

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 12/3/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 12/3/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

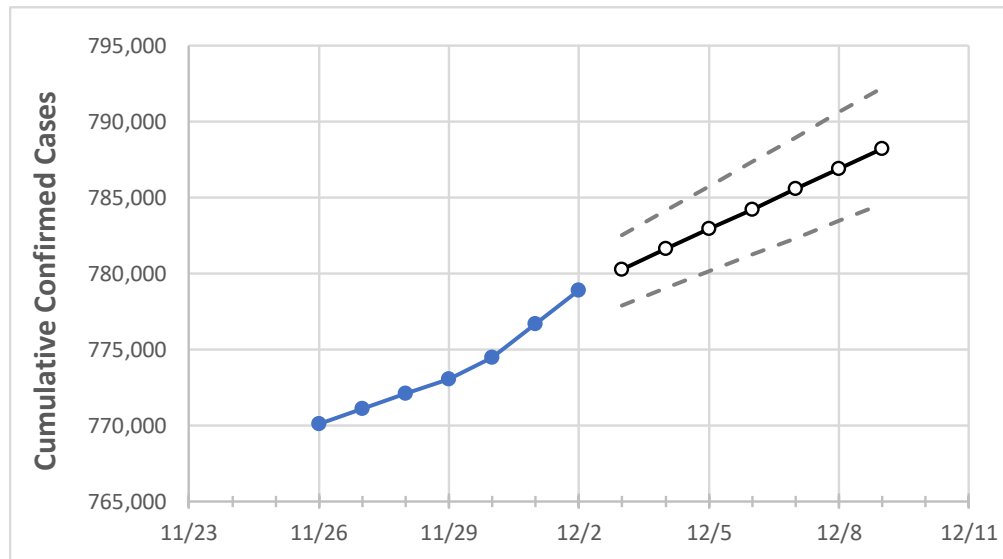
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Washington State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Washington	773,069	774,465	776,691	778,916	780,270	781,628	782,955	784,220	785,588	786,927	788,230

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Benton	32,238	32,293	32,330	32,367	32,393	32,420	32,446	32,471	32,497	32,525	32,550
Clark	44,887	45,118	45,281	45,443	45,542	45,636	45,732	45,835	45,929	46,027	46,130
Grant	16,935	16,944	16,981	17,018	17,033	17,049	17,064	17,080	17,095	17,110	17,124
Island	4,445	4,457	4,476	4,494	4,508	4,522	4,536	4,549	4,564	4,578	4,592
King	172,912	173,128	173,517	173,905	174,149	174,397	174,641	174,892	175,137	175,384	175,630
Kitsap	18,127	18,173	18,237	18,301	18,339	18,380	18,417	18,456	18,494	18,533	18,573
Pierce	98,694	98,822	99,214	99,605	99,789	99,968	100,146	100,330	100,510	100,696	100,868
Skagit	12,788	12,832	12,874	12,916	12,946	12,976	13,005	13,033	13,061	13,089	13,116
Snohomish	71,971	72,146	72,410	72,674	72,862	73,049	73,234	73,425	73,613	73,806	73,993
Spokane	77,191	77,283	77,505	77,726	77,836	77,955	78,067	78,175	78,286	78,399	78,506
Thurston	22,769	22,828	22,936	23,043	23,104	23,163	23,224	23,284	23,343	23,403	23,465
Whatcom	18,249	18,308	18,387	18,465	18,521	18,579	18,635	18,693	18,751	18,809	18,867
Yakima	45,198	45,240	45,308	45,375	45,418	45,461	45,502	45,545	45,587	45,628	45,670

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

Washington Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	11/29	11/30	12/1	12/2	12/4				12/6				12/8			
Benton	32,238	32,293	32,330	32,367	32,420	(6,484)	[1,556]	{778}	32,471	(6,494)	[1,559]	{779}	32,525	(6,505)	[1,561]	{781}
Clark	44,887	45,118	45,281	45,443	45,636	(9,127)	[2,191]	{1,095}	45,835	(9,167)	[2,200]	{1,100}	46,027	(9,205)	[2,209]	{1,105}
Grant	16,935	16,944	16,981	17,018	17,049	(3,410)	[818]	{409}	17,080	(3,416)	[820]	{410}	17,110	(3,422)	[821]	{411}
Island	4,445	4,457	4,476	4,494	4,522	(904)	[217]	{109}	4,549	(910)	[218]	{109}	4,578	(916)	[220]	{110}
King	172,912	173,128	173,517	173,905	174,397	(34,879)	[8,371]	{4,186}	174,892	(34,978)	[8,395]	{4,197}	175,384	(35,077)	[8,418]	{4,209}
Kitsap	18,127	18,173	18,237	18,301	18,380	(3,676)	[882]	{441}	18,456	(3,691)	[886]	{443}	18,533	(3,707)	[890]	{445}
Pierce	98,694	98,822	99,214	99,605	99,968	(19,994)	[4,798]	{2,399}	100,330	(20,066)	[4,816]	{2,408}	100,696	(20,139)	[4,833]	{2,417}
Skagit	12,788	12,832	12,874	12,916	12,976	(2,595)	[623]	{311}	13,033	(2,607)	[626]	{313}	13,089	(2,618)	[628]	{314}
Snohomish	71,971	72,146	72,410	72,674	73,049	(14,610)	[3,506]	{1,753}	73,425	(14,685)	[3,524]	{1,762}	73,806	(14,761)	[3,543]	{1,771}
Spokane	77,191	77,283	77,505	77,726	77,955	(15,591)	[3,742]	{1,871}	78,175	(15,635)	[3,752]	{1,876}	78,399	(15,680)	[3,763]	{1,882}
Thurston	22,769	22,828	22,936	23,043	23,163	(4,633)	[1,112]	{556}	23,284	(4,657)	[1,118]	{559}	23,403	(4,681)	[1,123]	{562}
Whatcom	18,249	18,308	18,387	18,465	18,579	(3,716)	[892]	{446}	18,693	(3,739)	[897]	{449}	18,809	(3,762)	[903]	{451}
Yakima	45,198	45,240	45,308	45,375	45,461	(9,092)	[2,182]	{1,091}	45,545	(9,109)	[2,186]	{1,093}	45,628	(9,126)	[2,190]	{1,095}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.