

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/6/21**

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 12/6/21 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.

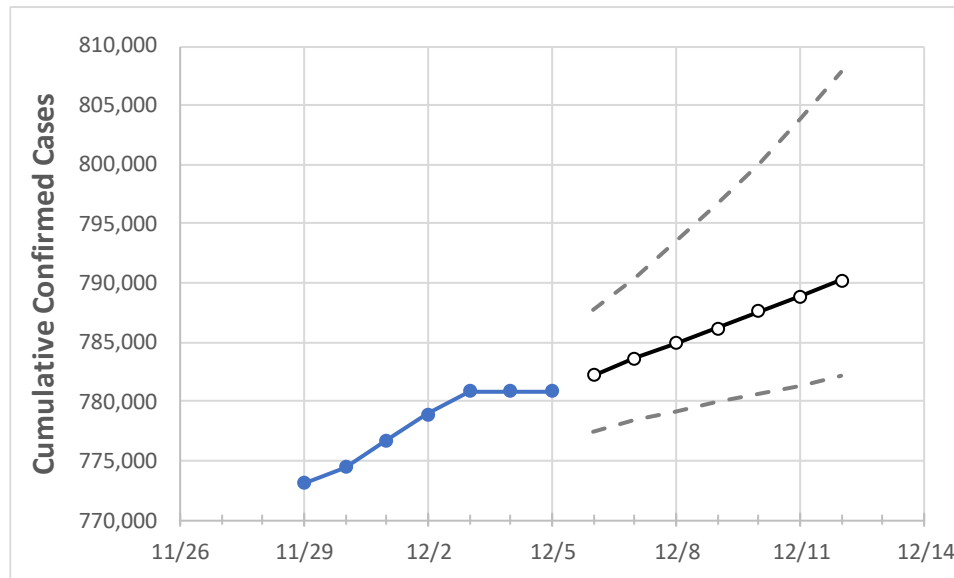
IEM's Modeling Lead

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:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
Washington	778,916	780,835	780,835	780,835	782,204	783,614	784,930	786,198	787,576	788,901	790,267

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:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
Benton	32,367	32,412	32,412	32,412	32,438	32,463	32,490	32,514	32,541	32,567	32,591
Clark	45,443	45,582	45,582	45,582	45,685	45,785	45,886	45,982	46,094	46,199	46,292
Grant	17,018	17,051	17,051	17,051	17,067	17,081	17,095	17,109	17,122	17,136	17,150
Island	4,494	4,503	4,503	4,503	4,514	4,524	4,535	4,545	4,556	4,565	4,575
King	173,905	174,326	174,326	174,326	174,667	175,041	175,435	175,831	176,257	176,688	177,186
Kitsap	18,301	18,359	18,359	18,359	18,392	18,423	18,455	18,486	18,519	18,551	18,583
Pierce	99,605	99,755	99,755	99,755	99,930	100,096	100,264	100,427	100,583	100,758	100,917
Skagit	12,916	12,954	12,954	12,954	12,981	13,008	13,036	13,062	13,088	13,113	13,138
Snohomish	72,674	73,013	73,013	73,013	73,319	73,657	74,016	74,405	74,810	75,243	75,703
Spokane	77,726	77,839	77,839	77,839	77,924	78,006	78,090	78,173	78,254	78,335	78,412
Thurston	23,043	23,137	23,137	23,137	23,185	23,233	23,277	23,322	23,367	23,414	23,459
Whatcom	18,465	18,539	18,539	18,539	18,605	18,674	18,741	18,810	18,881	18,952	19,024
Yakima	45,375	45,461	45,461	45,461	45,507	45,550	45,594	45,640	45,683	45,728	45,772

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:											
	12/2	12/3	12/4	12/5	12/7				12/9				12/11			
Benton	32,367	32,412	32,412	32,412	32,463	(6,493)	[1,558]	{779}	32,514	(6,503)	[1,561]	{780}	32,567	(6,513)	[1,563]	{782}
Clark	45,443	45,582	45,582	45,582	45,785	(9,157)	[2,198]	{1,099}	45,982	(9,196)	[2,207]	{1,104}	46,199	(9,240)	[2,218]	{1,109}
Grant	17,018	17,051	17,051	17,051	17,081	(3,416)	[820]	{410}	17,109	(3,422)	[821]	{411}	17,136	(3,427)	[823]	{411}
Island	4,494	4,503	4,503	4,503	4,524	(905)	[217]	{109}	4,545	(909)	[218]	{109}	4,565	(913)	[219]	{110}
King	173,905	174,326	174,326	174,326	175,041	(35,008)	[8,402]	{4,201}	175,831	(35,166)	[8,440]	{4,220}	176,688	(35,338)	[8,481]	{4,241}
Kitsap	18,301	18,359	18,359	18,359	18,423	(3,685)	[884]	{442}	18,486	(3,697)	[887]	{444}	18,551	(3,710)	[890]	{445}
Pierce	99,605	99,755	99,755	99,755	100,096	(20,019)	[4,805]	{2,402}	100,427	(20,085)	[4,820]	{2,410}	100,758	(20,152)	[4,836]	{2,418}
Skagit	12,916	12,954	12,954	12,954	13,008	(2,602)	[624]	{312}	13,062	(2,612)	[627]	{313}	13,113	(2,623)	[629]	{315}
Snohomish	72,674	73,013	73,013	73,013	73,657	(14,731)	[3,536]	{1,768}	74,405	(14,881)	[3,571]	{1,786}	75,243	(15,049)	[3,612]	{1,806}
Spokane	77,726	77,839	77,839	77,839	78,006	(15,601)	[3,744]	{1,872}	78,173	(15,635)	[3,752]	{1,876}	78,335	(15,667)	[3,760]	{1,880}
Thurston	23,043	23,137	23,137	23,137	23,233	(4,647)	[1,115]	{558}	23,322	(4,664)	[1,119]	{560}	23,414	(4,683)	[1,124]	{562}
Whatcom	18,465	18,539	18,539	18,539	18,674	(3,735)	[896]	{448}	18,810	(3,762)	[903]	{451}	18,952	(3,790)	[910]	{455}
Yakima	45,375	45,461	45,461	45,461	45,550	(9,110)	[2,186]	{1,093}	45,640	(9,128)	[2,191]	{1,095}	45,728	(9,146)	[2,195]	{1,097}

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.