Severe cases may impact cardiovascular and cognitive function.[29]

Data are for 2010 through 2017, the most recent year available. The data does not allow for partitioning by where the disease was contracted.

What is happening in the region

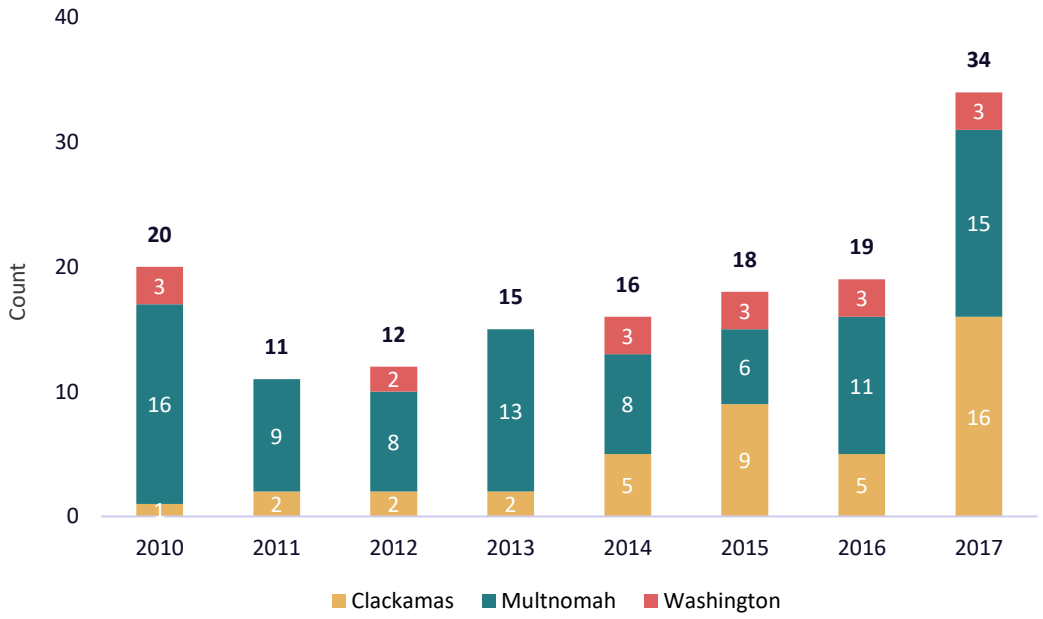
Regional counts of Lyme disease peaked in 2017 with 34 cases. Over the eight-year study period, the average rate of Lyme disease cases was roughly one person per 100,000 people every year.

While some cases were not contracted within the region, there are several reasons to include the indicator in this report. Cases of Lyme disease in the region, regardless of where they were contracted, are a burden on local health care systems. Tracking cases is necessary to monitor changes in this burden, and including this indicator provides a baseline for future evaluation.

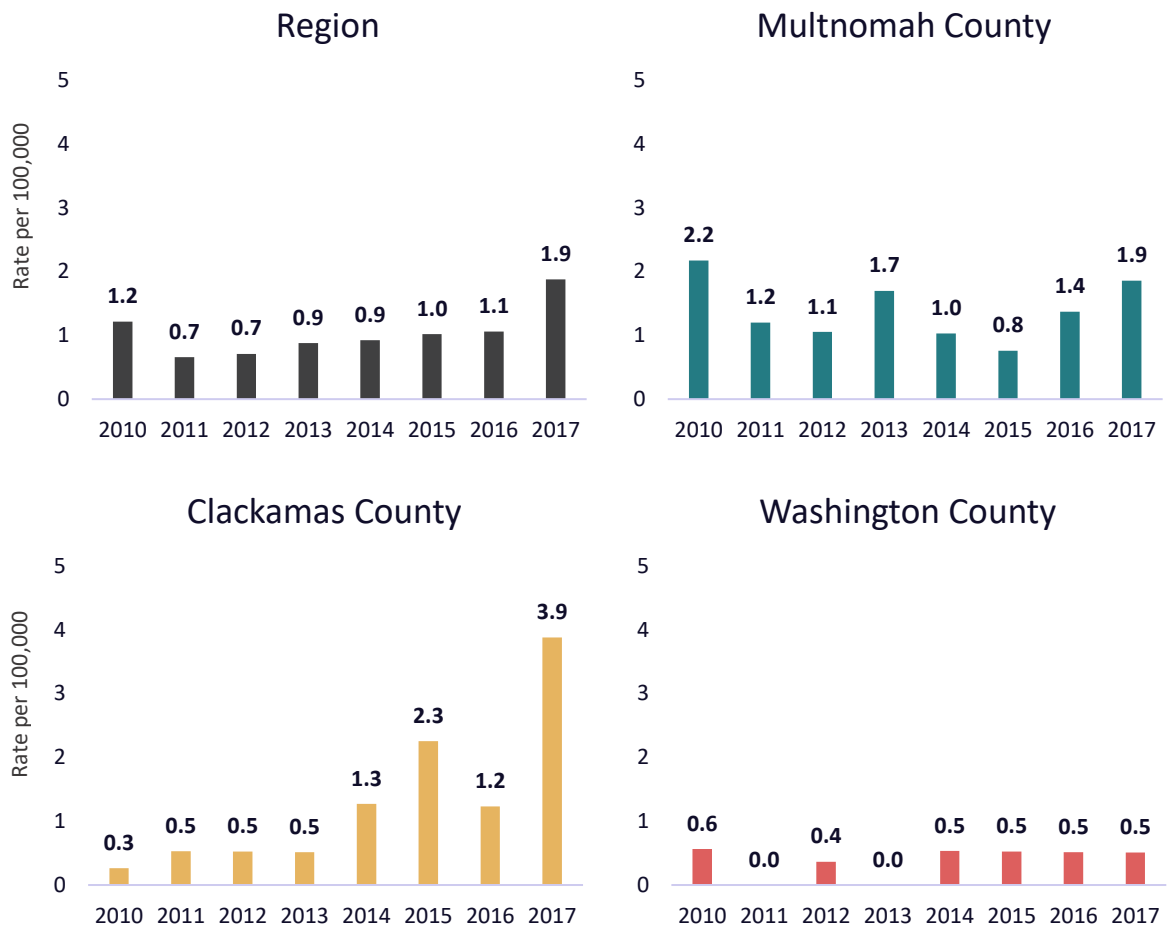
Table 8. Regional cases (count) of Lyme disease, 2010-2017, OHA

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	1	2	2	2	5	9	5	16	n/a
Multnomah	16	9	8	13	8	6	11	15	n/a
Washington	3	0	2	0	3	3	3	3	n/a
Regional Total	20	11	12	15	16	18	19	34	n/a

Lyme Disease Case Count



Lyme Disease Case Rate per 100,000



Communicable Disease

Climate Change Connection

Climate change influences the survival, reproduction and adaptation of the microorganisms that carry disease.[30] Some climate events, such as extreme heat or flooding, increase the growth of disease-causing microbe populations, as well as human exposure and the risk of infection through contaminated food, water, and water-based recreational activities. Changes in temperature and rainfall in the Pacific Northwest are projected to create conditions that promote the growth of disease-causing microbes.[31, 32]

- **Salmonellosis:** Increase in temperature is directly associated with increased number of reported salmonellosis cases. Studies have estimated an increase of 1.2% in the relative risk of salmonellosis for every degree increase in weekly temperature.[33] Salmonella species multiply faster in warmer temperatures, which leads to an increased risk of food contamination during processing, storage, and production.[34] The number of cases is typically higher during summer months, with an increased risk among children under 5 years of age and those over 65 years.

- **Campylobacter:** Campylobacter infection shows a seasonal pattern peaking in the summer months. Warmer conditions promote the growth of bacteria in raw sewage, increasing the risk of exposure. Heavy rains and floods can lead to sewage overflow, also increasing the risk of exposure.

- **Tuberculosis:** Climate change can impact the spread of TB by displacing people through drought, landscape change, rising sea levels and natural disasters. The spread of TB increases when climate refugees from countries where TB is common travel to countries with low rates of the disease. Famine and changes in environmental conditions can also spread TB by lowering a person's immunity and increasing their susceptibility for infections.

Groups Most Vulnerable

Low income and rural areas are impacted more by communicable diseases resulting from climate change and environmental factors. People with low incomes have fewer resources and live in areas less equipped to mitigate the fallout from extreme heat, floods from precipitation, and other extreme weather conditions.[35] Groups that are at higher risk of communicable diseases include:

- Older adults, children, pregnant people and those with compromised immune systems
- Communities of color that have experienced historic redlining, structural exclusion, or lived in areas that have not been prioritized for public works enhancements

- People who spend time in water bodies for recreation or occupation
- People living in communities with aging water and sewage infrastructure that may be more prone to flooding and water contamination
- Communities that are geographically isolated or do not have backup systems for essential services like water when damaged by extreme weather

Indicator 8. Salmonellosis

Data Description

This indicator measures the number of cases of salmonellosis diagnosed in each county. Salmonellosis is primarily a foodborne illness caused by bacteria with gastrointestinal symptoms that include diarrhea, cramps, nausea, and vomiting.

Data is based on hospital visit records from ORPHEUS. Rates may be affected by underreporting or other misclassification errors. Additionally, it is common for people suffering from mild GI illnesses, those with low incomes, and people without insurance to not seek medical care, in which case they would not be captured in hospital visit statistics.

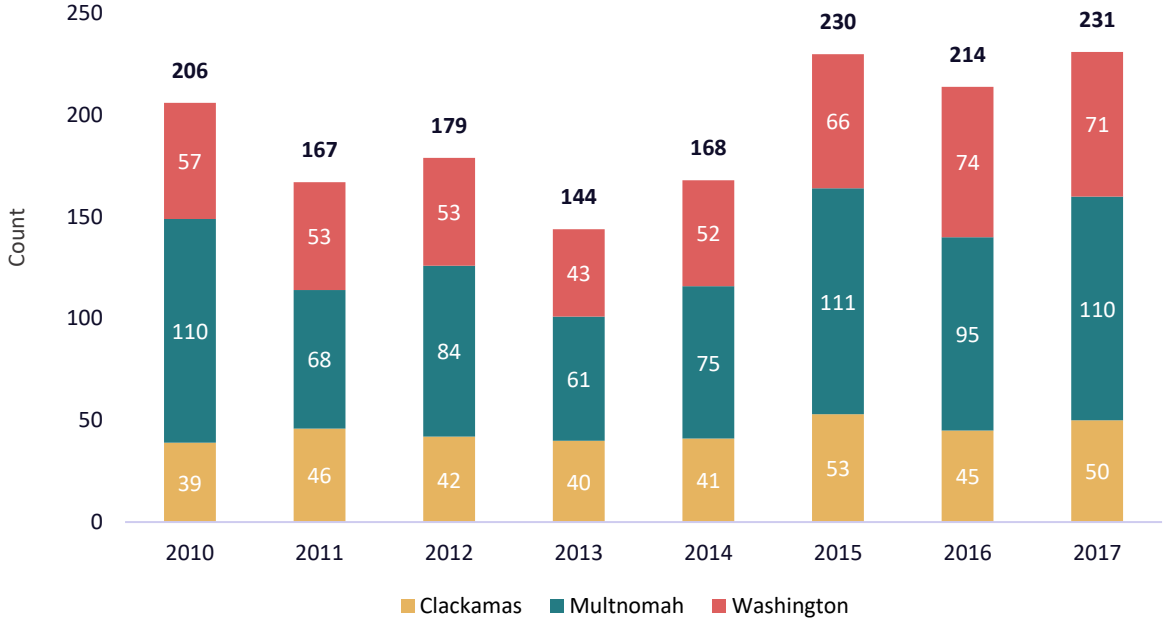
What is happening in the region

Regional counts were lowest in 2013 with 144 cases, and highest in 2017 with 231 cases. Over the eight-year period, the average rate of salmonellosis cases for the region was 11 new cases per 100,000 people every year.

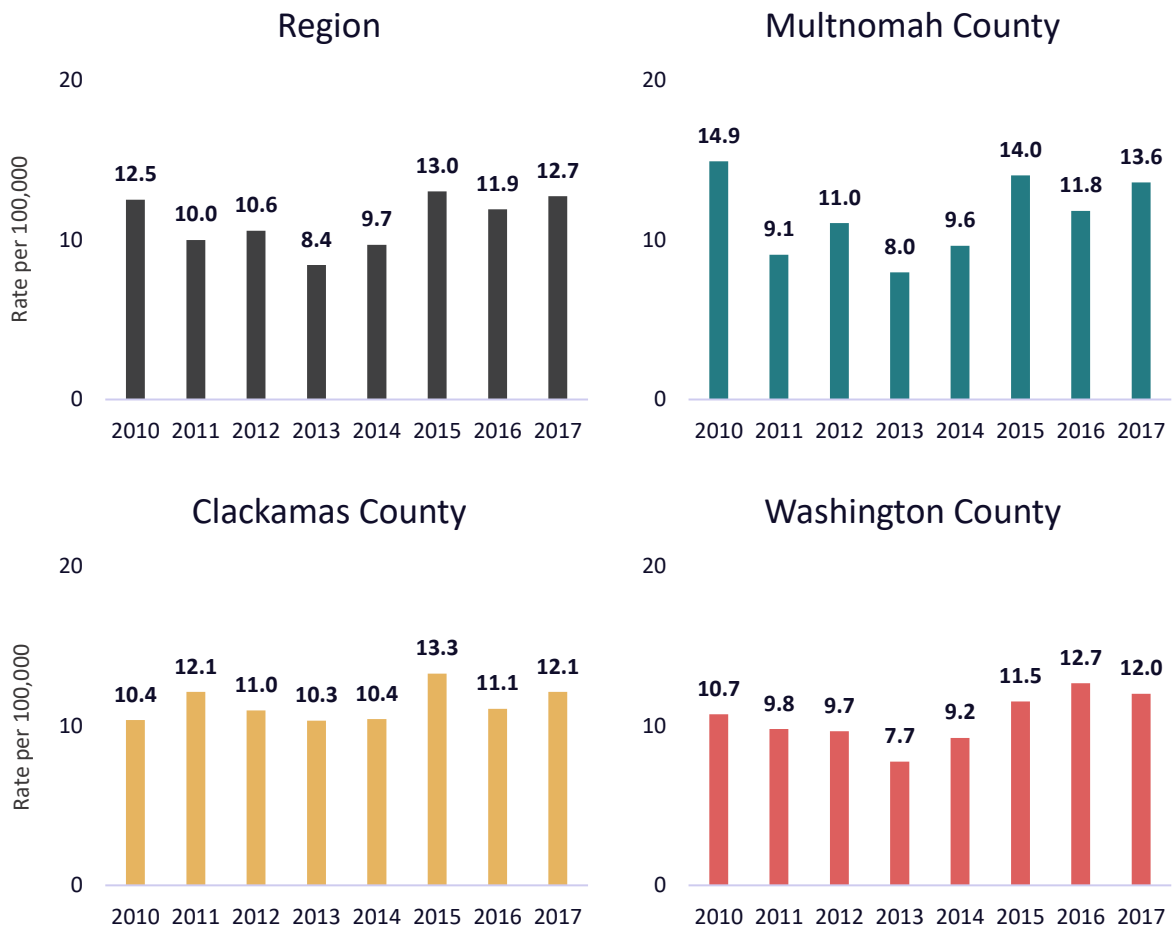
Table 9. Regional cases (count) of salmonellosis, 2010-2017, OHA

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	39	46	42	40	41	53	45	50	n/a
Multnomah	110	68	84	61	75	111	95	110	n/a
Washington	57	53	53	43	52	66	74	71	n/a
Regional Total	206	167	179	144	168	230	214	231	n/a

Salmonellosis Case Count



Salmonellosis Case Rate per 100,000



Indicator 9. Campylobacterosis

Data Description

This indicator measures the number of campylobacterosis cases diagnosed in each county. Campylobacter infection, one of the most common foodborne illnesses in the United States, occurs through consumption of raw or uncooked poultry, or through contaminated water. Symptoms include diarrhea, abdominal pain, vomiting and headache.[36]

Data is based on hospital visit records from ORPHEUS. Rates may be affected by underreporting or other misclassification errors. Additionally, it is common for people suffering from mild GI illnesses, those with low incomes, and people without insurance to not seek medical care, in which case they would not be captured in hospital visit statistics.

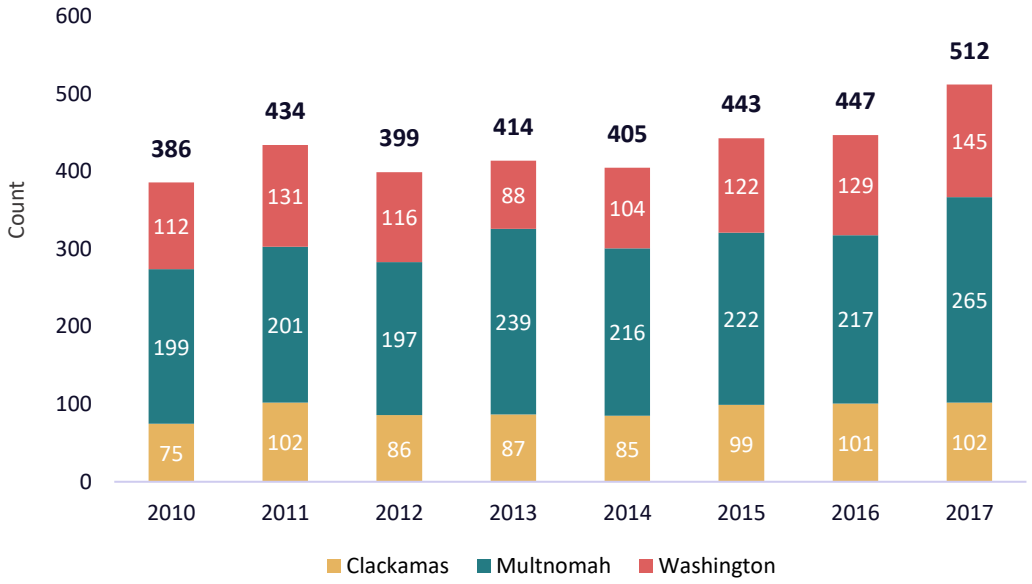
What is happening in the region

Total number of campylobacteriosis cases reported in the region ranged from just below 400 in 2010 to over 500 in 2017. Over the eight-year period, the regional average rate of campylobacterosis cases was roughly 25 cases per 100,000 people every year.

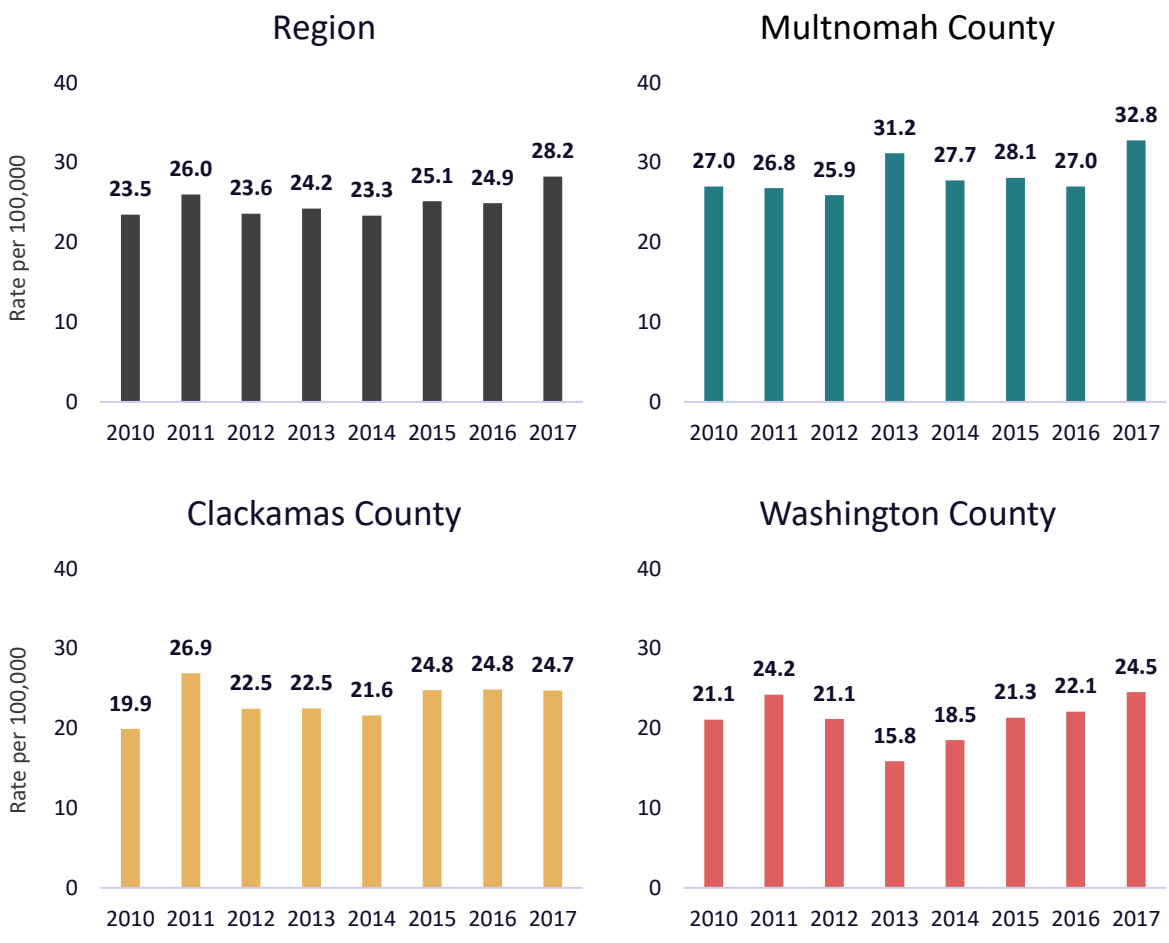
Table 10. Regional cases (count) of campylobacterosis, 2010-2017, OHA

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	75	102	86	87	85	99	101	102	n/a
Multnomah	199	201	197	239	216	222	217	265	n/a
Washington	112	131	116	88	104	122	129	145	n/a
Regional Total	386	434	399	414	405	443	447	512	n/a

Campylobacterosis Case Count



Campylobacterosis Case Rate per 100,000



Indicator 10. Tuberculosis

Data Description

This indictor measures the number of active cases of tuberculosis in each county. Tuberculosis (TB), is caused by *Mycobacterium tuberculosis*, which most frequently attacks the respiratory system but can infect other body systems as well. An infected person does not always develop clinically visible signs of the infection. While infection may remain dormant for a long period of time (i.e., latent TB), only a person with active TB can spread the infection to others.

Data is based on hospital visit records from ORPHEUS. Rates may be affected by underreporting or other misclassification errors.

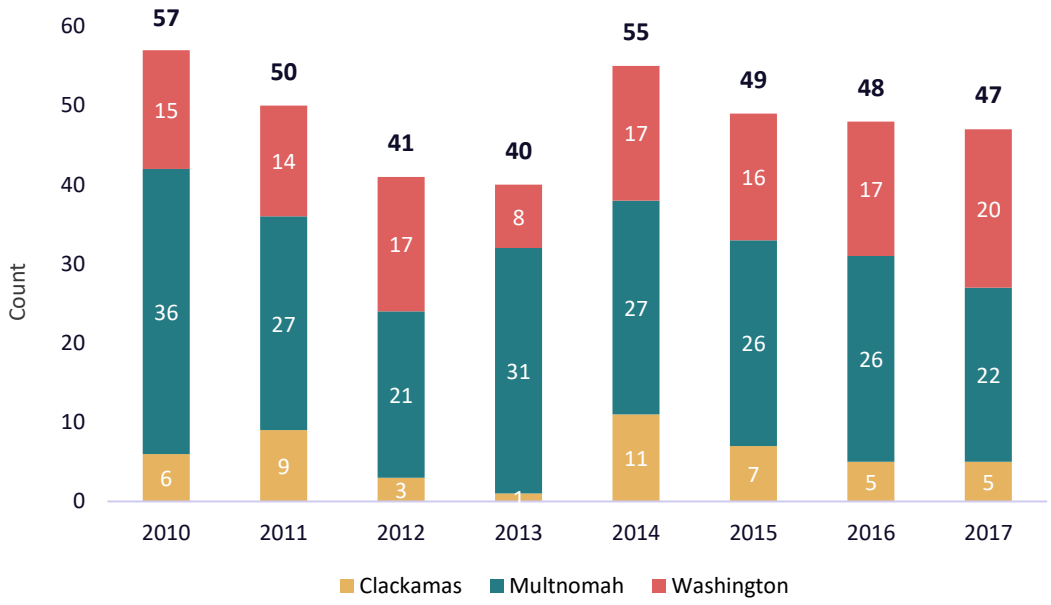
What is happening in the region

The number of TB cases in the tri-county area was highest in 2010 with 57 cases and lowest in 2013 with 40 cases. Over the eight-year period, the regional average rate of active TB cases was three cases per 100,000 people.

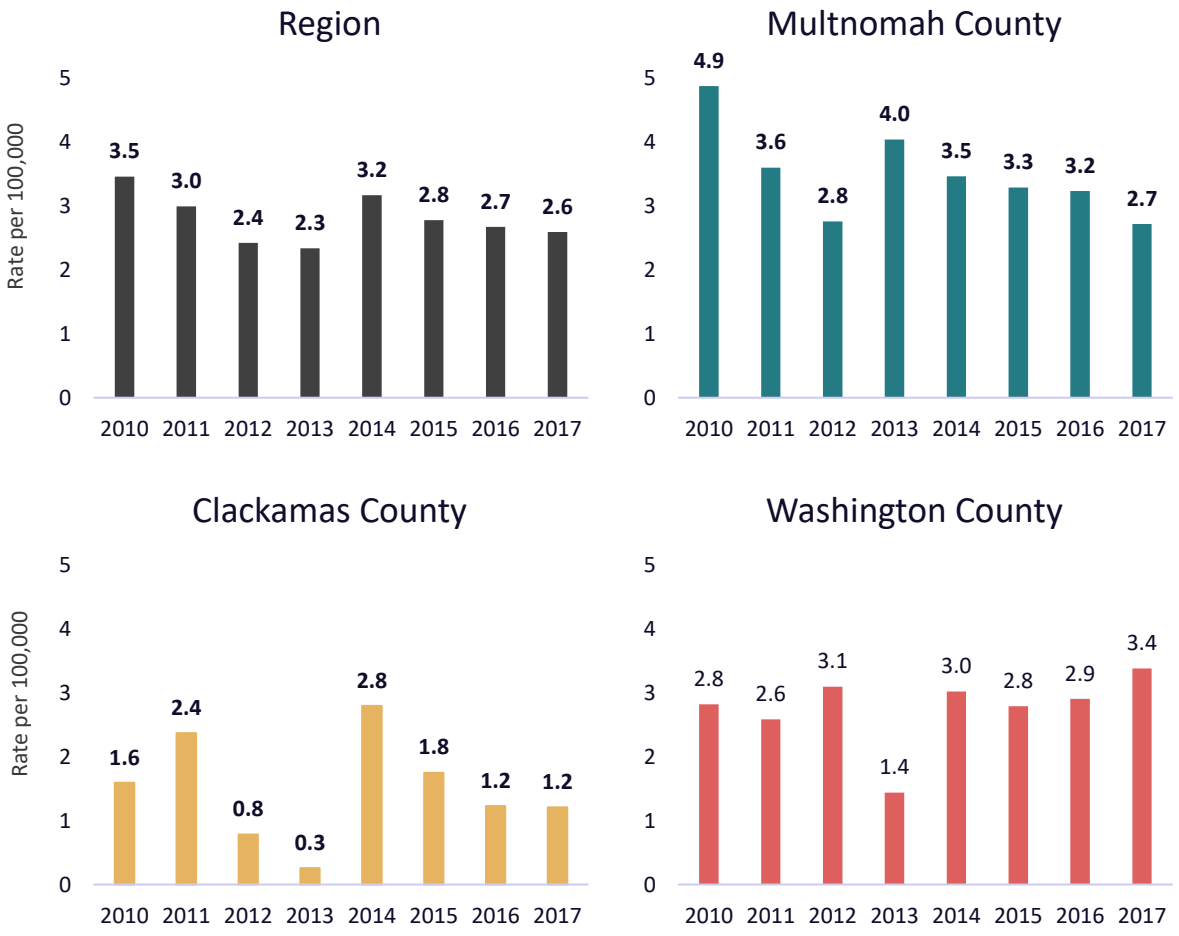
Table 11. Regional cases (count) of tuberculosis, 2010-2017, OHA

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	6	9	3	1	11	7	5	5	n/a
Multnomah	36	27	21	31	27	26	26	22	n/a
Washington	15	14	17	8	17	16	17	20	n/a
Regional Total	57	50	41	40	55	49	48	47	n/a

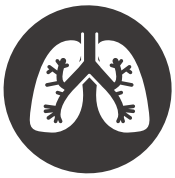
Tuberculosis Active Case Count



Tuberculosis Active Case Rate per 100,000



Air Quality



Climate Change Connection

Changes in air quality are strongly linked to climate change and events related to hotter, drier conditions as our region experiences more smoke from wildfires. Warmer temperatures and less high-altitude snowpack create dryer and longer summers and increase the risk of wildfires.[37] This risk is expected to continue to increase across Oregon, with one of the largest increases happening throughout the Willamette Valley.[38] Air quality is expected to worsen as a result of the increase in smoke and other harmful pollutants like smog (ground-level ozone).[39]

Asthma symptoms are commonly triggered from exposure to a pollutant or allergen in the air, including smoke from wildfires, exhaust from vehicles, or pollen.[40, 41] Fine particles (like $PM_{2.5}$) released from wildfires and other sources increase the risk of adverse respiratory conditions, including asthma exacerbations.[42]

Warmer conditions also extend the length of pollen season and the geographic area where some plants may grow.[43] Studies show that higher temperature extremes and carbon dioxide levels increase both the amount and allergenic content of pollen that plants produce.[44] Interactions between high levels of pollen, air pollutants, and extreme weather events that stir up particulate matter from the ground or plants are also likely to worsen air quality.[45] Ragweed and grass pollens are common environmental triggers influenced by climate changes in the region.

Groups Most Vulnerable

Due to historic housing and development policies and practices, communities of color and low-income groups are more likely to live in areas with disproportionately high exposure to air pollution roads and industries. They also are less likely to live near greenspaces. Groups who face higher risk of health impacts from poor air quality include:

- Outdoor laborers (e.g., construction, road crews, farm workers)
- Older adults, children, and people with chronic lung conditions like asthma or chronic obstructive pulmonary disease
- Communities of color that have experienced historic redlining, structural exclusion, or lived in areas that have not been prioritized for public works enhancements
- Those living near high traffic areas or near industrial facilities
- Immigrants and communities that are culturally or linguistically isolated and may not have access to emergency communications on poor air quality days

Indicator 11. Asthma-Like Symptom Emergency Department Visits

Data Description

This indicator measures the number of visits to hospital emergency departments and urgent care clinics made by people with symptoms of asthma. Asthma is a respiratory condition where the airways in the lungs inflame, causing wheezing, chest tightness, and shortness of breath.

Data was collected from Oregon ESSENCE. The search query developed for this data returned cases with any mention of an asthma-like symptom in addition to asthma as the chief complaint.

Data from ESSENCE are subject to several limitations. Complete data became available beginning in the 2016 season, meaning that comparisons to earlier years are not reliable. Records are for visits, not patients, meaning that the one person could be counted multiple times if they visited the emergency department more than once for the same complaint or for different complaints. Missing or incomplete records could result in undercounting.

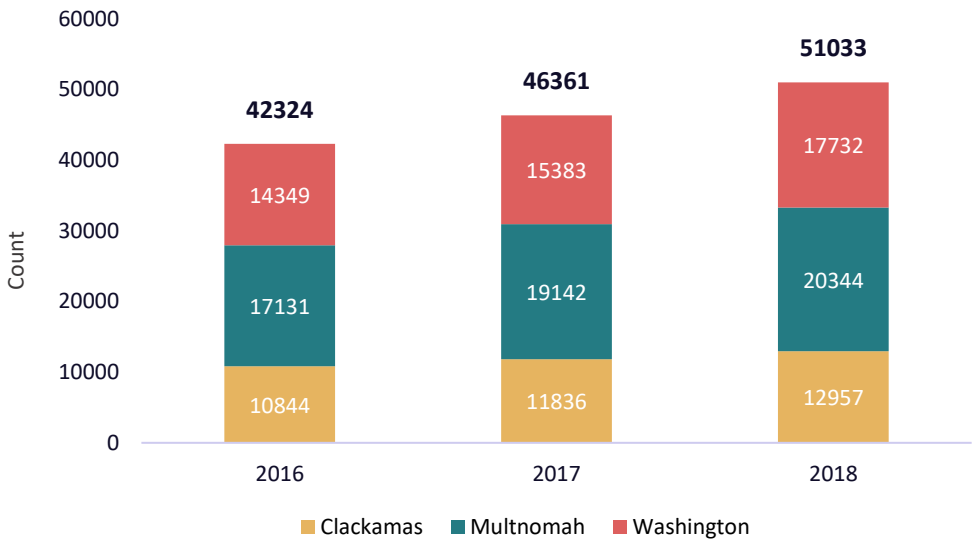
What is happening in the region

Between 2016 and 2018 the region has seen an increase in the count of people visiting emergency departments with asthma-like symptoms. Data from ED visits showed an increase in the rate of asthma-like symptoms in each county. Over the three-year period, the average rate of emergency department visits for asthma-like symptoms was 2,552 visits per 100,000 people every year.

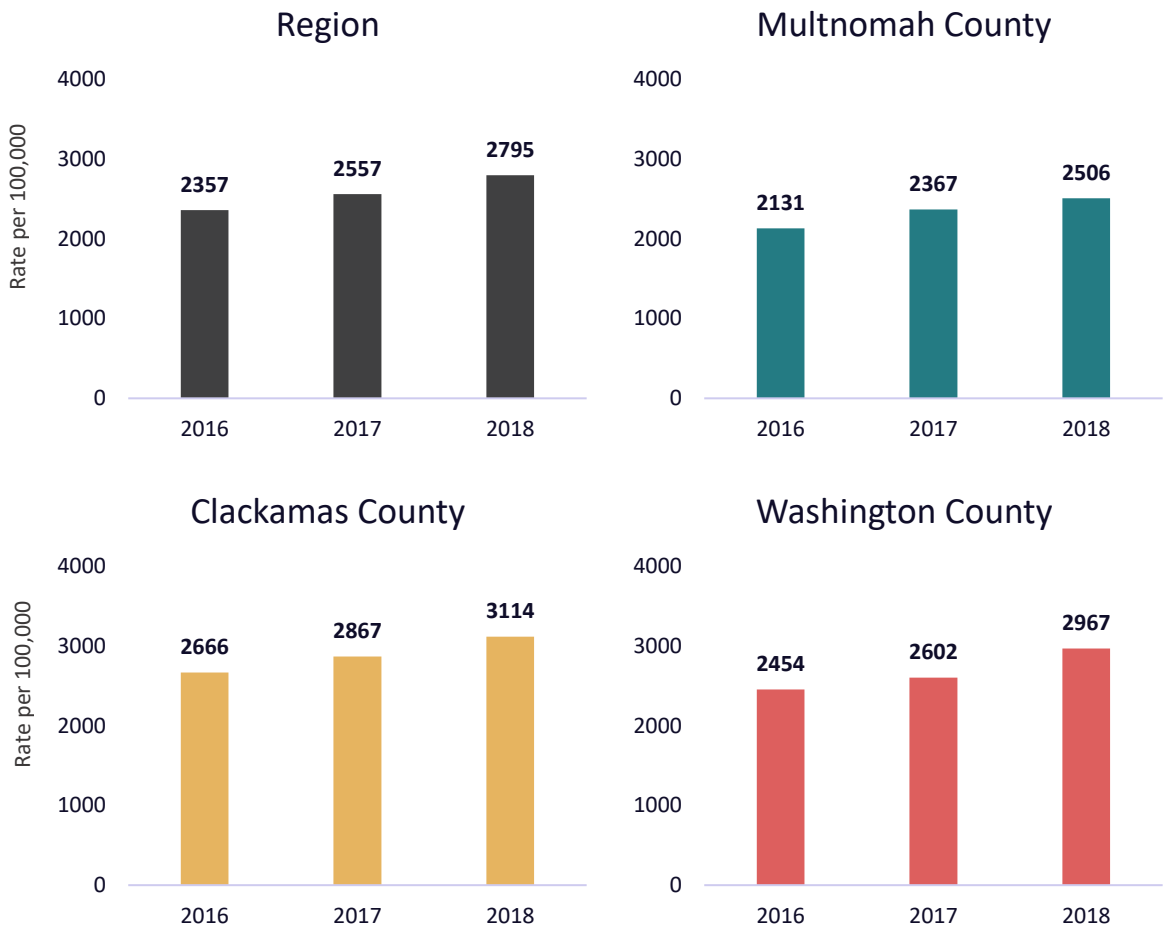
Table 12. Annual Counts of Regional Asthma-like Symptom Emergency Department Visit, 2016-2018, ESSENCE

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	n/a	n/a	n/a	n/a	n/a	n/a	10,844	11,836	12,957
Multnomah	n/a	n/a	n/a	n/a	n/a	n/a	17,131	19,142	20,344
Washington	n/a	n/a	n/a	n/a	n/a	n/a	14,349	15,383	17,732
Regional Total	n/a	n/a	n/a	n/a	n/a	n/a	42,324	46,361	51,033

Asthma-Like Symptom Emergency Department Visit Count



Asthma-Like Symptom Emergency Department Visit Rates per 100,000



Indicator 12. Allergic Disease Emergency Department Visits

Data Description

This indicator measures the number of visits to hospital emergency departments and urgent care clinics made by people with symptoms of allergic disease. Allergic disease is a broad term that refers to the response of the immune system to external allergens like mold, dust, or pollen. Symptoms include sneezing, runny nose, shortness of breath, wheezing, and itchy eyes.

Data was collected from Oregon ESSENCE. The search query developed for this data returned cases with allergic disease as the chief complaint.

Data from ESSENCE are subject to several limitations. Complete data became available beginning in the 2016 season, meaning that comparisons to earlier years are not reliable. Records are for visits, not patients, meaning that the one person could be counted multiple times if they visited the emergency department more than once for the same complaint or for separate complaints. Missing or incomplete records could result in undercounting.

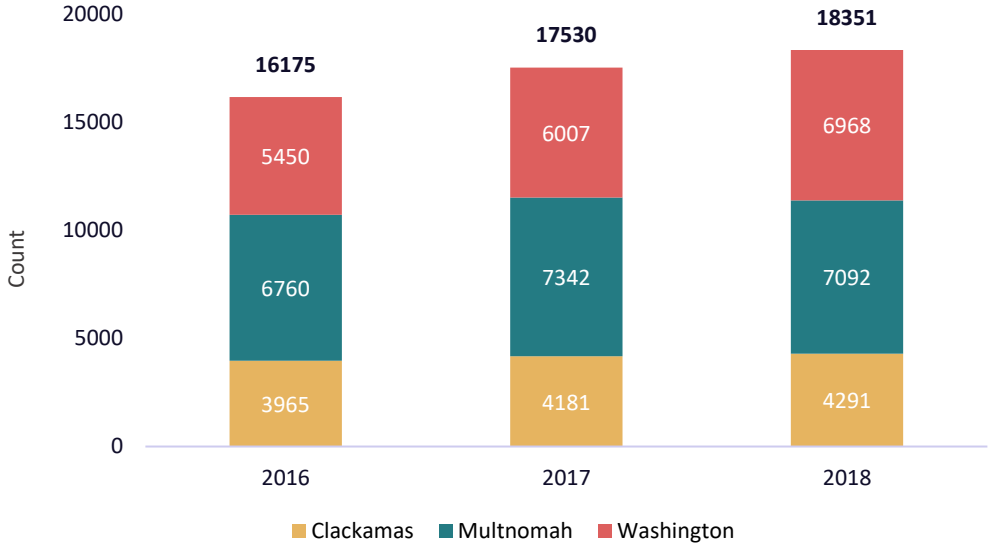
What is happening in the region

Between 2016 and 2018 the count of people visiting emergency departments with asthma-like symptoms grew progressively higher. Over the three-year period, the average rate of ED visits related to allergic disease was 951 visits per 100,000 people. Data from ED visits suggested an increase in the rate of visits for allergic disease in the region, rising from 901 in 2016 to 967 in 2017 and 1,005 in 2018.

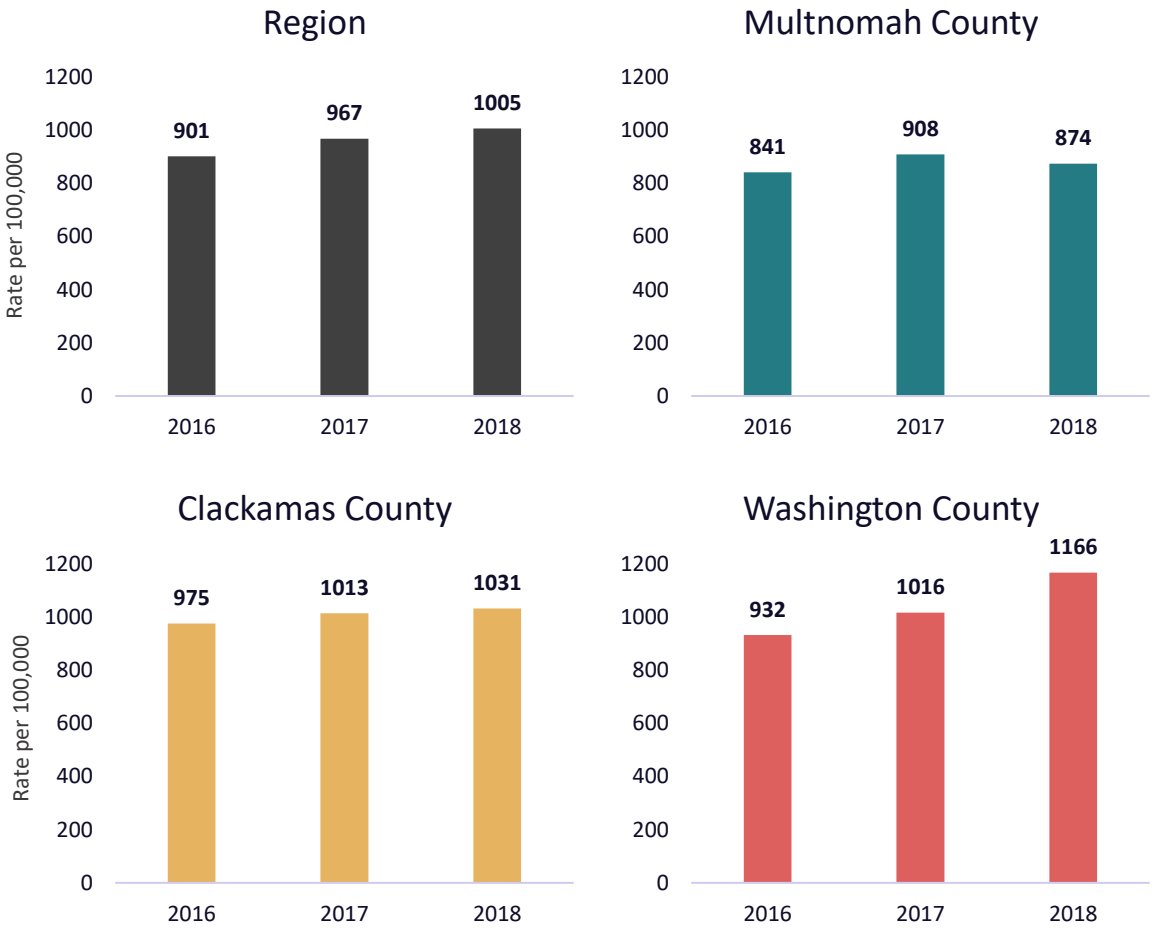
Table 13. Annual Counts of Regional Emergency Department Visits for Allergic Disease Symptoms, 2016-2018, ESSENCE

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clackamas	n/a	n/a	n/a	n/a	n/a	n/a	3,965	4,181	4,291
Multnomah	n/a	n/a	n/a	n/a	n/a	n/a	6,760	7,342	7,092
Washington	n/a	n/a	n/a	n/a	n/a	n/a	5,450	6,007	6,968
Regional Total	n/a	n/a	n/a	n/a	n/a	n/a	16,175	17,530	18,351

Allergic Disease Symptom Emergency Department Visit Count



Allergic Disease Symptom Emergency Department Visit Rates per 100,000



What's Next?

This report provides a snapshot of some health indicators that have an established connection to climate change. As the region continues to experience the effects of climate change, including wetter, warmer winters and hotter, drier summers, it is essential to continue to monitor these and other indicators that reflect climate change health. A three-year surveillance cycle aligning with the regional community health assessments and community health improvement plans is recommended.

For future reporting, other indicators and methods to assess health impacts related to climate change include:

- Adding shigella, harmful algae blooms (HABs), climate-related anxiety and depression, drownings during summer months, climate-related migration, and cryptococcus gatii
- Analyzing data by race/ethnicity to better understand racial disparities
- Establish a consistent methodology to assess change over time for indicators, including testing for statistical significance over time and between counties

This report can be used by public health departments and other sectors to inform and prioritize climate change adaptation and response strategies at the regional and county level. Strategies to address climate change and its potential health impact may include:

- Increasing community knowledge of climate change and capacity to mitigate its health impacts.
- Educating the public and policy makers on the the health benefits of climate change mitigation strategies.
- Building cross-sector partnerships and interventions to address factors and practices that cause or exacerbate climate change.
- Increasing the representation of vulnerable population groups in climate change mitigation and adaptation planning.
- Prioritizing areas for future research and intervention.

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