

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/29/21**

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 12/29/21 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.

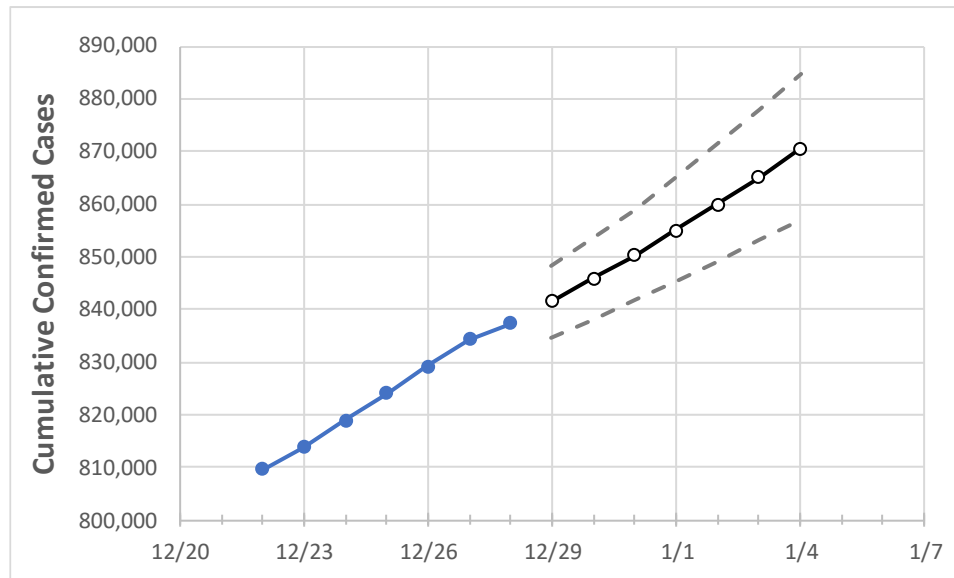
IEM's Modeling Lead

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:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Washington	823,988	829,112	834,235	837,378	841,531	845,827	850,353	855,101	859,973	865,111	870,495

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:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Benton	32,978	33,009	33,040	33,135	33,162	33,187	33,213	33,241	33,266	33,293	33,317
Clark	47,916	48,017	48,119	48,387	48,524	48,677	48,823	48,977	49,140	49,293	49,456
Grant	17,471	17,487	17,504	17,510	17,525	17,540	17,555	17,570	17,584	17,598	17,613
Island	4,781	4,797	4,812	4,830	4,846	4,862	4,878	4,894	4,911	4,929	4,945
King	189,343	191,778	194,213	195,696	198,021	200,555	203,228	206,133	209,277	212,759	216,348
Kitsap	19,444	19,561	19,678	19,740	19,827	19,915	20,007	20,103	20,204	20,304	20,409
Pierce	106,965	107,949	108,932	109,460	110,285	111,101	111,996	112,931	113,907	114,959	116,028
Skagit	13,688	13,736	13,784	13,820	13,866	13,914	13,962	14,010	14,060	14,111	14,163
Snohomish	77,556	78,071	78,585	78,915	79,298	79,689	80,077	80,513	80,944	81,384	81,837
Spokane	79,706	79,813	79,920	79,987	80,069	80,148	80,230	80,310	80,390	80,473	80,552
Thurston	25,237	25,499	25,761	25,864	26,077	26,305	26,541	26,779	27,045	27,311	27,599
Whatcom	19,804	19,899	19,994	20,057	20,131	20,209	20,285	20,365	20,448	20,529	20,613
Yakima	46,220	46,259	46,299	46,388	46,419	46,451	46,480	46,511	46,540	46,573	46,603

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:											
	12/25	12/26	12/27	12/28	12/30				1/1				1/3			
Benton	32,978	33,009	33,040	33,135	33,187	(6,637)	[1,593]	{796}	33,241	(6,648)	[1,596]	{798}	33,293	(6,659)	[1,598]	{799}
Clark	47,916	48,017	48,119	48,387	48,677	(9,735)	[2,336]	{1,168}	48,977	(9,795)	[2,351]	{1,175}	49,293	(9,859)	[2,366]	{1,183}
Grant	17,471	17,487	17,504	17,510	17,540	(3,508)	[842]	{421}	17,570	(3,514)	[843]	{422}	17,598	(3,520)	[845]	{422}
Island	4,781	4,797	4,812	4,830	4,862	(972)	[233]	{117}	4,894	(979)	[235]	{117}	4,929	(986)	[237]	{118}
King	189,343	191,778	194,213	195,696	200,555	(40,111)	[9,627]	{4,813}	206,133	(41,227)	[9,894]	{4,947}	212,759	(42,552)	[10,212]	{5,106}
Kitsap	19,444	19,561	19,678	19,740	19,915	(3,983)	[956]	{478}	20,103	(4,021)	[965]	{482}	20,304	(4,061)	[975]	{487}
Pierce	106,965	107,949	108,932	109,460	111,101	(22,220)	[5,333]	{2,666}	112,931	(22,586)	[5,421]	{2,710}	114,959	(22,992)	[5,518]	{2,759}
Skagit	13,688	13,736	13,784	13,820	13,914	(2,783)	[668]	{334}	14,010	(2,802)	[672]	{336}	14,111	(2,822)	[677]	{339}
Snohomish	77,556	78,071	78,585	78,915	79,689	(15,938)	[3,825]	{1,913}	80,513	(16,103)	[3,865]	{1,932}	81,384	(16,277)	[3,906]	{1,953}
Spokane	79,706	79,813	79,920	79,987	80,148	(16,030)	[3,847]	{1,924}	80,310	(16,062)	[3,855]	{1,927}	80,473	(16,095)	[3,863]	{1,931}
Thurston	25,237	25,499	25,761	25,864	26,305	(5,261)	[1,263]	{631}	26,779	(5,356)	[1,285]	{643}	27,311	(5,462)	[1,311]	{655}
Whatcom	19,804	19,899	19,994	20,057	20,209	(4,042)	[970]	{485}	20,365	(4,073)	[978]	{489}	20,529	(4,106)	[985]	{493}
Yakima	46,220	46,259	46,299	46,388	46,451	(9,290)	[2,230]	{1,115}	46,511	(9,302)	[2,233]	{1,116}	46,573	(9,315)	[2,236]	{1,118}

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.