

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

Date: 1/25/21

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 1/25/21 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.

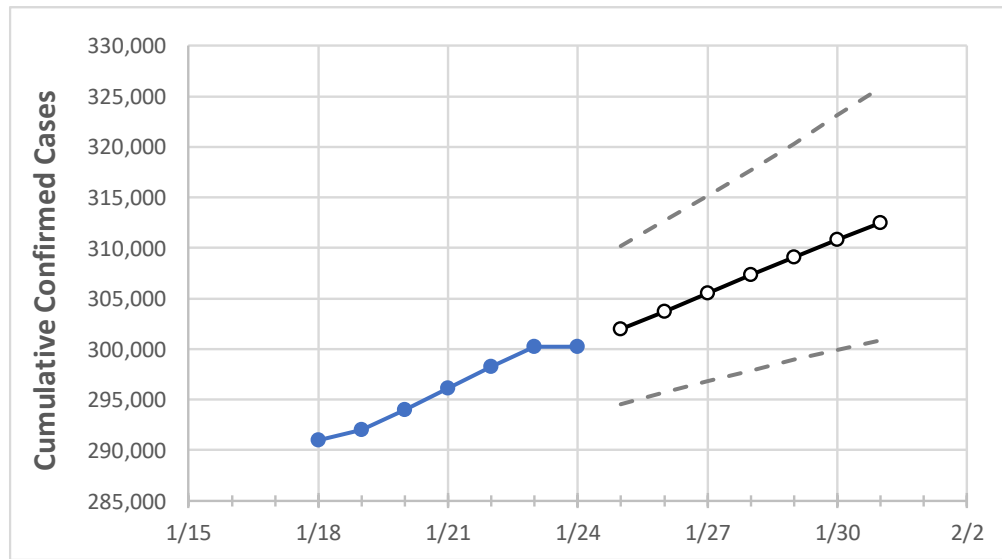
IEM's Modeling Lead

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Washington	296,087	298,249	300,198	300,198	301,982	303,742	305,563	307,307	309,103	310,787	312,497

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Benton	13,706	13,796	13,887	13,887	13,963	14,040	14,119	14,193	14,269	14,344	14,419
Clark	16,506	16,639	16,786	16,786	16,894	17,004	17,112	17,222	17,323	17,429	17,535
Grant	6,865	6,902	6,931	6,931	6,969	7,008	7,046	7,084	7,122	7,159	7,197
Island	1,122	1,125	1,140	1,140	1,148	1,156	1,164	1,171	1,179	1,187	1,195
King	74,500	74,951	75,433	75,433	75,833	76,225	76,620	76,994	77,368	77,752	78,113
Kitsap	4,846	4,893	4,924	4,924	4,963	5,001	5,040	5,076	5,113	5,152	5,189
Pierce	31,781	32,137	32,305	32,305	32,555	32,801	33,045	33,284	33,528	33,766	34,001
Skagit	3,875	3,898	3,945	3,945	3,976	4,008	4,040	4,071	4,102	4,135	4,169
Snohomish	26,625	26,773	26,925	26,925	27,054	27,174	27,294	27,411	27,527	27,637	27,737
Spokane	31,417	31,696	31,930	31,930	32,135	32,337	32,537	32,732	32,919	33,104	33,279
Thurston	5,959	6,017	6,059	6,059	6,110	6,163	6,216	6,268	6,323	6,376	6,431
Whatcom	5,027	5,142	5,203	5,203	5,288	5,377	5,463	5,554	5,651	5,750	5,851
Yakima	23,407	23,543	23,690	23,690	23,814	23,934	24,055	24,177	24,290	24,401	24,515

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:											
	1/21	1/22	1/23	1/24	1/26				1/28				1/30			
Benton	13,706	13,796	13,887	13,887	14,040	(2,808)	[674]	{337}	14,193	(2,839)	[681]	{341}	14,344	(2,869)	[689]	{344}
Clark	16,506	16,639	16,786	16,786	17,004	(3,401)	[816]	{408}	17,222	(3,444)	[827]	{413}	17,429	(3,486)	[837]	{418}
Grant	6,865	6,902	6,931	6,931	7,008	(1,402)	[336]	{168}	7,084	(1,417)	[340]	{170}	7,159	(1,432)	[344]	{172}
Island	1,122	1,125	1,140	1,140	1,156	(231)	[55]	{28}	1,171	(234)	[56]	{28}	1,187	(237)	[57]	{28}
King	74,500	74,951	75,433	75,433	76,225	(15,245)	[3,659]	{1,829}	76,994	(15,399)	[3,696]	{1,848}	77,752	(15,550)	[3,732]	{1,866}
Kitsap	4,846	4,893	4,924	4,924	5,001	(1,000)	[240]	{120}	5,076	(1,015)	[244]	{122}	5,152	(1,030)	[247]	{124}
Pierce	31,781	32,137	32,305	32,305	32,801	(6,560)	[1,574]	{787}	33,284	(6,657)	[1,598]	{799}	33,766	(6,753)	[1,621]	{810}
Skagit	3,875	3,898	3,945	3,945	4,008	(802)	[192]	{96}	4,071	(814)	[195]	{98}	4,135	(827)	[198]	{99}
Snohomish	26,625	26,773	26,925	26,925	27,174	(5,435)	[1,304]	{652}	27,411	(5,482)	[1,316]	{658}	27,637	(5,527)	[1,327]	{663}
Spokane	31,417	31,696	31,930	31,930	32,337	(6,467)	[1,552]	{776}	32,732	(6,546)	[1,571]	{786}	33,104	(6,621)	[1,589]	{794}
Thurston	5,959	6,017	6,059	6,059	6,163	(1,233)	[296]	{148}	6,268	(1,254)	[301]	{150}	6,376	(1,275)	[306]	{153}
Whatcom	5,027	5,142	5,203	5,203	5,377	(1,075)	[258]	{129}	5,554	(1,111)	[267]	{133}	5,750	(1,150)	[276]	{138}
Yakima	23,407	23,543	23,690	23,690	23,934	(4,787)	[1,149]	{574}	24,177	(4,835)	[1,160]	{580}	24,401	(4,880)	[1,171]	{586}

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.