2016

State of Oregon West Nile Virus Summary Report

Oregon Health Authority

PUBLIC HEALTH DIVISION
Acute and Communicable Disease Prevention Program

Acknowledgments

This report was prepared by:

Emilio DeBess, DVM, MPVM

and

Cedric Cicognani, B.S.

Acute and Communicable Disease Prevention

800 N.E. Oregon St., Suite 772

Portland, OR 97232

Phone: 971-673-1111

Fax: 971-673-1100

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For more information, contact Emilio.E.DeBess@state.or.us.

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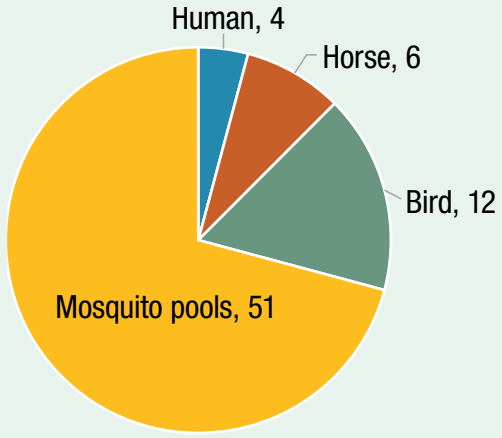
Oregon's surveillance for West Nile virus (WNV) in 2016 identified the following:

- 4 human cases
- 6 equine cases
- 12 avian cases
- 51 positive mosquito pools

Figure 1. Number of positive WNV tests, Oregon, 2016



Source: Oregon State University Veterinary Diagnostic Laboratory and Oregon State Public Health Laboratory

Table 1. Confirmed WNV infections by species, Oregon, 2004–2016

Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Human	5	8	73	27	16	12	0	0	12	16	8	1	4
Horse	32	46	35	16	0	5	0	2	2	6	3	6	6
Bird	23	15	25	52	2	16	0	0	2	2	7	11	12
Mosquito pools	0	11	22	28	16	262	4	3	71	89	58	59	51
Sentinel chickens	0	15	0	11	0	0	0	0	0	0	0	0	0

Source: Oregon State University Veterinary Diagnostic Laboratory and Oregon State Public Health Laboratory

Introduction

Oregon's surveillance program for West Nile virus (WNV) was launched in 2001. The virus was first identified in humans, birds and horses in Oregon in 2004. Our peak year followed two years later when 73 human cases were reported.

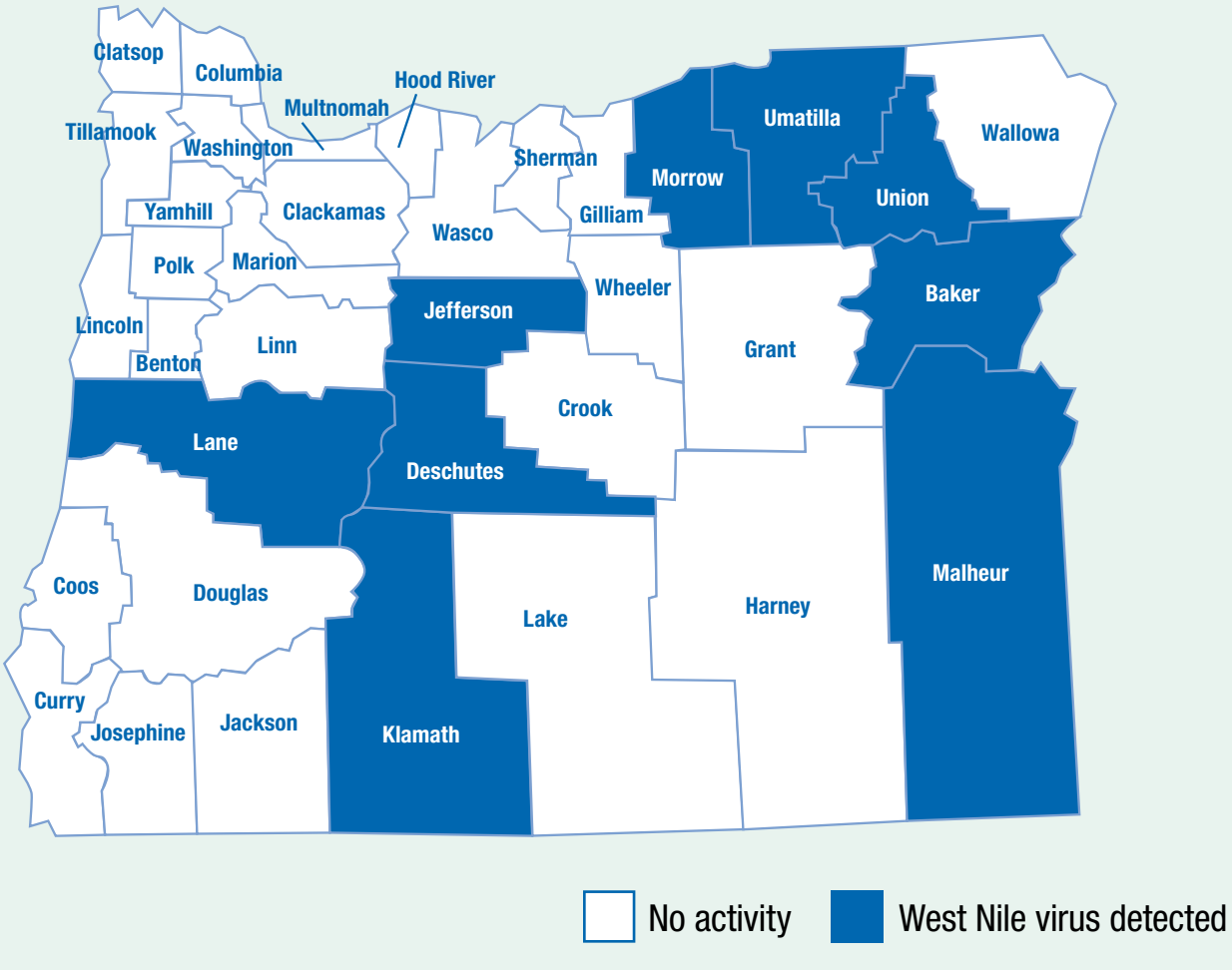
Incidence of human WNV disease remained low in Oregon in 2016. Four human cases, 12 birds, six horses and 51 mosquito pools tested positive for WNV in 2016.

Thirteen vector control districts (VCDs) collect, identify and test mosquitoes and dead birds for WNV surveillance (Figure 4). Some VCDs conduct initial WNV tests for mosquito pools and dead birds using the Rapid Analyte Measurement Platform (RAMP). The Oregon State Public Health Laboratory (OSPHL) performs confirmatory testing of WNV for human specimens. Oregon State University's (OSU's) Veterinary Diagnostic Laboratory performs WNV testing of mosquitoes, dead birds, horses and other mammals.

The following sections summarize Oregon WNV surveillance findings for humans, horses, birds and mosquitoes in 2016.

Figure 2. Map of Oregon with shaded counties reporting WNV, 2016

County	Mosquitoes	Birds	Horses	Human
Umatilla	34	0	3	0
Baker	9	0	0	0
Morrow	7	1	0	0
Lane	0	10	0	0
Union	1	0	0	0
Deschutes	0	0	1	1
Malheur	0	0	2	2
Jefferson	0	0	0	1
Klamath	0	1	0	0
Total	**51**	**12**	**6**	**4**



See https://public.health.oregon.gov/DiseasesConditions/DiseasesAZ/Pages/disease.aspx?did=8 for more information about West Nile virus.

WNV surveillance and related activities

Human surveillance

In 2016, four Oregon residents tested positive for WNV by immunoglobulin M (IgM) antibody; one had neuroinvasive disease. Illnesses related to neuroinvasive disease are usually characterized by the acute onset of fever with stiff neck, altered mental status, seizures, limb weakness, cerebrospinal fluid (CSF) pleocytosis or abnormal neuroimaging. Acute flaccid paralysis (AFP) may result from anterior ("polio") myelitis, peripheral neuritis or post-infectious peripheral demyelinating neuropathy (i.e., Guillain-Barré syndrome). Less common neurological manifestations, such as cranial nerve palsies, also occur.

Table 2. Trend data for Oregon residents who contracted WNV in Oregon, 2004–2016

Year	All cases	Neuroinvasive	Deaths
2004	5	0	0
2005	8	1	0
2006	73	13	1
2007	27	7	1
2008	15	3	0
2009	12	0	0
2010	0	0	0
2011	0	0	0
2012	12	1	0
2013	16	8	0
2014	8	2	0
2015	1	0	0
2016	4	1	0
TOTAL	**181**	**36**	**2**

Source: Oregon State Public Health Laboratory

Veterinary surveillance

WNV surveillance in Oregon's equine population resulted in six positive tests. Positive test results by county are summarized in Table 3. No other mammals tested positive for WNV in 2016.

Table 3. Positive equine WNV test results, Oregon, 2016

County	Horses tested for WNV	Horses with positive WNV test results
Benton	1	0
Clackamas	2	0
Deschutes	1	1
Douglas	1	0
Grant	1	0
Jackson	1	0
Jefferson	1	0
Malheur	4	2
Umatilla	4	3
Total	**16**	**6**

Source: Oregon State University Veterinary Diagnostic Laboratory

Avian surveillance

WNV surveillance in Oregon's avian population resulted in 12 positive test results out of 44 birds tested by OSU's Veterinary Diagnostic Laboratory and the VCDs. Of the 44 birds collected, 30 were of the family Corvidae (a.k.a. corvids), while the remaining 14 were American species other than corvid. Table 4 shows Oregon's avian species collection totals by county for 2016. Trend data for avian WNV testing and positive test results for Oregon counties for the years 2004–2016 are presented in Table 5.

Table 4. Avian WNV test results by county, Oregon, 2016

County	Corvids tested	All other species tested	Total positives
Baker	0	1	0
Benton	0	1	0
Clackamas	2	0	0
Josephine	1	0	0
Klamath	0	1	1
Lane	10	3	10
Marion	1	0	0
Morrow	2	0	1
Multnomah	7	0	0
Umatilla	4	4	0
Union	1	4	0
Wallowa	1	0	0
Washington	1	0	0
TOTAL	**30**	**14**	**12 (27%)**

Source: Oregon State Public Health Laboratory

Table 5. Avian WNV tests and trend of positive test results, Oregon, 2004–2016

Year	Number tested	Number positive	% positive
2004	448	23	5%
2005	298	15	5%
2006	212	25	12%
2007	246	55	22%
2008	117	2	2%
2009	90	16	18%
2010	24	0	0%
2011	20	0	0%
2012	35	2	6%
2013	22	2	9%
2014	35	7	20%
2015	36	11	30%
2016	44	12	27%

Source: Oregon State Public Health Laboratory

Sentinel chicken surveillance

Sentinel chicken surveillance was discontinued in 2011.

Mosquito surveillance

In 2016, the VCDs conducted WNV surveillance in Oregon's mosquito population. Figure 4, page 10 shows the counties with participating VCDs and their activities. Statewide, 159,847 mosquitoes were sampled (see Table 7, page 7). Of those, 108,174 mosquitoes in 3,071 mosquito pools were tested for WNV (see Table 8, page 7). The tested mosquitoes comprise 29 mosquito species. OSU conducted polymerase chain reaction (PCR) testing, and some VCDs performed RAMP. Table 6 below displays the number of Oregon mosquito pools by species that tested positive for WNV in 2016. Table 9, page 8 displays Oregon mosquito species between 2004 and 2016 found positive for WNV. Figure 3, page 9 indicates the efficiency of vector transmission for various mosquito species (information obtained from the Centers for Disease Control and Prevention).

Table 6. WNV-positive mosquito pools, Oregon, 2016

VCD	Mosquito species	Number of positive mosquito pools	Collection date
Baker	*Culex tarsalis*	9	7/21–9/9
Morrow	*Culex pipiens*	7	7/29–8/26
Umatilla	*Culex pipiens*	14	7/1–9/15
Umatilla	*Culex tarsalis*	18	7/1–9/16
Umatilla	*Genus Culex*	2	8/12–9/15
Union	*Culex tarsalis*	1	8/19
Total		**51**	

Source: Oregon vector control districts

Table 7. Total female mosquitoes collected for surveillance purposes by Oregon VCDs, 2016

County / VCD	Aedes cheeus	Aedes dorsalis	Aedes increpitus	Aedes Nigromaculis	Aedes nipadopsis	Aedes species	Aedes sierrensis	Aedes sticticus	Aedes vexans	Aedes /Oc. washinoi	Anopheles species	Anopheles punctipennis	Anopheles freeborni	Coquillettidia perturbans	Culex erythrothorax
Baker		7,082		4,510					428				595		
Clackamas						8	17	8	48	58		196	67		7
Columbia			1,940					333	849			168		95	
Crook													1,395		
Deschutes									1,250				225		
Jackson									1,677					17	
Klamath		576			11				6,447				10,482		
Malheur		534							342		173				
Morrow		23	163	156					313				7,034	128	
Multnomah									422	255		276	56	665	
Union									3,795				579		
Washington	16					13	51		477	1,683		1,091	654	470	
Total:	**16**	**8,215**	**2,103**	**4,666**	**11**	**21**	**68**	**341**	**16,048**	**1,996**	**173**	**1,731**	**21,087**	**1,375**	**7**

Additional Mosquito species

County / VCD	Culex pipiens	Culex restuans	Culex species	Culex stigmatosoma	Culex tarsalis	Culex territans	Culiseta inciden	Culiseta inornata	Culiseta minnesotae	Culiseta morsitans	Culiseta particeps	Culiseta species	Ochlerotatus sierrensis	Ochlerotatus sticticus	**Total mosquitoes collected**
Baker	2				8,137			362							**21,116**
Clackamas	1,541		5	78	279		2,180	3							**4,495**
Columbia	198				455			19							**4,057**
Crook	100				555										**2,050**
Deschutes	615				650			330							**3,070**
Jackson	7,019				8,655										**17,368**
Klamath	548				11,769		82	2,834							**32,749**
Malheur			132												**1,181**
Morrow	8,403		82		4,891		42	1,214				48			**22,497**
Multnomah	1,536				5,604		1,380	209			9		60	154	**10,626**
Umatilla	7,431		503		4,454										**12,388**
Union	798				4,320			56							**9,548**
Washington	7,534	2	7	70	2,094	1	3,887	244	308	4	96				**18,702**
Total all species:	**35,725**	**2**	**729**	**148**	**51,863**	**1**	**7,571**	**5,271**	**308**	**4**	**105**	**48**	**60**	**154**	**159,847**

Source: Oregon Vector control districts

Table 8. Female mosquito pools collected by Oregon VCDs and tested for WNV at Oregon State University, 2016

County	Aedes dorsalis	Aedes increpitus	Aedes sticticus	Aedes vexans	Anopheles freeborni	Anopheles punctipennis	Coquillettidia perturbans	Culex pipiens	Culex tarsalis	Culiseta inciden	Culiseta inornata	Family culicidae	Genus Aedes	Genus Culex	Total mosquito pools
Baker								236							236
Columbia	39	7	20		1	2	6	11		1					87
Deschutes			22	36			15	30		8					111
Jackson			52			1	266	351							670
Klamath	16		139	223			20	252	5	78		1			734
Malheur								2					4		6
Morrow			6			4	253	193					6		462
Multnomah			3			4	6	64	8						85
Umatilla							113	112			1		25		251
Union			71				24	136							231
Washington			4		16	6	144	28							198
Total:	**16**	**39**	**7**	**317**	**259**	**17**	**17**	**847**	**1,415**	**13**	**87**	**1**	**1**	**35**	**3,071**

Source: Oregon vector control districts and Oregon State University

Table 9. Trend data, WNV-positive mosquito pools*, Oregon, 2004–2016

Year	Mosquito species	Number of positives
2004	-	-
2005	*Culex tarsalis*	11 pools
	Culex stigmatosoma	
	Culex pipiens	
2006	*Culex tarsalis*	22 pools
2007	*Aedes vexans*	8 pools
	Culex pipiens	2 pools
	Culex tarsalis	23 pools
2008	*Aedes vexans*	5 pools
	Culex pipiens	3 pools
	Culex tarsalis	8 pools
2009	*Aedes vexans*	1 pool
	Anopheles freeborni	1 pool
	Anopheles punctipennis	1 pool
	Coquillettidia perturbans	1 pool
	Culex pipiens	75 pools
	Culex tarsalis	131 pools
	Culex sp.	52 pools
2010	*Culex pipiens*	1 pool
	Culex tarsalis	2 pools
	Culex sp	1 pool
2011	*Culex* sp.	3 pools
2012	*Culex pipiens*	53 pools
	Culex tarsalis	3 pools
	Culex sp.	15 pools
2013	*Culex pipiens*	14 pools
	Culex tarsalis	74 pools
	Anopheles freeborni	1 pool
2014	*Aedes vexans*	4 pools
	Culex pipiens	13 pools
	Culex tarsalis	41 pools
2015	*Culex pipiens*	20 pools
	Culex tarsalis	35 pools
	Genus Culex	4 pools
2016	*Culex pipiens*	21 pools
	Culex tarsalis	28 pools
	Genus Culex	2 pools

Source: Oregon State University Veterinary Diagnostic Laborator

*1 pool ≈ 40 mosquitoes

Figure 3. Potential Oregon vectors of WNV based on laboratory vector competence studies

Table 3. Potential for selected North American mosquitoes to transmit WNV based on bionomics, vector competence, virus isolations, and involvement with other arboviruses

Species	Association with other viruses[a]	Host preference	Activity time	Flight range	Vector competence for WNV[b]	Field isolations of WNV[c]	Potential to serve as a	
							Enzootic vector[d]	Bridge vector[e]
Ae. aegypti		Mammals	Crepuscular/day	200 m	+++, 3	+	0	+
Ae. albopictus	EEE	Opportunistic	Crepuscular/day	200 m	++++, 3, 6	+	+	++++
Ae. vexans	EEE, WEE, SLE	Mammals	Crepuscular/night	>25 km	++ 1, 5, 8	+++	0	++
Cq. perturbans	EEE	Opportunistic	Crepuscular/night	5 km	+, 4	+	+	+
Cs. melanura	EEE	Birds	Crepuscular/night	9 km	+, 8	++	++	0
Cs. inornata	WEE	Mammals	Crepuscular/night	2 km	+++, 5	+	+	++
Cx. stigmatosoma	SLE	Birds	Night	1 km	+++, 5	0	+++	+
Cx. erythrothorax	WEE	Opportunistic	Crepuscular/day	<2 km	++++, 5	0	++	+++
Cx. nigripalpus	EEE, SLE	Opportunistic[f]	Crepuscular	5 km	++, 4	+++	+++	++
Cx. pipiens	SLE	Birds	Crepuscular/night	2 km	+++, 1, 3, 5	++++	+++++	++
Cx quinquefasciatus	SLE	Birds	Crepuscular/night	2 km	+++, 4, 5	0	++++	++
Cx. restuans	SLE	Birds	Crepuscular/night	2 km	++++, 4	+++	+++++	++
Cx. salinarius	EEE, SLE	Opportunistic	Crepuscular/night	10 km	++++, 4	+++	+++	++++
Cx. tarsalis	WEE, SLE	Opportunistic[f]	Crepuscular/night	>6 km	++++, 5, 7	++++	++++	+++
Oc. atropalpus		Mammals	Day and night	1 km	++++, 3	+	+	++
Oc. canadensis	EEE	Mammals	Day	2 km	++, 8	+	0	++
Oc. cantator	EEE	Mammals	Day	>10 km	++, 8	+	0	++
Oc. dorsalis	WEE	Mammals	Day and night	5 km	+++, 5	+	0	++
Oc. japonicus	JE?	Mammals	Crepuscular/day	unk	++++, 2, 3	+++	+	++++
Oc. melanimon	WEE	Mammals	Day and night	>10 km	+++, 5	0	0	++
Oc. sierrensis		Mammals	Crepuscular/day	1 km	+, 5	0	0	+
Oc. sollicitans	EEE	Mammals	Crepuscular/night	>25 km	++, 1, 3	+	0	+
Oc. taeniorhynchus	EEE	Mammals	Day and night	>25 km	+, 1, 3	+	0	+
Oc. triseriatus		Mammals	Day	200 m	+++, 8	++	0	+++
Ps. ferox	SLE	Mammals	Day	2 km	0, 8	+	0	0

Distribution and bionomics based on and generalized from information in Carpenter and LaCasse (1955), Darsie and Ward (1981), and Moore et al. (1993).

[a] Known association with other viruses with a similar transmission cycle. EEE, eastern equine encephalomyelitis virus; JE; Japanese encephalitis virus; SLE; St. Louis encephalitis virus; WEE; western equine encephalomyelitis virus. Based on Karabatsos (1985).

[b] Efficiency with which this species is able to transmit WNV in the laboratory. 0, incompetent; +, inefficient; ++++, extremely efficient vector. Based on 1 (Turell et al. 2000), 2 (Sardelis and Turell 2001), 3 (Turell et al. 2001), 4 (Sardelis et al. 2001), 5 (Goddard et al. 2002), 6 (Sardelis et al. 2002), 7 (Turell et al. 2003), or 8 (present study).

[c] Relative number of WNV-positive pools detected. 0, none; +, few; ++++, many.

[d] Potential for this species to be an enzootic or maintenance vector based on virus isolations from the field, vector competence, feeding behavior, etc. 0, little to no risk; +++++, this species may play a major role.

[e] Potential for this species to be an epizootic or bridge vector based on virus isolations from the field, vector competence, feeding behavior, etc. 0, little to no risk; +++++, this species may play a major role.

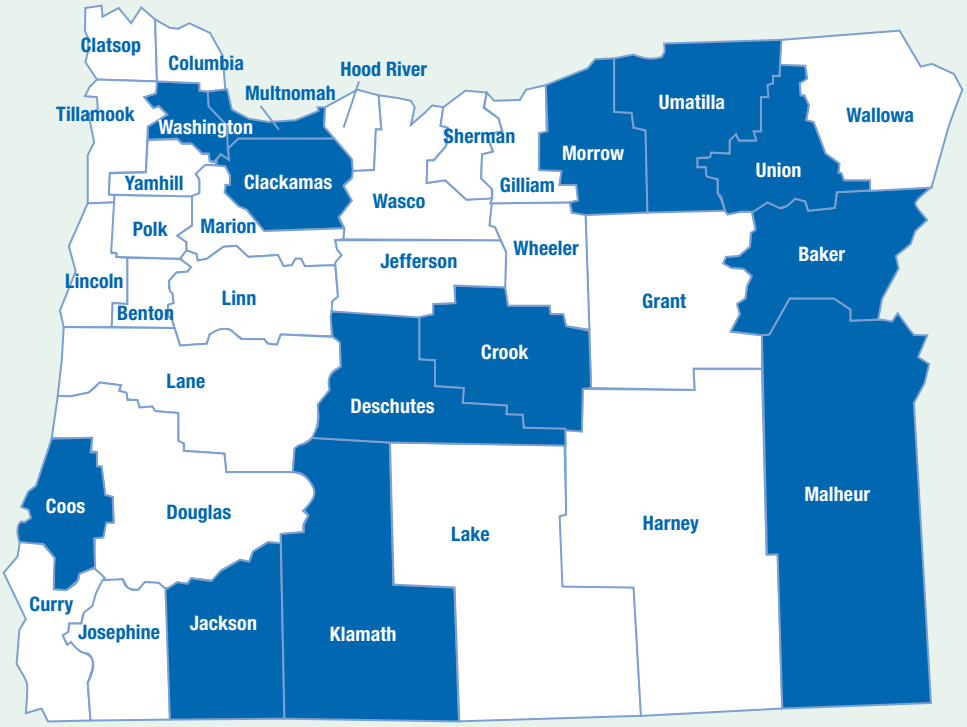
[f] Feeds primarily on avian hosts in spring and early summer and mixed between avian and mammalian hosts in late summer and fall.

* Turell MJ, Dohm DJ, Sardelis MR, Oquinn ML, Andreadis DJ, Blow JA. An update on the potential of North American mosquitoes (Diptera: Culicidae) to transmit West Nile virus. J Med Entomol 2005; 42: 57–62. Used with permission.

Vector control districts in Oregon

Figure 4. Oregon counties with participating vector control districts (VCDs) and their activities

County	Mosquito collection	Bird collection
Baker	YES	YES
Clackamas	YES	YES
Coos	NO	YES
Crook	YES	YES
Deschutes	YES	YES
Jackson	YES	YES
Klamath	YES	YES
Malheur	YES	YES
Morrow	YES	YES
Multnomah	YES	YES
Umatilla	YES	YES
Union	YES	YES
Washington	YES	YES



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PUBLIC HEALTH DIVISION
Acute and Communicable Disease
Prevention Program
Phone: 971-673-1111
Fax: 971-673-1100

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