

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

Date: 3/24/21

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 3/24/21 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.

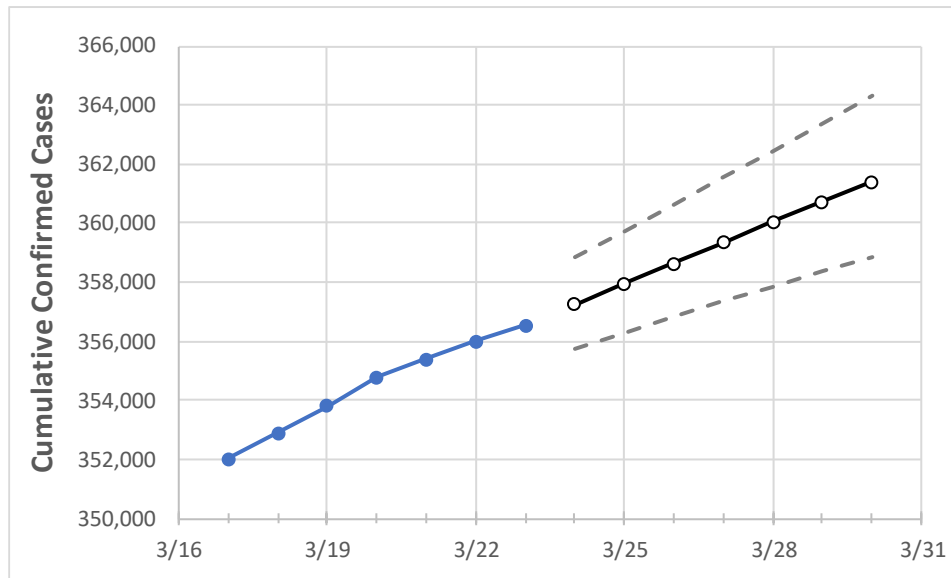
IEM's Modeling Lead

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Washington	354,782	355,384	355,986	356,536	357,245	357,943	358,641	359,339	360,032	360,723	361,406

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Benton	15,455	15,472	15,488	15,507	15,527	15,546	15,565	15,585	15,605	15,624	15,643
Clark	19,710	19,739	19,768	19,799	19,840	19,882	19,924	19,966	20,008	20,051	20,095
Grant	7,928	7,938	7,948	7,956	7,967	7,979	7,991	8,003	8,015	8,027	8,038
Island	1,445	1,448	1,450	1,453	1,456	1,460	1,463	1,466	1,469	1,472	1,474
King	87,626	87,824	88,021	88,112	88,317	88,516	88,720	88,923	89,126	89,332	89,546
Kitsap	6,148	6,161	6,174	6,187	6,207	6,227	6,249	6,271	6,293	6,316	6,338
Pierce	40,819	40,954	41,089	41,200	41,332	41,464	41,600	41,737	41,873	42,010	42,151
Skagit	4,644	4,651	4,658	4,662	4,667	4,672	4,677	4,682	4,686	4,690	4,695
Snohomish	31,258	31,312	31,365	31,409	31,457	31,504	31,552	31,598	31,644	31,692	31,738
Spokane	37,663	37,704	37,745	37,820	37,879	37,937	37,996	38,052	38,109	38,167	38,223
Thurston	7,567	7,584	7,600	7,618	7,633	7,648	7,663	7,678	7,692	7,706	7,720
Whatcom	7,278	7,291	7,303	7,331	7,349	7,366	7,384	7,401	7,418	7,433	7,449
Yakima	27,576	27,597	27,617	27,636	27,668	27,698	27,729	27,759	27,789	27,817	27,843

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:											
	3/20	3/21	3/22	3/23	3/25				3/27				3/29			
Benton	15,455	15,472	15,488	15,507	15,546	(3,109)	[746]	{373}	15,585	(3,117)	[748]	{374}	15,624	(3,125)	[750]	{375}
Clark	19,710	19,739	19,768	19,799	19,882	(3,976)	[954]	{477}	19,966	(3,993)	[958]	{479}	20,051	(4,010)	[962]	{481}
Grant	7,928	7,938	7,948	7,956	7,979	(1,596)	[383]	{192}	8,003	(1,601)	[384]	{192}	8,027	(1,605)	[385]	{193}
Island	1,445	1,448	1,450	1,453	1,460	(292)	[70]	{35}	1,466	(293)	[70]	{35}	1,472	(294)	[71]	{35}
King	87,626	87,824	88,021	88,112	88,516	(17,703)	[4,249]	{2,124}	88,923	(17,785)	[4,268]	{2,134}	89,332	(17,866)	[4,288]	{2,144}
Kitsap	6,148	6,161	6,174	6,187	6,227	(1,245)	[299]	{149}	6,271	(1,254)	[301]	{150}	6,316	(1,263)	[303]	{152}
Pierce	40,819	40,954	41,089	41,200	41,464	(8,293)	[1,990]	{995}	41,737	(8,347)	[2,003]	{1,002}	42,010	(8,402)	[2,016]	{1,008}
Skagit	4,644	4,651	4,658	4,662	4,672	(934)	[224]	{112}	4,682	(936)	[225]	{112}	4,690	(938)	[225]	{113}
Snohomish	31,258	31,312	31,365	31,409	31,504	(6,301)	[1,512]	{756}	31,598	(6,320)	[1,517]	{758}	31,692	(6,338)	[1,521]	{761}
Spokane	37,663	37,704	37,745	37,820	37,937	(7,587)	[1,821]	{910}	38,052	(7,610)	[1,826]	{913}	38,167	(7,633)	[1,832]	{916}
Thurston	7,567	7,584	7,600	7,618	7,648	(1,530)	[367]	{184}	7,678	(1,536)	[369]	{184}	7,706	(1,541)	[370]	{185}
Whatcom	7,278	7,291	7,303	7,331	7,366	(1,473)	[354]	{177}	7,401	(1,480)	[355]	{178}	7,433	(1,487)	[357]	{178}
Yakima	27,576	27,597	27,617	27,636	27,698	(5,540)	[1,330]	{665}	27,759	(5,552)	[1,332]	{666}	27,817	(5,563)	[1,335]	{668}

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.