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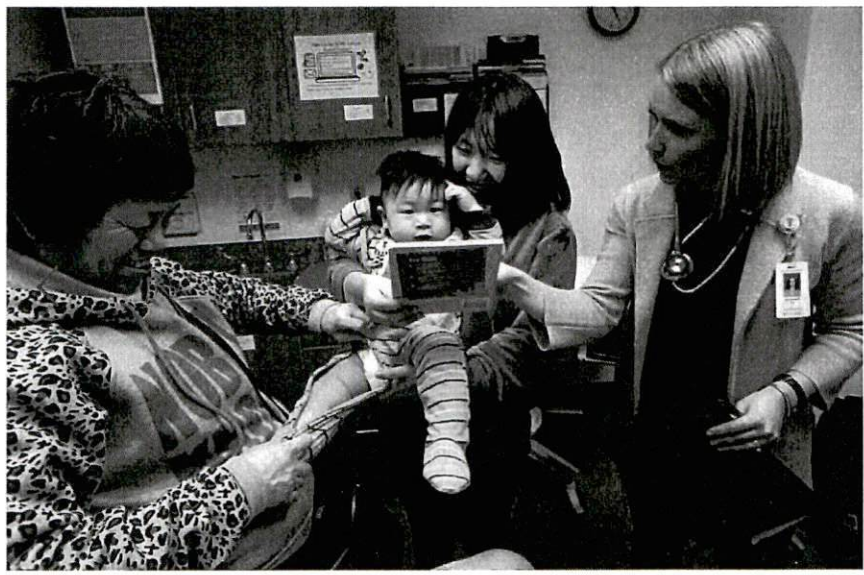
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Health

Cost of Washington's measles outbreak tops \$1 million; expected to climb higher



Originally published February 21, 2019 at 6:00 am | Updated February 21, 2019 at 7:55 pm



1 of 2 Wenyi Zhang holds her 1-year-old son, Abel Zhang, who has just received inoculations, including a vaccine for measles,... (Elaine Thompson / The Associated Press) [More](#) ▾



Clark County, where the measles outbreak is centered, has dedicated 40 to 50 public-health employees to the response while the state Department of Health has assigned 166 staffers.

By Jake Goldstein-Street 
Seattle Times staff reporter

OLYMPIA — The cost of Washington's measles outbreak has surpassed \$1 million as more than 200 health-department staffers from the state and Clark County focus their efforts on the disease.

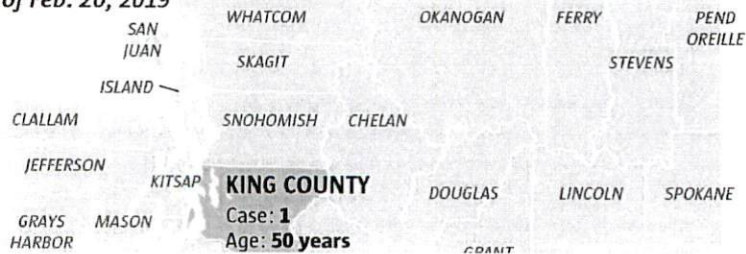
As of Tuesday, there were 63 confirmed cases of measles in Clark County, 44 of which were in children under 10 years old, according to the county's Public Health department, which is also investigating one suspected case. There is also a single case reported in King County, bringing the statewide total to 64, according to the state Department of Health (DOH).

DOH has spent approximately \$614,000 on staff and supplies as of Tuesday, in addition to about \$115,000 in other non-budgeted expenditures, according to state epidemiologist Dr. Scott Lindquist, who expects the total response to eventually cost the state "well over a million dollars."

Meanwhile, Clark County Public Health has spent about \$500,000 responding to the measles outbreak, bringing the statewide total over \$1 million, says Dr. Alan Melnick, the county's public health director.

Washington state measles outbreak

As of Feb. 20, 2019





CLARK COUNTY

Confirmed cases: 63

Suspected cases: 1

Confirmed cases by age:

1 to 10 years		45
11 to 18 years		15
19 to 29 years		1
30 to 39 years		2

Sources: clark.wa.gov, doh.wa.gov

Confirmed cases by immunization status:

Unimmunized		55
Unverified		6
1MMR vaccine		2

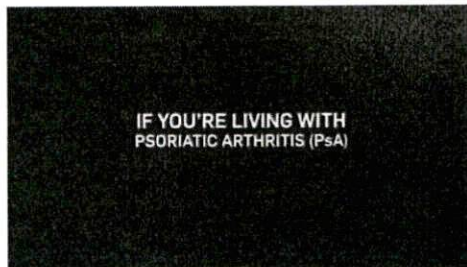
MARK NOWLIN / THE SEATTLE TIMES

“This is taxpayer money for something that could have been completely, utterly preventable in the first place,” he said.

Out of approximately 1,900 total staffers, 166 state Department of Health staff members, working approximately 8,700 hours, have been assigned to the measles outbreak so far, according to Lindquist. Some are communicable disease epidemiologists, normally focusing on issues such as hepatitis and day-to-day food-borne illness outbreaks — duties that have largely been put on the back burner.

“It’s going to slow down everything else,” Lindquist said, noting that usual work is picked up by the remaining staff or is put aside. “The current public health infrastructure is really threatened by events like this.”

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Each Department of Health staffer spends about two weeks at a time in Clark County, which means the state must pay for hotel rooms, their day-to-day costs and travel, according to Lindquist.

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Of about 110 full-time employees, Clark County Public Health has 40 to 50 staffers working on measles at any given time, according to Melnick.

Epidemiological staff members, who were working on sexually transmitted diseases and tuberculosis among other health concerns, are being forced to shift their focus onto measles, as are environmental-health staff members, some of whom do

restaurant inspections. Melnick says restaurants are still safe for eating because those inspections will still get done, but they could be carried out slower.

Two additional Epidemic Intelligence Service officers, who conduct outbreak investigations and are assigned by the federal Centers for Disease Control and Prevention (CDC), were set to go to Clark County again Wednesday. Volunteers from the Medical Reserve Corps have also lent their time to the ongoing efforts.

The state Military Department's Emergency Operations Center, which coordinates resources in support of the DOH, brought in a five-person incident management team with medical specialties from North Dakota, which finished a 19-day stint in Washington on Monday, along with two disease investigators from Idaho, who were here from Feb. 2 to Sunday, according to Robert Ezelle, director of the department's Emergency Management Division.

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The team from North Dakota cost the state just over \$24,000, while the Idaho investigators cost a little more than \$8,000, according to Ezelle.

As the outbreak slowed recently, Ezelle says there are no plans to bring more resources to Washington from other states.

Measles has spread since the start of the year primarily through children who aren't vaccinated, with 55 of the 63 confirmed cases in Clark County in patients who have not been immunized. Clark County, which includes Vancouver, has uncharacteristically high vaccine exemption rates for school-age children.

While the nonmedical exemption rate for kindergarten enrollment in the 2017-2018 school year was approximately 2 percent nationwide, according to the CDC, Washington had an exemption rate on philosophical, personal or religious grounds of 4 percent. By comparison, Clark County, had a 6.7 percent exemption rate, according to state health-department data.

In hopes of reducing the possibility of future outbreaks, lawmakers in Olympia have proposed two measures to tighten the personal or philosophical exemption used to excuse children from vaccines necessary for school entry. Legislation moving through the House would eliminate the objection for the measles, mumps and rubella vaccine, while a Senate bill, subject of a committee hearing Wednesday in Olympia, aims to get rid of the personal exemption for all vaccines needed to attend school or a licensed day-care center.

Given that cases tend to come in waves, Tara Lee, a spokeswoman for Gov. Jay Inslee, said there is not an end date for the state of emergency he declared on Jan. 25, which allows Washington to get resources from other states.

"We will keep it open as long as necessary," Lee said. Lindquist, of the state DOH, says he is "cautiously optimistic" that the upsurge is slowing, but it's too early to predict.

Clark County's Melnick notes that the outbreak will only be considered over after 42 days, or two full incubation periods, pass without any new cases.

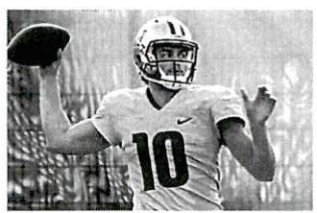
"This could easily go on for another month or two," he said. "Or even beyond."

Jake Goldstein-Street: jgoldsteinstreet@seattletimes.com; on Twitter: [@goldsteinstreet](https://twitter.com/goldsteinstreet).

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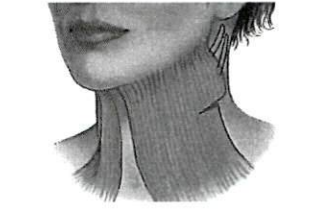
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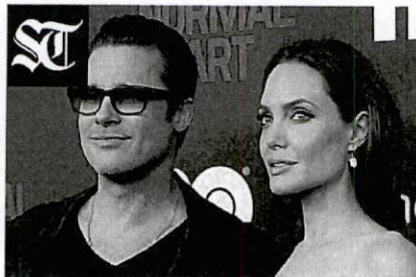


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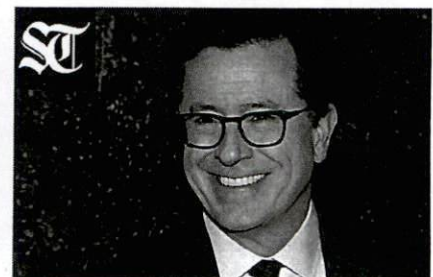
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Vaccines for Children Program (VFC)

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VFC Publications: Supplement

Last updated April 23, 2014

Appendix: Methods for the cost-benefit analyses presented in “Benefits from Immunization during the Vaccines for Children Program Era – United States, 1994–2013”, *MMWR* 2014;63:352-5.

Decision Analysis Model

We developed one decision tree for each vaccine as the basis for our model (see example, Figure 1) and then evaluated the effect of routine childhood vaccination on hypothetical US birth cohorts for children born during 1994 through 2013 (range 3,744,999 children to 4,147,947 children per cohort) [<http://www.census.gov/popest/>] from birth through death. When the VFC program began in 1994, vaccines targeting nine diseases were provided for children aged ≤ 6 years: diphtheria, tetanus, and pertussis (DTaP), polio (OPV then IPV), *Haemophilus influenzae* type b disease (Hib), hepatitis B (Hep B), and measles, mumps, and rubella (MMR). Three vaccines were added between 1996 and 2013: varicella (1996), pneumococcal disease (PCV; 7-valent in 2000, 13-valent in 2010), and rotavirus vaccine (Rota; 2006); influenza and hepatitis A vaccines were also added by VFC during this period but were not included in our model. In the 2013 schedule, the Centers for Disease Control and Prevention (CDC)’s Advisory Committee on Immunization Practices (ACIP) recommended routine administration of 5 doses of DTaP, 3 or 4 doses of Hib (depending on product used), 4 doses of IPV, 2 doses of MMR, 3 doses of HepB, 2 doses of VAR, 4 doses of PCV13, and 2 or 3 doses of Rota (depending on product used) by age 6.^[1] Our analysis is based on coverage attained for each of these vaccines in the United States each year during 1994–2012 as estimated by the National Immunization Survey (NIS),^[2] Immunization Information Systems^[3,4] available in some areas, and School and Childcare Vaccination Surveys.^[5]

The analyses were performed from 2 perspectives: direct cost (direct medical and nonmedical costs) and societal (direct and indirect costs). Direct medical costs include those associated with treating an initial infection as well as costs associated with complications and sequelae of diseases. Direct non-medical costs include travel costs, costs for special education of children disabled by diseases, and costs for other supplies for special needs. Indirect costs include the productivity losses due to premature mortality and permanent disability among cohort members as well as opportunity costs associated with parents who miss work to care for their sick children or cohort members themselves who miss work due to vaccine-preventable illness. Benefits of routine childhood immunization are quantified as the savings in direct and indirect costs that accrue from averting morbidity and mortality by vaccination. The costs associated with the immunization program include the vaccines, their administration, parent travel and work time lost and adverse events associated with these vaccines. All costs were adjusted to 2013 dollars using general and medical Consumer Price Indices, and all costs and benefits in the future were discounted at a 3% annual rate. We calculated net present values (NPV) for all vaccines together. NPV is the sum of the discounted benefits from the routine childhood immunization program minus the sum of the discounted costs.

The data for burden of diseases, costs of diseases, costs for outbreak control and costs of vaccination and adverse events used in our analysis were compiled from a variety of sources: the published literature including surveillance data, study data, and expert consensus; several large computerized data sets; and CDC unpublished data. When it was necessary to make estimates about the incidence of disease and complications from multiple publications, results from existing meta-analyses were used.

Estimating the burden of diseases without vaccination

The age-specific annual incidence rates of diphtheria, tetanus, pertussis, Hib, poliomyelitis, measles, mumps, rubella and varicella diseases, and the prevalence, complications and perinatal transmission of hepatitis B in the United States in the pre-vaccine era were obtained from a previous analysis (Table 1).^[6-23]

For pneumococcus-related diseases, the age-specific estimated incidence rates in the United States in the pre-vaccine era were obtained from CDC's Active Bacterial Core Surveillance (ABCs) (for invasive pneumococcal diseases, or IPD) and the literature (for pneumonia and acute otitis media).^[24-27] Age-specific pre-vaccine IPD rates and case-fatality rates for IPD were based on data from the ABCs program for 1998 and 1999. All-cause pneumonia incidence and acute otitis media rates were obtained from the literature. ^[24-27]

For rotavirus disease, we assumed that the cumulative incidence of rotavirus gastroenteritis is 75% in the first 5 years of life,^[28-31] the cumulative incidence of hospitalization visits due to rotavirus gastroenteritis in the first 5 years is 1.70%, the cumulative incidence of outpatient visits is 11.14%, the cumulative incidence of emergency department visits is 5.36%, and the cumulative incidence of deaths is 0.00078%.^[31]

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Estimating the burden of diseases with vaccination

For all diseases except varicella, hepatitis B, pneumococcal diseases, and rotavirus, we used surveillance data for 1994-2012 from the National Notifiable Diseases Surveillance System (NNDSS) to estimate the burden of diseases with vaccination in 1994-2013. For varicella, we used age-specific incidence data from West Philadelphia Varicella Active Surveillance Project (VASP) site for 1996-2010, and for 2011 and 2012, we used the age-specific data from 31 states from NNDSS, to estimate the total number of varicella cases in the United States. Based on data from VASP, we assumed that 0-92.3% of reported cases involved persons that had previously received varicella vaccine, with the proportion vaccinated varying by year, and that cases in vaccinated persons were much milder than cases among unvaccinated persons.^[32] For hepatitis B, since chronic cases were not reported to NNDSS, we used an established hepatitis B decision analysis model^[33] the vaccination coverage rates^[2] and the vaccine efficacy estimates^[34] to estimate the likelihood of hepatitis B infection and sequelae among vaccinated and unvaccinated children in the cohort. For pneumococcal disease, vaccination era IPD rates and case-fatality rates for IPD were based on data for 2001-2012 from ABCs. All-cause pneumonia incidence and acute otitis media rates were obtained from the literature.^[24-27,35] For rotavirus disease, we developed a decision analysis model using the vaccination coverage rates from NIS^[2] and efficacies of the two vaccines^[36-40] to estimate the likelihood of rotavirus infections and their sequelae among vaccinated children in the cohort.

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Costs associated with disease

Direct Costs

Direct costs for outbreak control, and outpatient and inpatient visits were included in the analysis. The cost of outpatient visits, average duration of hospital stay, hospitalization costs and costs for outbreak control for each condition related to these diseases including congenital rubella syndrome (CRS), were obtained from published and unpublished studies (Table 2).^[7-10,25-27,30,31,33,41-46] All costs shown here were in 2013 dollars.

Indirect Costs

To estimate the productivity losses from premature mortality, we used the human capital approach.^[47] Costs for work loss were determined by the number of days of missed work (for provision of care to sick children, for illness among cohort members, or for resulting disability) multiplied by the daily wage rate associated with the value of lost wage-earning work and the imputed value of housekeeping and home-care activities. We assumed the days of morbidity were distributed randomly throughout the week.

Vaccination coverage, costs and adverse events associated with vaccination

Vaccination coverage was based on 1994-2012 NIS data (2012 data were used for 2013), and used to calculate the vaccine costs for each cohort. Overall, more than 50% of US childhood vaccines were publicly purchased in 2013 (CDC, unpublished data, 2013). The 1994-2013 public and private prices for all vaccines were obtained from the CDC Vaccine Price List

(<https://www.cdc.gov/vaccines/programs/vfc/awardees/vaccine-management/price-list/index.html>). We assumed that the overall rate of vaccine wastage (public and private sectors) was 5%.^[48] The federal excise tax that supports the National Vaccine Injury Compensation Program was not included in vaccine prices.

NIS data indicate that more than 70% of children obtained their vaccines from private providers.^[49] The cost for administering a vaccine dose during a visit to a private clinic was estimated at \$29.07.^[9,10] For the public clinic, we used an administration cost of \$8.15.^[9,10]

We assumed that caregivers take 2 hours off from work to take the child for vaccination (as per previous economic studies^[9,10]). We assumed that the average cost for these caregivers was \$18.19 per hour, and cost for caregiver's travel to the clinic was \$23.45.^[31]

The severe and mild adverse reaction rates of DTaP, Hib, MMR and VAR from the previous analyses were used.^[6,23] We assumed that there were no serious side effects for IPV.^[50] For HepB, we assumed 1.1 episode of anaphylaxis per 1,000,000 vaccinated children.^[51,52] For PCV7, we assumed that 5 per 1,000,000 vaccinated children will have a seizure.^[53] For RV, we assumed that 2,250 per 1,000,000^[54] vaccinated infants will have physician visits for adverse events and 10 per 1,000,000 vaccinated infants will have intussusception caused by rotavirus vaccine, and that the case-fatality rate for intussusception is 0.4%.

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Disease	Without vaccination (i.e., prevaccine era)		With vaccination (i.e., after vaccine introduction)	
	Baseline rates	Data source (s)	Range of disease rates	Data source(s)
Diphtheria [†]	600	7	0	NNDSS
Tetanus [†]	0.3	7	0-0.01	NNDSS
Pertussis [†]	4,720	7	3-43	NNDSS
Hib [‡]	158	9	0.2-0.3	ABCs
Polio, Paralytic [†]	31	6	0	NNDSS
Measles [§]	10,641	10	0-3	NNDSS
Rubella [†]	6,205	10	2-27	NNDSS
Mumps [†]	3,300	10	0-1	NNDSS
Hepatitis B	72	33	6-46	Modeled
Varicella	9,839	22	30-1,140	VASP and NNDSS
Invasive Pneumococcal Disease [‡]	212	26	14-69	ABCs
Rotavirus ^{***}	12,750	31	4,551-7,150	Modeled

* Incidence estimates used in the analysis varied by age.

† Estimates shown are for children 5-9 years old.

‡ Estimates shown are for children 1 year old.

§ Estimates shown are for children 2-4 years old.

|| Estimates shown are for children 1-4 years old.

** Estimates shown are for children 2 years old in one region.

*** Estimates shown are for children 2 years old.

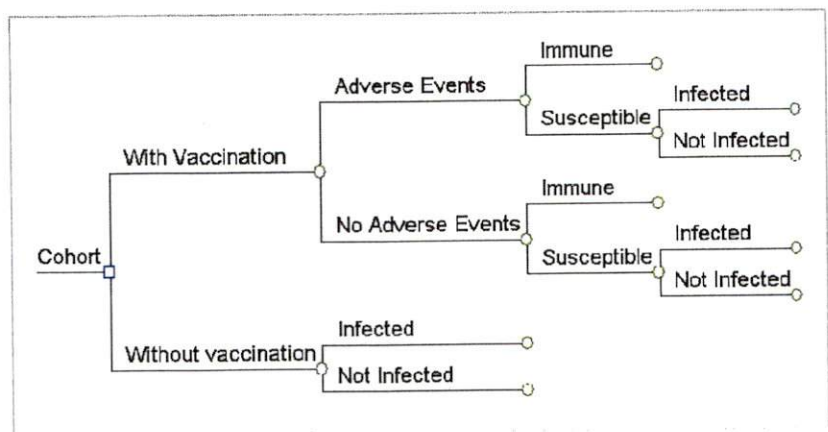
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Table 2. Probabilities and costs of hospitalizations, and outpatient visits for selected vaccine preventable diseases. All costs are in 2013 US \$. *7,12-15,-23,29-31,33,39,40

Disease	Probability of Hospitalization	No. of Hospitalization Days	Cost per Hospitalization	Cost per outpatient visit
Diphtheria	100%	6.1	\$16,982	\$100
Tetanus	100%	16.7	\$102,584	\$100
Pertussis	0.65-30%	5.5-15	\$10,765-22,410	\$100-173
Hib				
◦ Sequelae Among Meningitis Cases	50-100%	2-7.29	\$4,111-38,270	\$100-353
◦ Acute Cases	5-30%	2.84-26.75	\$18,195-49,236	\$310-570
Poliomyelitis	5-100%	4-17	\$7,781-50,554	\$100
Measles	11-100%	1.3-10.9	\$4,032-46,060	\$88-526
Mumps	1-100%	2.8-8.7	\$11,196-46,060	\$110-556
Rubella	0.1-100%	2.6-8.7	\$4,886-46,060	\$89-651
Congenital rubella syndrome				
◦ Hospitalization for investigation	100%	13.6	\$62,233	\$110
◦ Heart surgery	100%	8.9	\$37,082	
◦ Cataract surgery	100%	2.2	\$8,786	
Hepatitis B	0.001-100%	3.9-11	\$15,662-27,051	\$214-599
Varicella	0.1-2.1%	3.1-9.3	\$4,136-22,113	\$83-254
Pneumococcal Diseases	0-100%	6.4-16.8	\$3,798-25,848	\$86-272
Rotavirus	0.5-3.8%	2-3.4	\$3,195-4,793	\$135-455

* Some estimates used in the analysis varied by age, outcome of disease, and with or without vaccination program.

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In class: July 22			<p>and/or adverse events supported vaccine advances.</p> <ol style="list-style-type: none"> 3. Students will be able to describe the complexity of vaccine production, including provide examples of analyses that are conducted to ensure safety and purity. 4. Students will be able to describe the potential effects of variations in production protocols (e.g., storage of intermediates) have on vaccine stability. 5. Students will be able to identify safeguards pharmacists and other health care providers can take to ensure vaccines are stored properly. 6. Students will gain an understanding of the dangers of freezing as well as heat stress to vaccine stability. 7. Students will discuss vaccine excipients and adjuvants and evidence (or lack thereof) for their potential to cause adverse events in patient populations.
Week 5 In class: July 29	Haight Guest	<p><u>Pre-class assignment</u></p> <p>Exam 2 opens July 29 at 6pm. Closes Aug. 5 at 6pm. Covers week 3,4 material.</p>	<ol style="list-style-type: none"> 1. Students will be able to describe FDA regulations on immunizations, including the VAERS system. 2. Students will be able to describe why certain immunizations are given at certain ages. Students will be able to describe potential adverse effects of immunizations, and what populations should not receive a particular immunization and the reasoning why.
Week 6 In class:	Feltman Guest Speaker: Jessica Cataldi, MD	<p><u>Pre-class assignment</u></p>	<ol style="list-style-type: none"> 1. Students will identify reasons why individuals refuse immunizations. 2. Students will be able to describe best practices to counsel vaccine hesitant parents and patients.

August 5		Exam 2 opens July 30 at 6pm. Closes Aug. 6 at 6pm.	
Week 7 In class: Aug 12	James Scott Denney, PharmD	<u>Pre-class assignment</u>	<ol style="list-style-type: none"> 1. Students will be able to list vaccines given to animals for diseases that may also occur in humans. Students will be able to discuss the importance of animal immunizations for human health. 2. Student will be able to find resources to describe travel immunizations. 3.
Week 8 In class: Aug 19	James Special guest panel	Final exam-entire course content/standardized patient	