

PUBLIC HEALTH
HAZARD
VULNERABILITY ASSESSMENT

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EXECUTIVE SUMMARY

This assessment reviews potential disasters and the consequences for the health of Oregon's population and the public health sector. Local health departments, tribal health agencies, and their emergency management partners reviewed 43 possible natural hazards and human-made threats; and they prioritized three weather-related disasters as most likely to occur: wildfires, winter storms, and flooding. Eleven additional hazards were identified as possible events meriting public health attention. It also should be noted that, in the near future, local climate change models will become available for local planners, and other weather-related priorities may emerge.

Public health consequences may be direct or indirect and can affect both a local population's health and its health infrastructure. The direct consequences of a public health disaster are counted in the number of injuries and fatalities occurring as a result of the incident. Among the disaster scenarios deemed as most probable, local health jurisdictions anticipate high fatality rates only in subduction zone earthquakes and pandemics. In all prioritized hazard scenarios, however, incident-related injuries are expected to stretch local hospitals, primary care providers, pharmacies, and emergency medical services operating capacities.

Indirect public health consequences can include exacerbation of mental and chronic health conditions (such as asthma, chronic heart disease, depression, and diabetes) or injuries sustained while cleaning up after an incident. Disasters also can push marginalized households over the edge into food insecurity and increase social isolation, jeopardizing a community's ability to respond and to support all households. Overall, local respondents were confident in their public health system's ability to respond to disease outbreaks after a disaster and to support continued care for those with chronic illnesses; however, respondents consistently expressed concern that multiple households in their jurisdictions would see diminishing food security and that there could be service gaps for vulnerable populations during and after a disaster.

The building of disaster-resilient communities across Oregon requires coordinated planning with all Emergency Support Function partners to mitigate when possible, to adapt when necessary, and to identify where our health system and the health of the population are most at risk.

This assessment is intended:

- To summarize the public health consequences of Oregon’s likely hazards and threats; and
- To recommend mitigation and adaptation strategies that public health jurisdictions in Oregon can implement to strengthen community resilience before, during and after emerging public health events.

To explore these issues, this assessment involved:

- The review of survey responses from local emergency managers identifying probable hazards;
- The review of population health indicators by local health jurisdictions; and
- The gathering of local partner perspectives on ways probable disasters would be expected to exacerbate current public health concerns or directly harm the health of the population.

INTRODUCTION

All disasters have public health consequences. Oregon’s shorelines and forests bear the evidence of our history of earthquakes, tsunamis, river floods and wildfires, and future occurrences of these natural disasters will affect local populations by causing physical injury, property loss and economic hardship. We also are vulnerable to pandemics and outbreaks of other novel communicable diseases, as well as to the chronic diseases that increasingly affect the health of the population. Our hazards may come in the form of natural disasters, as the unintentional result of human activities, or through intentional acts of destruction. Although the public health consequences of each of these hazards may be significant, they can be moderated through proactive planning, practice and evaluation.

Since the turn of the century, public health agencies have made attempts to assess the hazard vulnerabilities of their populations. Oregon's first effort took place in 2008, with a technical review of local health department data and the introduction of mapping tools for local staff use. Even with the introduction of local mapping tools, this initial effort to quantify risk to the health of the population and the public health system did not clearly point to solutions that would help communities survive and bounce back from public health emergencies.

The current trend toward all hazards, capability-based investment in public health and health care program preparedness offers a structure for engaging the whole health care system. When used in combination with readily available, Web-based tools for identifying at-risk populations and for measuring community health security, state, tribal and local health departments are poised to use data effectively to inform their public health security policies and practice.

During the past year, the Oregon Public Health Division (OPHD) worked with Oregon Emergency Management, the Oregon Partnership for Disaster Resiliency, and local public health emergency preparedness partners to develop a survey instrument for evaluating the public health consequences of hazards that may come our way. Using hazard and threat priorities identified by local emergency management, this instrument walked respondents from local health departments and tribal health agencies through considerations of their jurisdiction's current health indicators, data on injuries and illness related to specific hazards, and their local health care system's ability to absorb the increased demand for resources during and after a disaster. It is expected that tribal and local health jurisdictions will be able to use these findings in combination with their capability gap assessments, after-action reviews, and improvement plans to develop, implement and exercise an all-hazards plan.

METHODS

Scope

This assessment integrates threat and hazard rankings from Oregon emergency managers and the qualitative analysis of the public health consequences of those hazards by all of Oregon's 34 local health departments and eight of Oregon's nine tribal health jurisdictions.

Approach

The assessment tool was developed in collaboration with partners at the Oregon Public Health Division, the Oregon Partnership for Disaster Resilience, and local health departments. These efforts were informed by the work of Kimberley Shoaf, Dr.P.H., at the University of California, Los Angeles Center for Public Health and Disasters, and the Oregon State Preparedness Report, as well as the Building Resilience Against Climate Effects (BRACE) model developed for Centers for Disease Control and Prevention-funded Climate Change Initiative projects.ⁱ An accompanying Excel worksheet was developed to leverage the standard reporting tool used by Oregon Emergency Management. The survey can be found in Appendix 1. Liaisons from the Health Security, Preparedness and Response Program at the Oregon Public Health Division distributed the survey via email and, when requested, assisted local health jurisdictions in person.

HAZARDS AND HEALTH SECURITY IN OREGON

Oregon has its share of natural disasters. The year 2012 began with President Obama issuing a major disaster declaration for Oregon due to winter storms and flooding.ⁱⁱ By the end of the year, wildfires had burned 1.26 million acres of Oregon land.ⁱⁱⁱ Since 1990, Oregon has experienced 19 major disasters, one emergency declaration and 31 fire management assistance disasters.^{iv} During this time, every Oregon county has been touched by a disaster affecting public health.

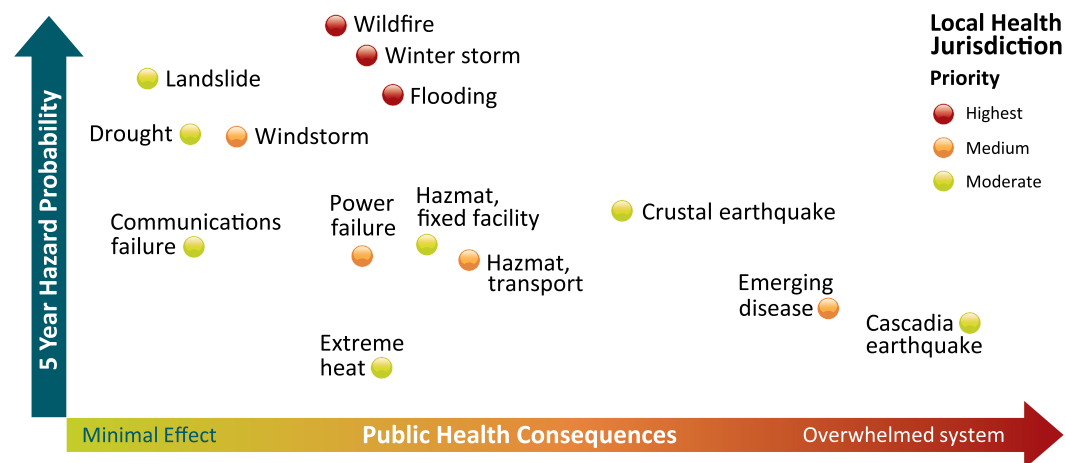
Climate scientists report that in the future, wildfires, floods, and other natural disasters will occur more frequently and will be more devastating to affected populations and the environment.^v Flooding, resulting from heavy precipitation and snow runoff, may increase the risk of waterborne disease, the spread of vector-borne diseases, water supply contamination, drowning, and degradation of local environments.^{vi} Drought plays a major role in the rise of wildfires across the United States. Though drought rarely is a direct cause of death, it is linked to indirect deaths through disruptions of agriculture and water systems, poor air quality, and increased heat-related and respiratory illnesses.^{vii}

Leading concerns

Over the next five to 10 years, 74% of local health and emergency jurisdictions expect to experience wildfires, winter storms or river flooding. Moderate consequences for the health of the population and burdens on health care are anticipated, as shown in Figure 1 below. Respondents report that more work is needed to identify and to serve vulnerable populations in preparation for these hazards.

Figure 1 shows hazards that local emergency managers expect to experience in the near future and their association with public health and health system consequences, as assessed by local public health departments. Consequences were estimated on a five-point Likert scale ranging from minimal to catastrophic effects on the population’s health and health services.

Figure 1 Oregon’s Public Health Hazard Vulnerability Assessment (PH-HVA)



Hazards on the horizon

Fifty percent of the local respondents anticipate that their communities should prepare for:

- Windstorms;
- Power failures;
- Release of hazardous materials on transportation routes; and
- Emerging diseases, including pandemics.

Emerging diseases stand out among these hazards, as local respondents saw that a pandemic would have both direct and indirect costs to the health of the population and to health care infrastructure that could quickly overwhelm their public health system.

Seven hazards were identified by at least 25% of respondents as significant concerns, but as less immediate threats. These include:

- Landslides;
- Droughts;
- Extreme heat events;
- Fixed-facility hazardous waste releases;
- Communication system failures;
- Crustal earthquakes; and
- Subduction zone earthquakes.

Although this assessment focuses on the three hazards prioritized by local jurisdictions, the Oregon Public Health Division uses an all-hazards framework to structure its preparation work. Figure 2, below, displays the anticipated population health consequences of Oregon's prioritized hazards. Overall, the direct effects of disasters, fatalities and injuries, are expected to be minimal to moderate. Communicable disease outbreaks related to these disasters are not likely. However, indirectly, these disasters are projected to stress systemic public health concerns, such as food and water insecurities.

Figure 2 Public Health Consequences of Prioritized Disasters, Local Estimates, 2012–2013

	Flooding	Wildfires	Winter Storms
Fatalities	Minimal	Minimal	Minimal
Injuries	Minimal	Moderate	Moderate
Chronic disease	Moderate	Minimal	Moderate
Respiratory disease	Minimal	Overwhelming	Minimal
Communicable disease	Low	Low	Low
Food insecurity	High	Moderate	High
Water insecurity	High	Low	High
Mental health needs	Moderate	Minimal	Minimal

Source: PH HVA, 2013. Scale is 1=minimal; 2=low; 3=moderate; 4=severe; 5=catastrophic

Most often, Public Health (Emergency Function 8) plays a supporting rather than a leading role in disaster response. Our responsibilities are to ensure that our partners and the public have timely health security guidance, biosurveillance data for situational awareness and intervention planning, recommendations for community mitigation and adaptation, and access to prophylaxis and other state and federal resources necessary to protect the public.

FLOODING

Between 1990 and 2011, 53% of Oregon’s major disasters were flood-related.^{viii} A disaster was declared in 1996, when a “pineapple express” subtropical jet stream brought warm, wet weather to Oregon. Snowpack melted quickly and 25 rivers reached flood stage. By the time the flooding receded, eight people had died and nearly every county had area under water. Oregon experienced another “pineapple express” storm in 2007, resulting in extensive flooding to the town of Vernonia. Again in 2012, a pineapple express storm swept through the state, leaving 18 counties flooded and in declared disasters; two people drowned in Linn County as their car was swept away.

While flood-related fatalities are rare in Oregon, injuries are common during a flood and flood recovery. Eight percent of local respondents anticipated that injury rates would stretch local health response capacity. Columbia River and Klamath Basin health jurisdictions were more likely than their counterparts

in other areas to believe that their public health infrastructure would be operating at surge capacity during a flooding event. Asthma, chronic obstructive pulmonary disease and other chronic health conditions can be worsened when medication regimens are disrupted, or during the recovery phase as householders encounter mold, mildew, and contaminated products and water in the clean up. The physical and psychological stress of these efforts will take a toll on healthy individuals as well as on those living with chronic conditions; respondents across the state anticipated that the demand for mental health services after a flood would exceed response capacity.

On an average day, 14%^{ix} of Oregon households are food-insecure. Local respondents expect hunger rates to worsen following a flood. Affected households and communities that are isolated by language, geography or socioeconomic conditions may be at increased risk of food insecurity, because food supplies may be destroyed or contaminated. Particularly in rural areas, where homes are supplied by private wells, local respondents expected that multiple households would be without potable water.

PUBLIC HEALTH RECOMMENDATIONS

Community preparedness:

1. Engage community partners to identify populations that may be at-risk during flooding events.

Community recovery:

1. Work with partner agencies to inform the community of drinking water standards and the availability of water quality testing services.

Emergency public information and warning:

1. OPHD review and refine flooding communications toolkit;
2. Develop communication plans for reaching vulnerable populations; and
3. Distribute clinical and public guidance on flood recovery health and safety.

Medical materiel management and distribution:

1. Review and support health care resource requests;
2. Consider targeted tetanus vaccination for those with potentially contaminated wounds.

Medical surge:

1. Fully engage clinical partners (pre-hospital and health care system) in surge and evacuation planning;
2. Continue to work with partners to assess and meet prescription medication and treatment needs of evacuees; and
3. Continue to support partners in assessment of need for alternative care facilities and crisis standards of care.

Epidemiology and surveillance:

1. Monitor health security through syndromic surveillance of emergency department visits for respiratory illness, cardiovascular disease, behavioral health, injury, and medication refills;
2. Consider active public health surveillance for water and vector-borne diseases;
3. Consider tracking river levels and predicted duration of flooding through National Oceanographic and Atmospheric Administration to guide planning about health care resource allocation and health care support for displaced persons; and
4. Consider post-event assessment of affected households to evaluate medical and service needs.

WILDFIRES

The 2012 Oregon wildfire season closed with 1,265,357 acres burned in 899 wildfires.^x Two fires each burned more than 100,000 acres. Since 1990, Oregon has experienced 31 fire management assistance disasters.^{xi} During the past decade, both wildfire incidence and acreage area burned have been trending upward. Climate change models predict that in the future Oregon will see fewer, but more destructive, wildfires.^{xii} Historically, central, southwestern and northeastern Oregon have been most likely to experience wildfires, and lightning is the predominant cause of the wildfires that affect Oregon communities at the wildland-urban interface.

People in those communities are, therefore, at increased risk of exposure to the poor air quality associated with wildfires. For members of the general public, the greatest health risk from wildfire smoke is due to fine particles suspended in the air. Particles smaller than 2.5 microns are easily inhaled and absorbed into the bloodstream. They can aggravate chronic health conditions, such as asthma, chronic lung disease, and heart disease. In one study, the relative risk of an asthma attack increased 66% with wildfire exposure, and the relative risk of an episode of congestive heart failure jumped 42%.^{xiii}

Forty-three percent of local health jurisdictions report the need to plan for a major increase in severe asthma cases, and 21% expect a limited and minor increase in chronic disease conditions. In short, people with existing medical conditions are likely to experience a worsening of their conditions. Populations at greatest risk include persons with existing respiratory conditions, chronic cardiovascular conditions, infants and young children, pregnant women, the elderly, smokers, and outdoor athletes or workers.

PUBLIC HEALTH RECOMMENDATIONS

Emergency public information and warning:

1. Oregon Public Health Division annual review and refine the wildfire communications toolkit;
2. Develop communication plans for reaching vulnerable populations; and
3. Continue to distribute clinical and public guidance on health and safety during and after wildfires.

Medical materiel management and distribution:

1. Review and support health care resource requests.

Medical surge:

1. Continue to engage clinical partners (pre-hospital and health care system) in surge planning and exercise;
2. Work with partners to assess and meet prescription medication and treatment needs of evacuees.

Epidemiology and Surveillance:

1. Monitor the health effects of poor air quality and wildfire-related injuries through syndromic surveillance of emergency department visits for respiratory illness, cardiovascular disease and injury;
2. Monitor air quality data from Department of Environmental Quality and local air quality districts in affected areas, as well as Oregon Department of Forestry forecasts, to guide public messaging, public health interventions, and as necessary, planning about health care resource allocation;
3. Consider monitoring pre-hospital care through emergency medical services reports or pharmaceutical sales information; and
4. Consider post-event assessment of affected households to evaluate medical and service needs.

WINTER STORMS

During a typical Oregon winter, storms come inland off the Pacific Ocean with wind, rain, and in higher elevations, snow. When temperatures warm, valleys and lowlands may experience flooding and landslides, and avalanches can occur in the mountain ranges. Climate change models predict reduced snowpack and extreme fluctuations in precipitation in the future.

Seventy percent of deaths during winter storms in Oregon result from automobile accidents, while few injuries and deaths result directly from cold weather.^{xiv} Although local respondents anticipated little increased risk to the health of the population related to a winter storm, they reported concern about providing care to vulnerable populations in their jurisdictions and anticipated that food and water security would decline as households depleted their on-hand food supplies and would have limited access to potable water. Populations most-at-risk during winter storms are the homeless, the elderly, low-income households that lack adequate space or income for stocked pantries, and households that are geographically isolated.

Health jurisdictions in the Willamette Valley and Columbia Basin were more likely to express concern about winter storm events. Regions expecting to see the most winter weather, Eastern and Central Oregon, anticipated that local surge capacity was adequate for response, though emergency transport and public health staffing might be limited while roads were closed.

PUBLIC HEALTH RECOMMENDATIONS

Emergency public information and warning:

1. Oregon Public Health Division develop winter storm communications toolkit;
2. Develop communication plans for reaching vulnerable populations; and
3. Distribute clinical and public guidance on health and safety during and after winter storms.

Medical materiel management and distribution:

1. Review and support health care resource requests.

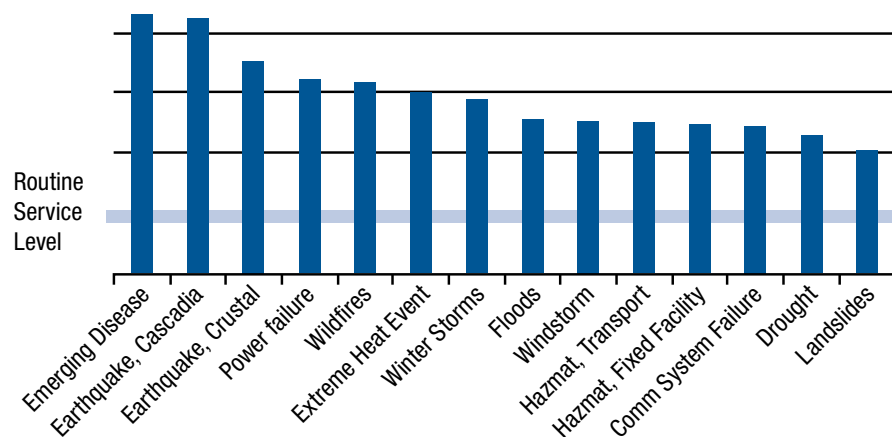
Epidemiology and surveillance:

1. Monitor injuries, motor vehicle accidents, and unintentional carbon monoxide poisoning through syndromic surveillance of emergency department visits;
2. Monitor NOAA/National Weather Service forecasts to guide health care resource allocation decisions;
3. Consider monitoring pre-hospital care through emergency medical services reports; and
4. Work with partners to make shelter recommendations based on exposures and population vulnerabilities.

HEALTH SECURITY FOR VULNERABLE POPULATIONS

Local health jurisdictions were asked to estimate the need for special services to support individuals who are geographically or linguistically isolated, or who have reduced ability to hear, speak, understand, move or walk independently. Respondents across the state estimated that the demand for increased services to vulnerable populations would exceed current service capacity.

Figure 3 Vulnerable Population Service Needs by Hazard, Oregon Public Health Vulnerability Assessment, 2013



It is challenging to meet the complex needs of vulnerable populations following a disaster; a primary reason is that people most at risk rarely participate in the community planning process. People with disabilities can face additional barriers to care during disaster response if shelter access, communication tools, equipment and transportation systems have not been designed to address their needs. However, pre-event collaboration with advocacy organizations, religious institutions, community centers, and residential facility administrators can bring the people who are the most vulnerable to the planning table. An inclusive strategy also can be an opportunity to introduce home preparedness activities to communities with low socioeconomic levels, acknowledging and addressing the finding that higher income, higher levels of education and home ownership are all associated with being better prepared for disasters.^{xv}

PUBLIC HEALTH RECOMMENDATIONS

Community preparedness

1. Engage all community sectors in identifying vulnerabilities.
2. Invite community members to be subject matter experts in the development and exercise of all hazard plans.
3. Support local and regional networks of diverse partners, striving to address health equity in public health, health care system and emergency preparedness activities.
4. Support partners in planning for family reunification.
5. Encourage community leaders to act as spokespersons, relaying public health messages for disaster response.
6. Provide timely guidance to educate the public, paying special attention to the needs of at-risk individuals, including considerations of reading levels, options for persons who are visually or hearing impaired, and culturally sensitive messaging.

Emergency public information and warning:

1. Develop communication plans for reaching vulnerable populations; and
2. Distribute culturally appropriate clinical and public guidance on recovery health and safety.

Medical surge:

1. Work with partners to assess and to meet prescription medication and treatment needs of evacuees; and
2. Support partners in assessment of need for culturally appropriate alternative care facilities.

Epidemiology and surveillance:

1. Monitor health security in vulnerable populations through syndromic surveillance of emergency department visits;
2. Consider monitoring pre-hospital care through emergency medical services reports; and
3. Consider post-event assessments of affected households to evaluate medical and service needs.

CONCLUSIONS

This assessment represents a step forward for emergency preparedness in Oregon. County and tribal health jurisdictions identified the hazards most likely to affect their communities and outlined public health consequences associated with these hazards. The assessment also offers a practical list of public health activities that will build state and local public health preparedness capacity before, during and after a disaster. Across the state, local respondents noted the need to better understand and meet the unique vulnerabilities of persons at risk in our communities. This work already is underway as public health collaborates with partners across all sectors to improve community health and resilience. Investments we make now will pay off as we become stronger, more resilient, and better prepared to respond together to face public health disasters.

FOOTNOTES

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