

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

Date: 4/27/21

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 4/27/21 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.

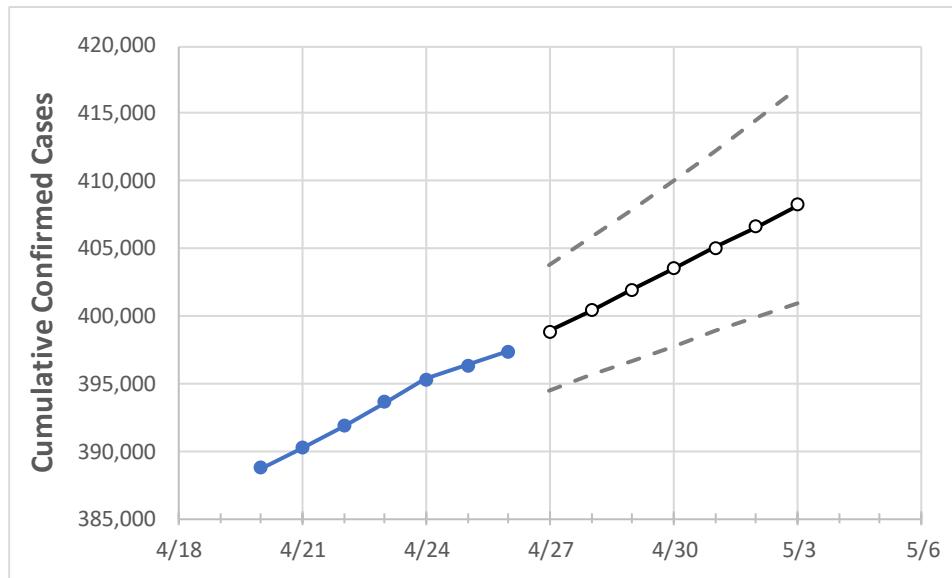
IEM's Modeling Lead

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Washington	393,594	395,312	396,365	397,417	398,878	400,377	401,928	403,490	405,031	406,637	408,246

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Benton	16,411	16,449	16,468	16,487	16,521	16,555	16,589	16,623	16,657	16,690	16,724
Clark	21,864	21,950	22,014	22,077	22,172	22,270	22,371	22,476	22,582	22,694	22,805
Grant	8,465	8,494	8,510	8,525	8,557	8,590	8,625	8,661	8,699	8,737	8,777
Island	1,585	1,601	1,607	1,612	1,621	1,630	1,640	1,650	1,661	1,672	1,684
King	99,085	99,551	99,914	100,276	100,693	101,113	101,545	101,969	102,400	102,845	103,294
Kitsap	7,293	7,330	7,369	7,407	7,454	7,502	7,551	7,601	7,651	7,703	7,755
Pierce	47,438	47,711	47,983	48,255	48,530	48,815	49,104	49,394	49,699	50,008	50,332
Skagit	5,189	5,211	5,236	5,260	5,289	5,320	5,351	5,383	5,416	5,450	5,485
Snohomish	35,020	35,133	35,224	35,314	35,460	35,604	35,748	35,898	36,044	36,201	36,350
Spokane	40,695	40,822	40,889	40,955	41,071	41,188	41,304	41,422	41,546	41,671	41,793
Thurston	8,617	8,681	8,706	8,731	8,779	8,830	8,881	8,934	8,989	9,044	9,103
Whatcom	8,176	8,207	8,237	8,266	8,306	8,344	8,384	8,423	8,465	8,507	8,550
Yakima	29,134	29,185	29,245	29,305	29,354	29,402	29,452	29,500	29,548	29,596	29,646

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:											
	4/23	4/24	4/25	4/26	4/28				4/30				5/2			
Benton	16,411	16,449	16,468	16,487	16,555	(3,311)	[795]	{397}	16,623	(3,325)	[798]	{399}	16,690	(3,338)	[801]	{401}
Clark	21,864	21,950	22,014	22,077	22,270	(4,454)	[1,069]	{534}	22,476	(4,495)	[1,079]	{539}	22,694	(4,539)	[1,089]	{545}
Grant	8,465	8,494	8,510	8,525	8,590	(1,718)	[412]	{206}	8,661	(1,732)	[416]	{208}	8,737	(1,747)	[419]	{210}
Island	1,585	1,601	1,607	1,612	1,630	(326)	[78]	{39}	1,650	(330)	[79]	{40}	1,672	(334)	[80]	{40}
King	99,085	99,551	99,914	100,276	101,113	(20,223)	[4,853]	{2,427}	101,969	(20,394)	[4,895]	{2,447}	102,845	(20,569)	[4,937]	{2,468}
Kitsap	7,293	7,330	7,369	7,407	7,502	(1,500)	[360]	{180}	7,601	(1,520)	[365]	{182}	7,703	(1,541)	[370]	{185}
Pierce	47,438	47,711	47,983	48,255	48,815	(9,763)	[2,343]	{1,172}	49,394	(9,879)	[2,371]	{1,185}	50,008	(10,002)	[2,400]	{1,200}
Skagit	5,189	5,211	5,236	5,260	5,320	(1,064)	[255]	{128}	5,383	(1,077)	[258]	{129}	5,450	(1,090)	[262]	{131}
Snohomish	35,020	35,133	35,224	35,314	35,604	(7,121)	[1,709]	{854}	35,898	(7,180)	[1,723]	{862}	36,201	(7,240)	[1,738]	{869}
Spokane	40,695	40,822	40,889	40,955	41,188	(8,238)	[1,977]	{989}	41,422	(8,284)	[1,988]	{994}	41,671	(8,334)	[2,000]	{1,000}
Thurston	8,617	8,681	8,706	8,731	8,830	(1,766)	[424]	{212}	8,934	(1,787)	[429]	{214}	9,044	(1,809)	[434]	{217}
Whatcom	8,176	8,207	8,237	8,266	8,344	(1,669)	[401]	{200}	8,423	(1,685)	[404]	{202}	8,507	(1,701)	[408]	{204}
Yakima	29,134	29,185	29,245	29,305	29,402	(5,880)	[1,411]	{706}	29,500	(5,900)	[1,416]	{708}	29,596	(5,919)	[1,421]	{710}

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.