Vaccinations and Vaccine-Preventable Diseases

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Vaccines prevent a lot of disease.

Disease	20th Century Annual Morbidity*	Reported Cases, 2016†	Percent Decrease
Smallpox	29,005	0	100%
Diphtheria	21,053	0	100%
Measles	530,217	69	>99%
Mumps	162,344	5,311	99%
Pertussis	200,752	15,737	91%
Paralytic polio	16,316	0	100%
Rubella	47,745	5	>99%
Tetanus	580	33	96%
Haemophilus influenzae b <5 y.o.	20,000	22	>99%

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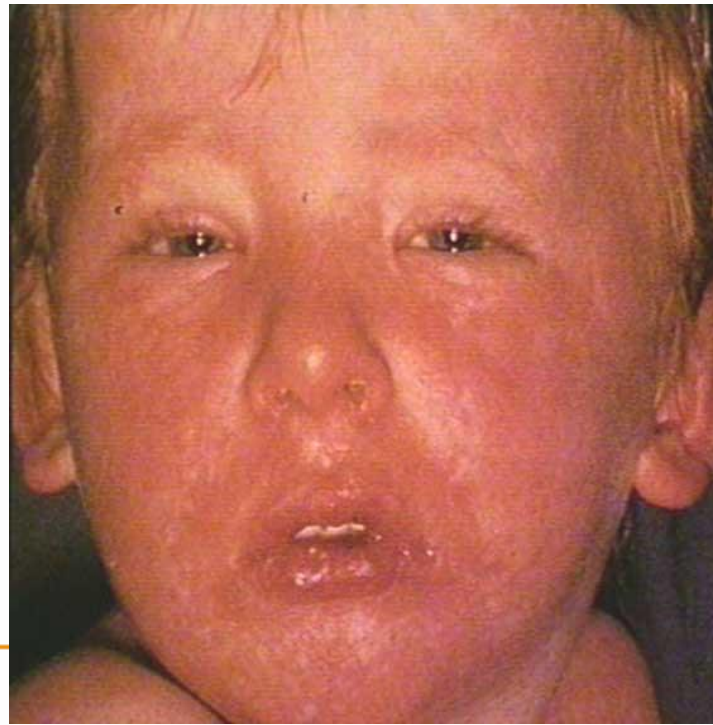
*JAMA 2007; 298:2155–63. †MMWR 2017;64:ND924–41.

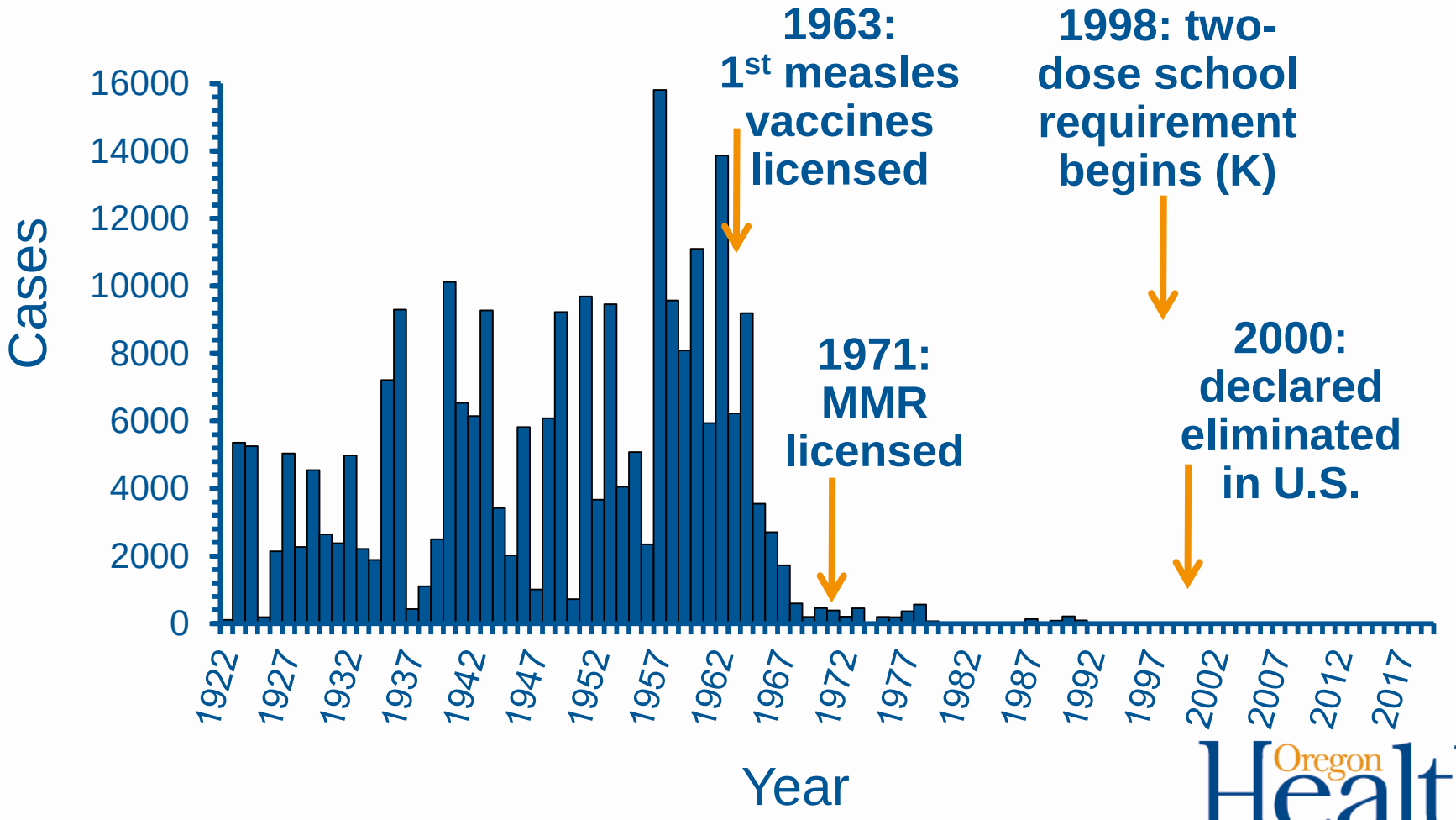
Virtually everyone got measles before a vaccine was developed.

- Nearly universal disease of childhood: 3–4 million cases
- ~500,000 reports to CDC
- 48,000 hospitalizations
- 4,000 cases encephalitis
- 450–500 deaths



www.cdc.gov/measles/about/history.html

Control of measles has been a public health victory.



*data as of 26 Feb 2019

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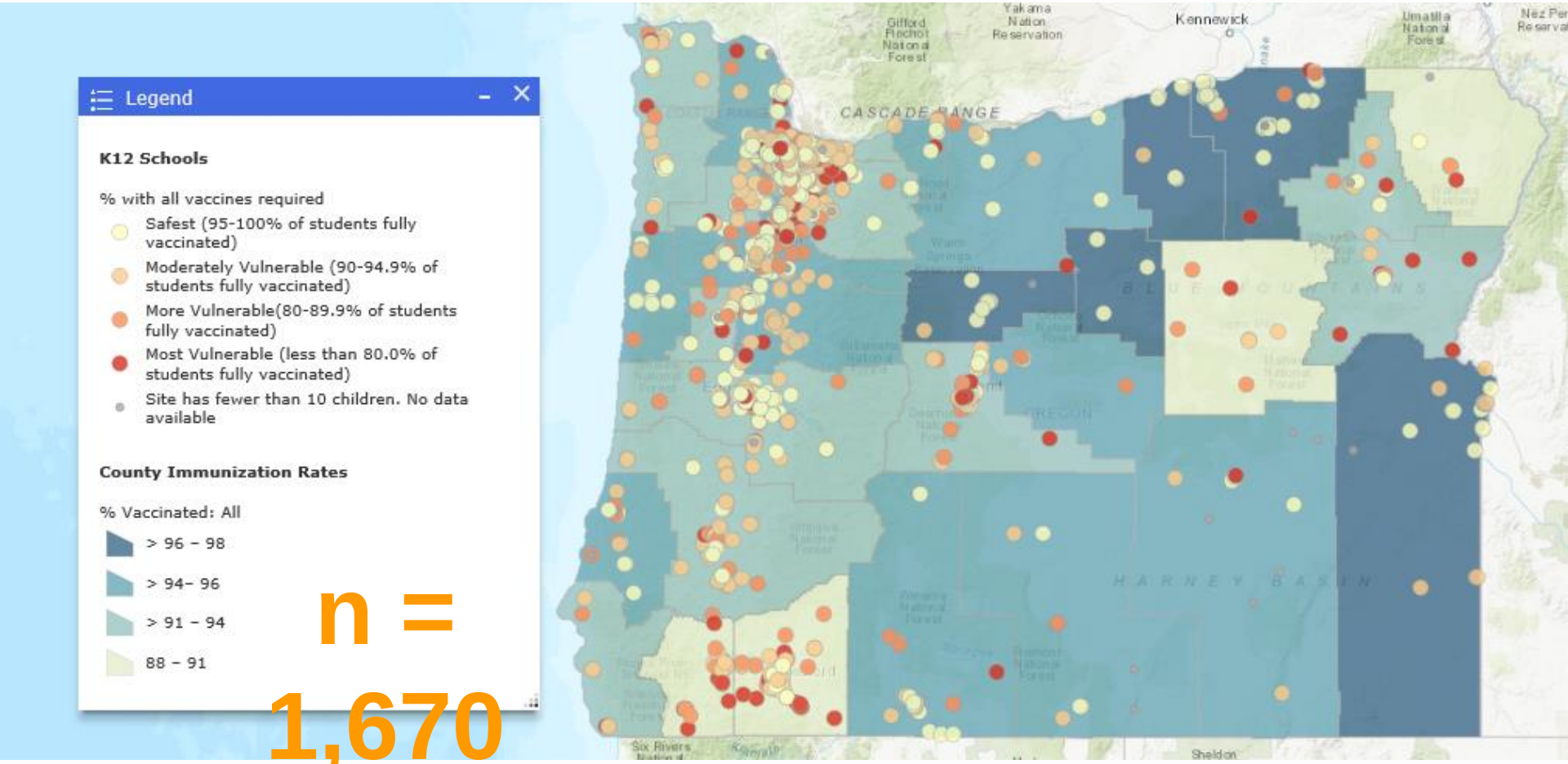
Vaccination is the key to controlling measles.

1. Maintain high population vaccination rates
2. Maintain high population vaccination rates
3. Maintain high population vaccination rates
4. Identify, test, isolate cases
5. Investigate to identify exposed, susceptible contacts
    a. Immunize
    b. Exclude school children, healthcare workers

Immunization rates, by school
Oregon K–12 schools, SY 2017–2018



Overall, 96% of K – 12 students are vaccinated against measles.

- First dose coverage >95% for children attending preschool or certified daycare
- 2nd dose coverage >95% for kindergarteners
- 2nd dose coverage >97% for 7th graders

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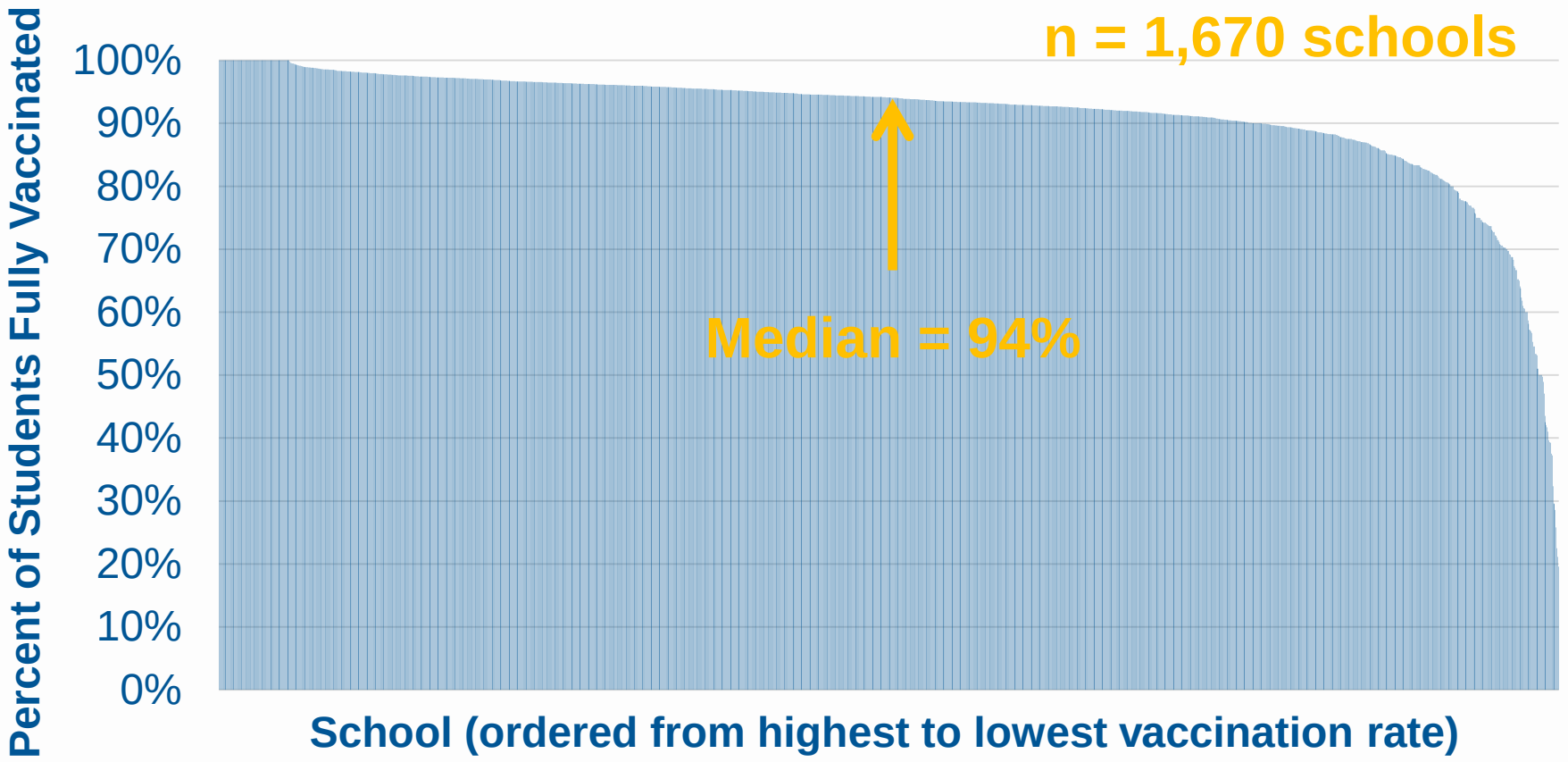
Vaccine completion rates, by school

Grades K–12, Oregon, 2018



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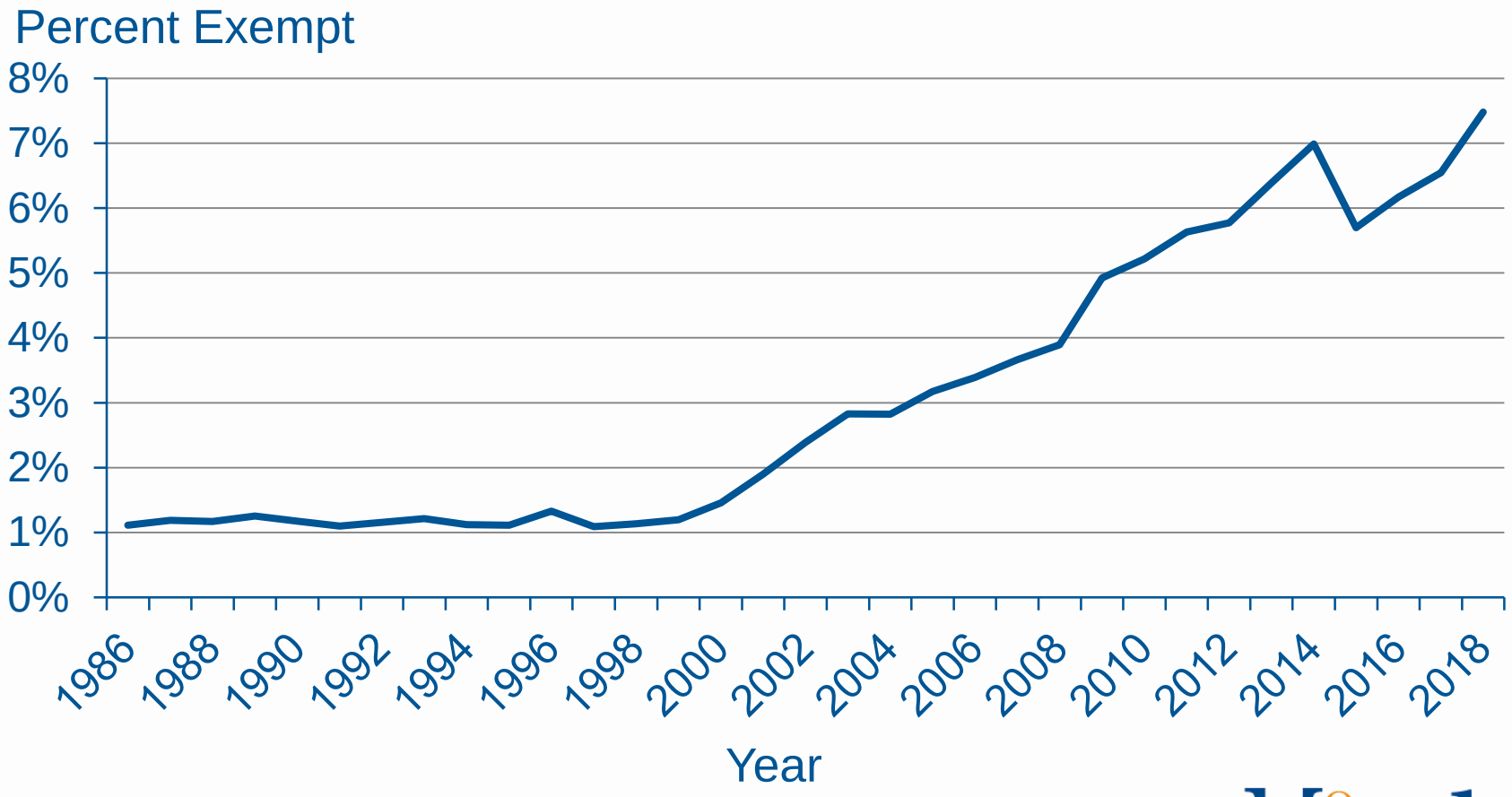
Exemptions to vaccination requirements hit 7.5% Among kindergartners in 2018.



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Most exemptions are for non-medical reasons.

K-12 Enrollment:	**605,276**
Non-medical exemptions:	**31,583 (5.2%)**
Medical exemptions:	**782 (0.1%)**

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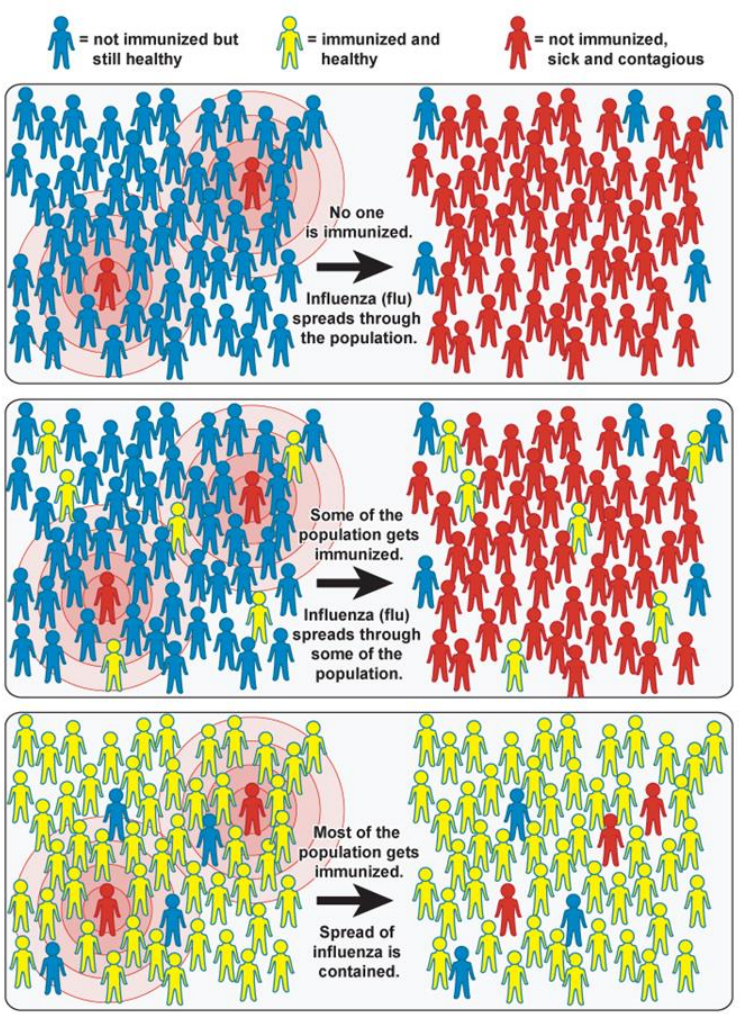
Community immunity
(a.k.a. “herd immunity”)

The resistance to the spread of a contagious disease within a population that results if a sufficiently high proportion of individuals are immune to the disease, especially through vaccination.



“Herd immunity” depends upon how contagious the disease is.

Infection	R_0	Crude Herd Immunity Threshold
Diphtheria	6–7	83%–85%
Influenza	1.4–4	30%–75%
Measles	12–18	92%–94%
Mumps	4–7	75%–86%
Pertussis	5–17	80%–94%
Polio	2–20	50%–95%
Rubella	6–7	83%–85%
Smallpox	5–7	80%–85%
Varicella	8–10?	?

Fine PEM, Mulholland K, Scott JA, Edmunds WJ. Community Protection. In: *Vaccines*, 7th edition. Plotkin S, Orenstein W, Offit P, Edwards KM. Elsevier Inc, 2018.1515.

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70 cases in the current outbreak.

County	Confirmed Cases
Clark	65
King	1
Multnomah	4

All but 2 cases unvaccinated
or no documentation
of vaccination

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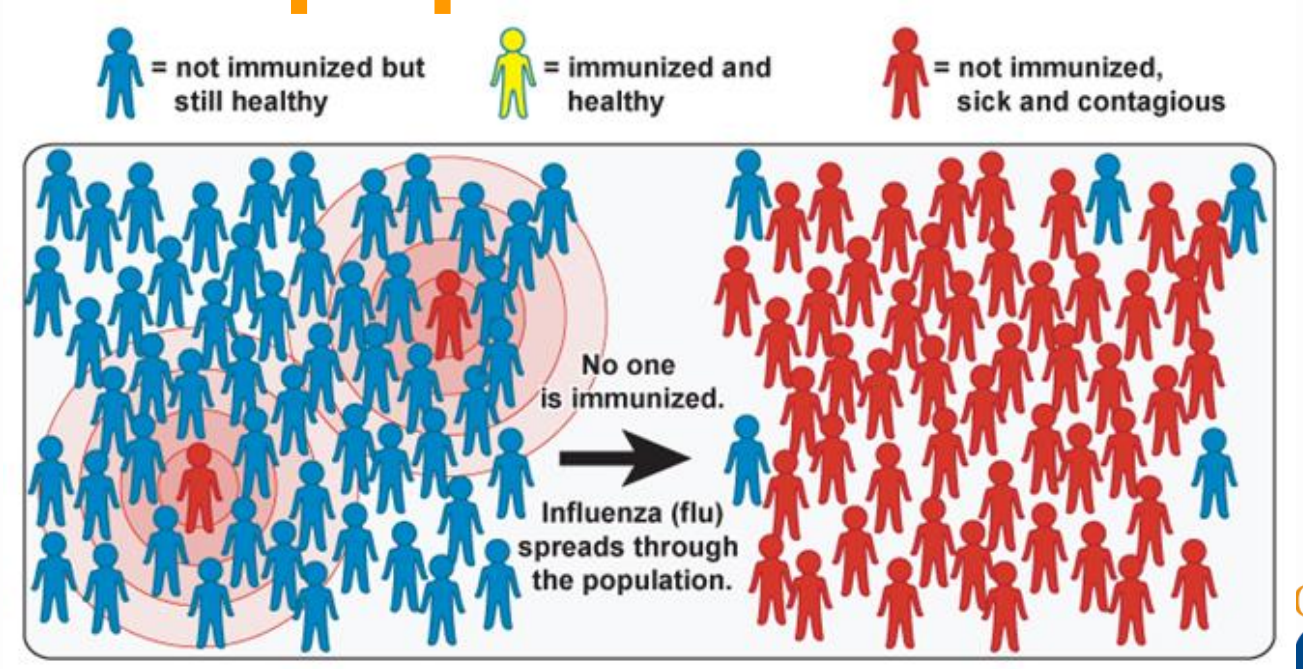
30 Dec 2018 – 26 Feb 2019

What happened?

Measles landed in a susceptible population.



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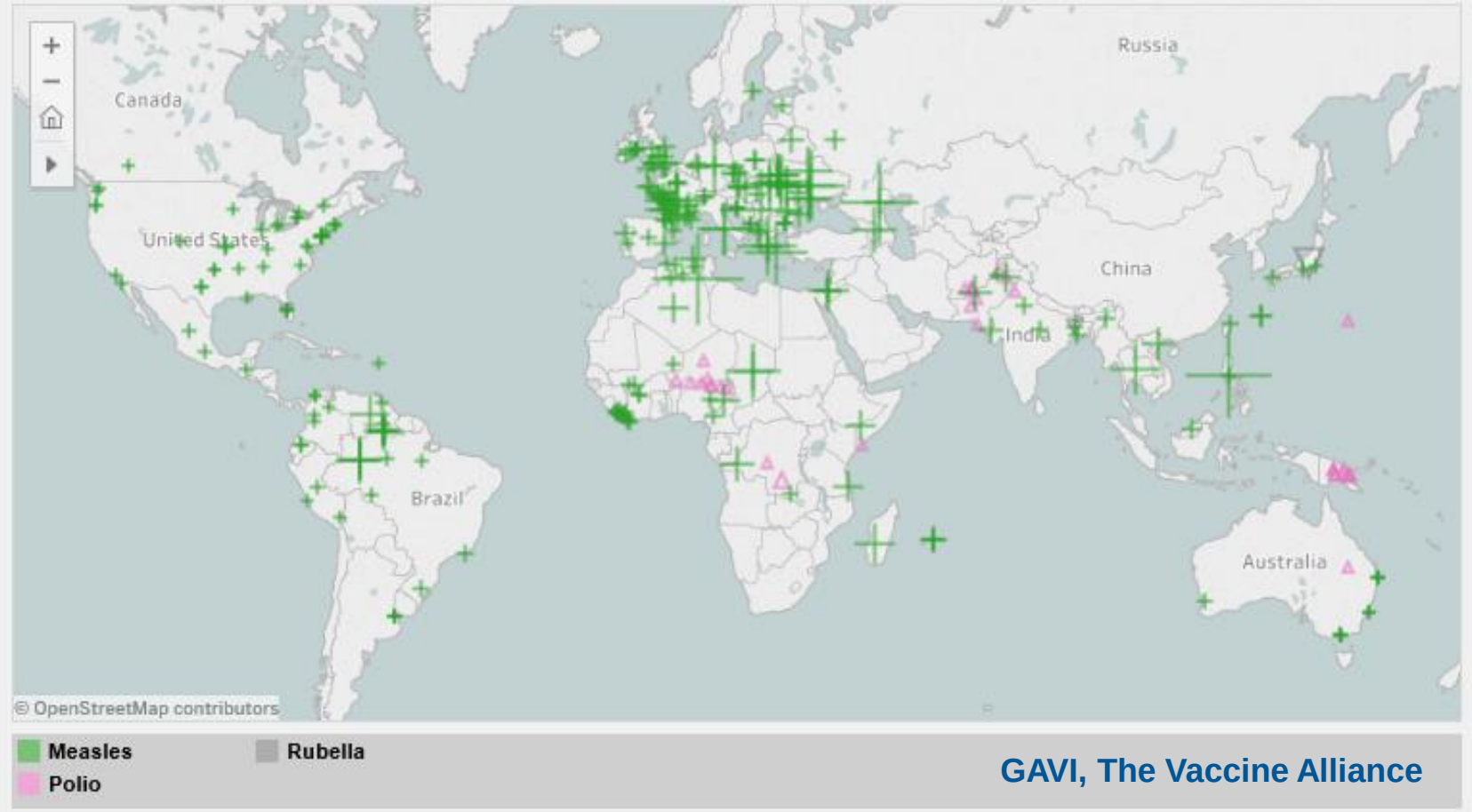
Many diseases are a plane ride away. Worldwide outbreaks, 2018



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Questions ?

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Oregon public health response to measles

- Activated Incident Management Team
- Coordinate with out-of-state colleagues and Oregon local public health authorities
- Guidance re: case investigation, contact follow-up, testing, isolation.
- Recommendations to providers
- Communication materials for public, including translations
- Testing at Oregon State Public Health Lab

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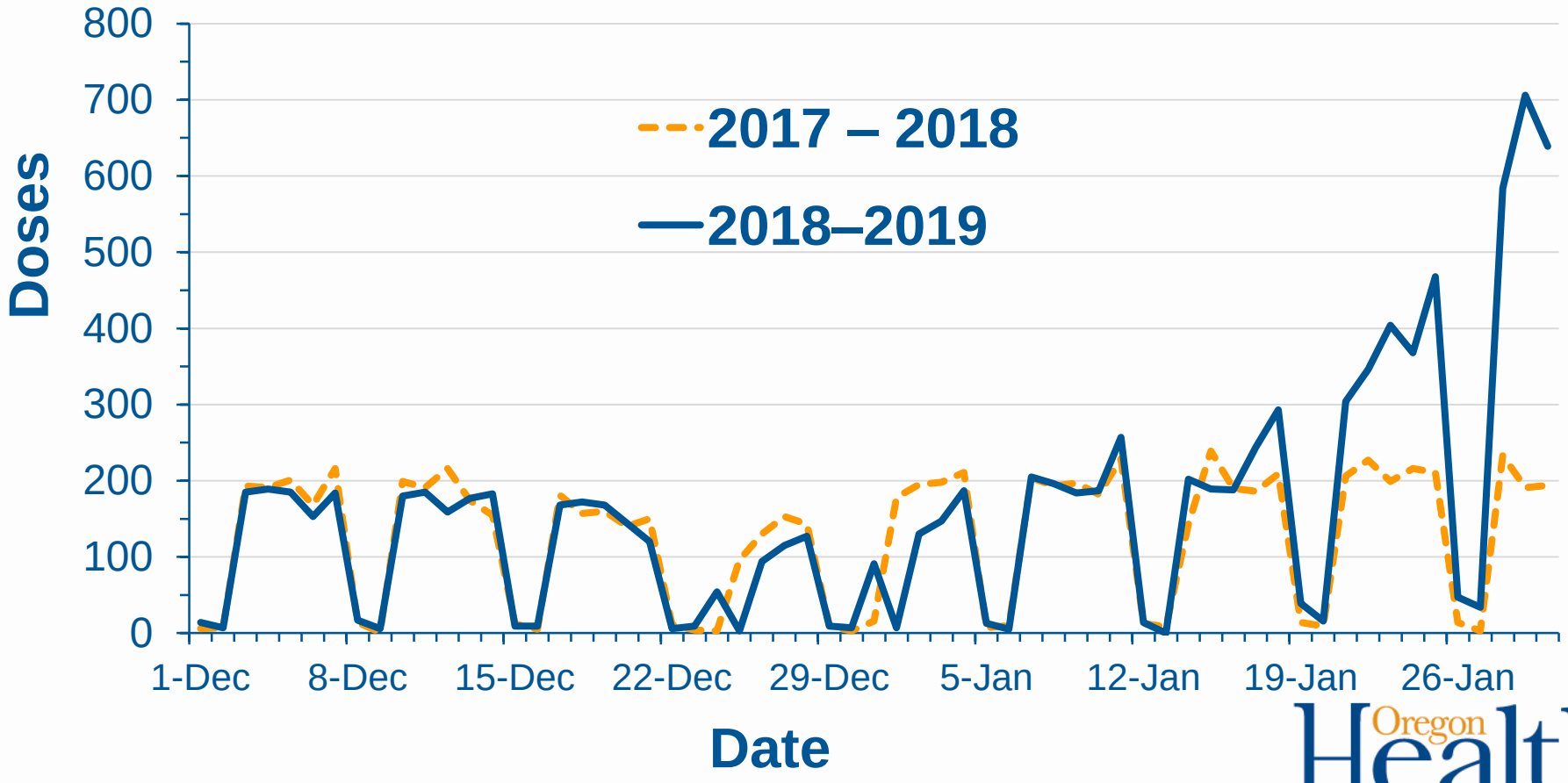
Measles Immunizations
Oregon, December – January
2017 – 2018 vs. 2018 – 2019



Source: ALERT Immunization Information System

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(Reportable) Vaccine-preventable diseases
Oregon, 2012–2018*

	2013	2014	2015	2016	2017	2018
Diphtheria	0	0	0	0	0	0
Hepatitis A	28	14	26	15	20	23
Hep B, acute	34	34	28	21	24	20
Hep B, chronic	455	537	515	481	489	388
Measles	6	5	1	0	0	6
Mumps	3	1	3	27	67	17
Pertussis	486	406	593	192	248	495
Rubella	0	0	0	0	0	0
Tetanus	1	0	1	0	2	1

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*data as of 31 Jan 2019

Immunization of 2-year-olds
Oregon, 2014–2017

Vaccination series	Percent up to date			
	2014	2015	2016	2017
4:3:1:3:3:1:4*	60%	64%	66%	68%
4:3:1:3:3:1†	66%	68%	70%	72%

***Fully immunized with 4 doses of DTaP, 3 doses IPV, 1 dose MMR, 3 doses Hib, 3 doses HepB, 1 dose Varicella, and 4 doses PCV. This is the official childhood vaccination series.**

† The same series, minus PCV doses.

Source: ALERT Immunization Information System

Vaccine Safety Datalink Publications, 2018

- Naleway AL, Mittendorf KF, Irving SA, et al. Primary ovarian insufficiency and adolescent vaccination. Pediatrics 2018; 142(3):20180943.
- Kharbanda EO, Vazquez-Benitez G, Lipkind HS, et al. Risk of spontaneous abortion after inadvertent human papillomavirus vaccination in pregnancy. Obstet Gynecol 132(1):35–44.
- Jackson ML, Yu O, Nelson JC, et al. Safety of repeated doses of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine in adults and adolescents. Pharmacoepidemiol Drug Saf 2018; 27(8):921–5.
- Xu S, Clarke CL, Newcomer SR, Daley MF, Glanz JM. Analyzing self-controlled case series data when case confirmation rates are estimated from an internal validation sample. Biom J 2018; 60(4):748–60.

Vaccine Safety Datalink Publications, 2018

- Zerbo O, Modaressi S, Goddard K, et al. Vaccination patterns in children after autism spectrum disorder diagnosis and in their younger siblings. JAMA Pediatr 2018; 172(5); 469–75.
- Tseng HF, Sy LS, Qian L, et al. Pneumococcal conjugate vaccine safety in elderly adults. Open Forum Infect Dis 2018; 5(6):ofy100.
- Li R, Weintraub E, McNeil MM, et al. Meningococcal conjugate vaccine safety surveillance in the Vaccine Safety Datalink using a tree temporal scan data mining method. Pharmacoeipdemiol Drug Saf 2018; 27(4): 391–7.
- Daley MF, Shoup JA, Newcomer SR, et al. Assessing potential confounding and misclassification bias when studying the safety of the childhood immunization schedule. Acta Pediat 2018; 18(7):754–62.

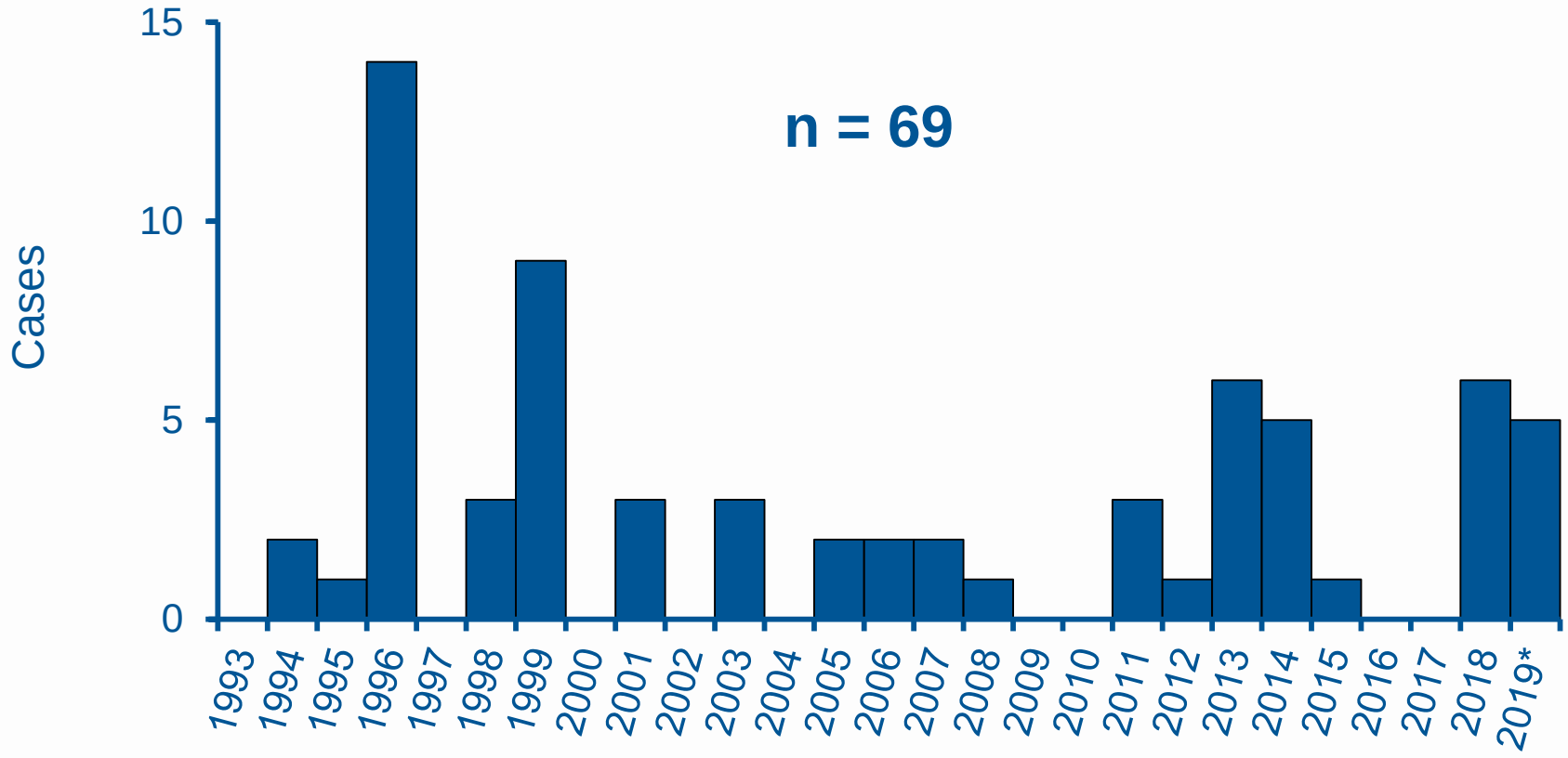
Vaccine Safety Datalink Publications, 2018

- Kuntz J, Crane B, Weinmann S, et al. Myocarditis and pericarditis are rare following live vaccinations in adults. Vaccine 2018; 36(12):1524–7.
- Glanz JM, Newcomer SR, Daley MF, et al. Association between estimated cumulative vaccine antigen exposure through the first 23 months of life and non-vaccine-targeted infections from 24 through 47 months of age. JAMA 2018; 319(9): 906–13.
- Sukumaran L, McCarthy NL, Kharbanda EO, et al. Infant hospitalizations and mortality after maternal vaccination. Pediatrics 2018; 141(3):e20173310.
- McNeil MM, DeStefano F. Vaccine-associated hypersensitivity. J Allergy Clin Imnmunol 2018; 141(2):463–72.

Vaccine Safety Datalink Publications, 2018

- Newcomer SR, Kulldorff M, Xu S, Daley MF, Fireman B, Lewis E, Glanz JM. Bias from outcome misclassification in immunization scheuld safety research. Pharmacoepidemiol Drug Saf 2018; 27(2):221–8.
- Daley MF, Clark CL, Glanz JM, et al. The safety of live attenuated influenza vaccine in children and adolescents 2 through 17 years of age: a Vaccine Safety Datalink study. Pharmacoepidemiol Drug Saf 2018; 27(1):59–68.
- Zhoe H, Thompson WW, Belongia EA, et al. Estimated rates of influenza-associated outpatient visits during 2001–2010 in six US integrated healthcare delivery organizations. Influenza Other Respir Viruses 2018; 12(1):122–31.

Oregon has had an average of <3 measles cases per year since 1993.



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