

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

Date: 12/20/21

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 12/20/21 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.

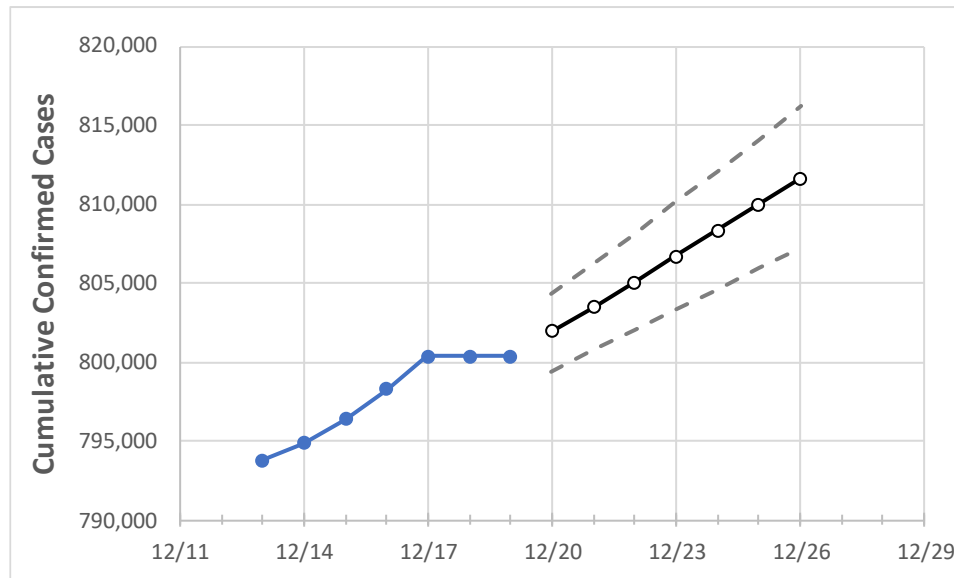
IEM's Modeling Lead

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:						
	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26
Washington	798,239	800,329	800,329	800,329	801,915	803,489	805,061	806,712	808,326	809,956	811,653

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:						
	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26
Benton	32,760	32,779	32,779	32,779	32,803	32,827	32,849	32,873	32,896	32,920	32,943
Clark	46,781	46,952	46,952	46,952	47,063	47,173	47,290	47,405	47,521	47,642	47,757
Grant	17,316	17,334	17,334	17,334	17,354	17,373	17,393	17,413	17,433	17,452	17,472
Island	4,653	4,667	4,667	4,667	4,678	4,690	4,702	4,713	4,725	4,737	4,748
King	178,403	179,140	179,140	179,140	179,600	180,076	180,542	181,053	181,581	182,109	182,628
Kitsap	18,844	18,910	18,910	18,910	18,956	19,000	19,047	19,094	19,140	19,188	19,237
Pierce	102,393	102,717	102,717	102,717	102,965	103,209	103,455	103,708	103,966	104,233	104,496
Skagit	13,295	13,339	13,339	13,339	13,365	13,391	13,417	13,443	13,468	13,494	13,520
Snohomish	75,005	75,154	75,154	75,154	75,308	75,460	75,612	75,765	75,915	76,071	76,220
Spokane	78,992	79,079	79,079	79,079	79,158	79,239	79,317	79,395	79,472	79,550	79,625
Thurston	23,900	23,991	23,991	23,991	24,058	24,129	24,200	24,271	24,345	24,416	24,489
Whatcom	19,203	19,281	19,281	19,281	19,336	19,391	19,443	19,496	19,551	19,606	19,660
Yakima	45,946	45,998	45,998	45,998	46,035	46,072	46,108	46,145	46,181	46,216	46,252

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:											
	12/16	12/17	12/18	12/19	12/21				12/23				12/25			
Benton	32,760	32,779	32,779	32,779	32,827	(6,565)	[1,576]	{788}	32,873	(6,575)	[1,578]	{789}	32,920	(6,584)	[1,580]	{790}
Clark	46,781	46,952	46,952	46,952	47,173	(9,435)	[2,264]	{1,132}	47,405	(9,481)	[2,275]	{1,138}	47,642	(9,528)	[2,287]	{1,143}
Grant	17,316	17,334	17,334	17,334	17,373	(3,475)	[834]	{417}	17,413	(3,483)	[836]	{418}	17,452	(3,490)	[838]	{419}
Island	4,653	4,667	4,667	4,667	4,690	(938)	[225]	{113}	4,713	(943)	[226]	{113}	4,737	(947)	[227]	{114}
King	178,403	179,140	179,140	179,140	180,076	(36,015)	[8,644]	{4,322}	181,053	(36,211)	[8,691]	{4,345}	182,109	(36,422)	[8,741]	{4,371}
Kitsap	18,844	18,910	18,910	18,910	19,000	(3,800)	[912]	{456}	19,094	(3,819)	[917]	{458}	19,188	(3,838)	[921]	{461}
Pierce	102,393	102,717	102,717	102,717	103,209	(20,642)	[4,954]	{2,477}	103,708	(20,742)	[4,978]	{2,489}	104,233	(20,847)	[5,003]	{2,502}
Skagit	13,295	13,339	13,339	13,339	13,391	(2,678)	[643]	{321}	13,443	(2,689)	[645]	{323}	13,494	(2,699)	[648]	{324}
Snohomish	75,005	75,154	75,154	75,154	75,460	(15,092)	[3,622]	{1,811}	75,765	(15,153)	[3,637]	{1,818}	76,071	(15,214)	[3,651]	{1,826}
Spokane	78,992	79,079	79,079	79,079	79,239	(15,848)	[3,803]	{1,902}	79,395	(15,879)	[3,811]	{1,905}	79,550	(15,910)	[3,818]	{1,909}
Thurston	23,900	23,991	23,991	23,991	24,129	(4,826)	[1,158]	{579}	24,271	(4,854)	[1,165]	{582}	24,416	(4,883)	[1,172]	{586}
Whatcom	19,203	19,281	19,281	19,281	19,391	(3,878)	[931]	{465}	19,496	(3,899)	[936]	{468}	19,606	(3,921)	[941]	{471}
Yakima	45,946	45,998	45,998	45,998	46,072	(9,214)	[2,211]	{1,106}	46,145	(9,229)	[2,215]	{1,107}	46,216	(9,243)	[2,218]	{1,109}

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.