

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/21/21**

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 1/21/21 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.

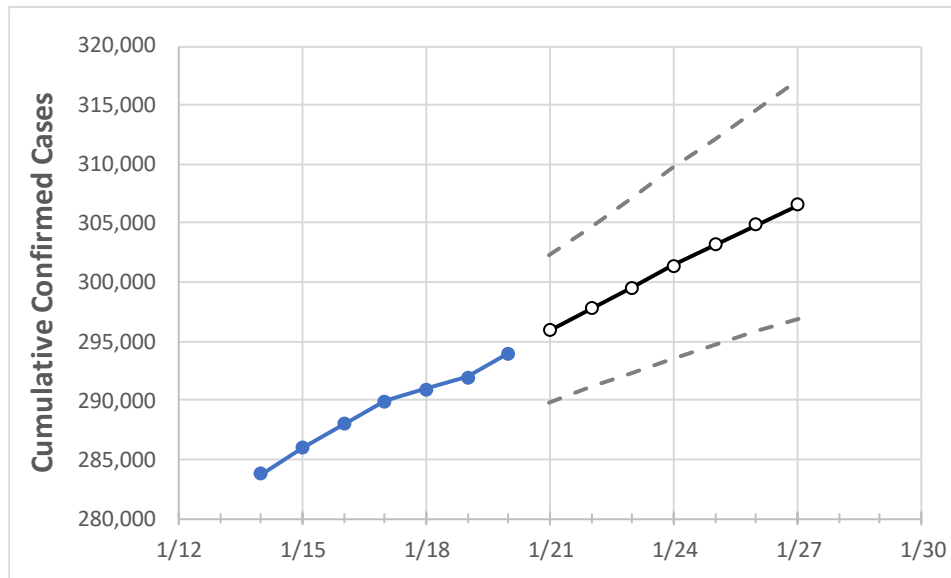
IEM's Modeling Lead

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Washington	289,939	290,964	291,989	294,017	295,880	297,779	299,590	301,400	303,159	304,846	306,565

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Benton	13,465	13,497	13,529	13,591	13,675	13,758	13,838	13,916	13,992	14,067	14,145
Clark	16,125	16,213	16,300	16,485	16,602	16,719	16,830	16,951	17,067	17,180	17,292
Grant	6,724	6,749	6,773	6,822	6,866	6,908	6,951	6,994	7,035	7,076	7,117
Island	1,087	1,091	1,095	1,107	1,114	1,121	1,128	1,136	1,142	1,149	1,156
King	73,015	73,341	73,667	74,077	74,542	75,002	75,467	75,928	76,372	76,807	77,240
Kitsap	4,701	4,725	4,748	4,801	4,843	4,884	4,924	4,964	5,006	5,045	5,085
Pierce	30,912	31,038	31,164	31,474	31,724	31,978	32,223	32,463	32,714	32,957	33,198
Skagit	3,801	3,807	3,812	3,837	3,866	3,897	3,926	3,956	3,985	4,015	4,044
Snohomish	26,267	26,315	26,363	26,498	26,647	26,792	26,926	27,054	27,181	27,303	27,417
Spokane	30,756	30,894	31,031	31,175	31,408	31,633	31,853	32,064	32,283	32,493	32,696
Thurston	5,760	5,783	5,805	5,863	5,909	5,959	6,008	6,057	6,104	6,152	6,199
Whatcom	4,885	4,890	4,894	4,954	5,047	5,141	5,242	5,344	5,448	5,559	5,665
Yakima	22,988	23,067	23,145	23,251	23,387	23,523	23,650	23,775	23,899	24,021	24,138

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:											
	1/17	1/18	1/19	1/20	1/22				1/24				1/26			
Benton	13,465	13,497	13,529	13,591	13,758	(2,752)	[660]	{330}	13,916	(2,783)	[668]	{334}	14,067	(2,813)	[675]	{338}
Clark	16,125	16,213	16,300	16,485	16,719	(3,344)	[802]	{401}	16,951	(3,390)	[814]	{407}	17,180	(3,436)	[825]	{412}
Grant	6,724	6,749	6,773	6,822	6,908	(1,382)	[332]	{166}	6,994	(1,399)	[336]	{168}	7,076	(1,415)	[340]	{170}
Island	1,087	1,091	1,095	1,107	1,121	(224)	[54]	{27}	1,136	(227)	[55]	{27}	1,149	(230)	[55]	{28}
King	73,015	73,341	73,667	74,077	75,002	(15,000)	[3,600]	{1,800}	75,928	(15,186)	[3,645]	{1,822}	76,807	(15,361)	[3,687]	{1,843}
Kitsap	4,701	4,725	4,748	4,801	4,884	(977)	[234]	{117}	4,964	(993)	[238]	{119}	5,045	(1,009)	[242]	{121}
Pierce	30,912	31,038	31,164	31,474	31,978	(6,396)	[1,535]	{767}	32,463	(6,493)	[1,558]	{779}	32,957	(6,591)	[1,582]	{791}
Skagit	3,801	3,807	3,812	3,837	3,897	(779)	[187]	{94}	3,956	(791)	[190]	{95}	4,015	(803)	[193]	{96}
Snohomish	26,267	26,315	26,363	26,498	26,792	(5,358)	[1,286]	{643}	27,054	(5,411)	[1,299]	{649}	27,303	(5,461)	[1,311]	{655}
Spokane	30,756	30,894	31,031	31,175	31,633	(6,327)	[1,518]	{759}	32,064	(6,413)	[1,539]	{770}	32,493	(6,499)	[1,560]	{780}
Thurston	5,760	5,783	5,805	5,863	5,959	(1,192)	[286]	{143}	6,057	(1,211)	[291]	{145}	6,152	(1,230)	[295]	{148}
Whatcom	4,885	4,890	4,894	4,954	5,141	(1,028)	[247]	{123}	5,344	(1,069)	[257]	{128}	5,559	(1,112)	[267]	{133}
Yakima	22,988	23,067	23,145	23,251	23,523	(4,705)	[1,129]	{565}	23,775	(4,755)	[1,141]	{571}	24,021	(4,804)	[1,153]	{577}

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.