

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

Date: 1/19/21

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 1/19/21 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.

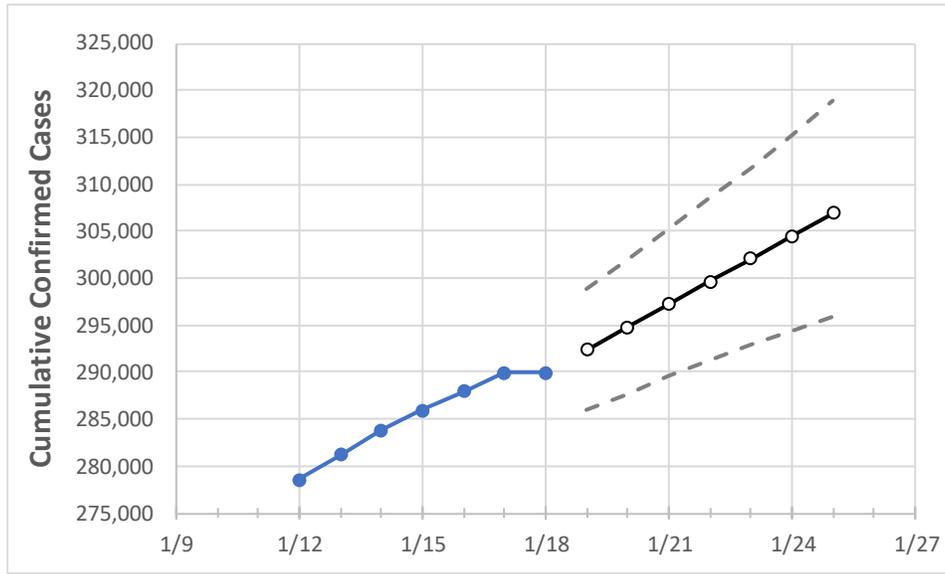
IEM's Modeling Lead

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Washington	285,970	287,955	289,939	289,939	292,387	294,781	297,231	299,655	302,076	304,513	306,906

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Benton	13,331	13,398	13,465	13,465	13,576	13,690	13,803	13,921	14,033	14,150	14,266
Clark	15,873	15,999	16,125	16,125	16,254	16,378	16,507	16,624	16,746	16,865	16,988
Grant	6,645	6,685	6,724	6,724	6,774	6,827	6,879	6,931	6,985	7,040	7,094
Island	1,074	1,081	1,087	1,087	1,095	1,103	1,111	1,118	1,125	1,133	1,141
King	72,253	72,634	73,015	73,015	73,550	74,082	74,625	75,166	75,702	76,249	76,775
Kitsap	4,641	4,671	4,701	4,701	4,752	4,801	4,850	4,900	4,950	4,999	5,047
Pierce	30,509	30,711	30,912	30,912	31,205	31,508	31,811	32,127	32,426	32,737	33,045
Skagit	3,732	3,767	3,801	3,801	3,846	3,892	3,940	3,990	4,041	4,094	4,149
Snohomish	25,869	26,068	26,267	26,267	26,476	26,678	26,880	27,078	27,267	27,461	27,651
Spokane	30,266	30,511	30,756	30,756	31,057	31,344	31,629	31,910	32,187	32,462	32,734
Thurston	5,664	5,712	5,760	5,760	5,821	5,881	5,944	6,006	6,067	6,128	6,190
Whatcom	4,667	4,776	4,885	4,885	5,029	5,177	5,337	5,503	5,680	5,870	6,068
Yakima	22,690	22,839	22,988	22,988	23,167	23,347	23,525	23,696	23,868	24,035	24,204

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:											
	1/15	1/16	1/17	1/18	1/20			1/22			1/24					
Benton	13,331	13,398	13,465	13,465	13,690	(2,738)	[657]	{329}	13,921	(2,784)	[668]	{334}	14,150	(2,830)	[679]	{340}
Clark	15,873	15,999	16,125	16,125	16,378	(3,276)	[786]	{393}	16,624	(3,325)	[798]	{399}	16,865	(3,373)	[810]	{405}
Grant	6,645	6,685	6,724	6,724	6,827	(1,365)	[328]	{164}	6,931	(1,386)	[333]	{166}	7,040	(1,408)	[338]	{169}
Island	1,074	1,081	1,087	1,087	1,103	(221)	[53]	{26}	1,118	(224)	[54]	{27}	1,133	(227)	[54]	{27}
King	72,253	72,634	73,015	73,015	74,082	(14,816)	[3,556]	{1,778}	75,166	(15,033)	[3,608]	{1,804}	76,249	(15,250)	[3,660]	{1,830}
Kitsap	4,641	4,671	4,701	4,701	4,801	(960)	[230]	{115}	4,900	(980)	[235]	{118}	4,999	(1,000)	[240]	{120}
Pierce	30,509	30,711	30,912	30,912	31,508	(6,302)	[1,512]	{756}	32,127	(6,425)	[1,542]	{771}	32,737	(6,547)	[1,571]	{786}
Skagit	3,732	3,767	3,801	3,801	3,892	(778)	[187]	{93}	3,990	(798)	[192]	{96}	4,094	(819)	[196]	{98}
Snohomish	25,869	26,068	26,267	26,267	26,678	(5,336)	[1,281]	{640}	27,078	(5,416)	[1,300]	{650}	27,461	(5,492)	[1,318]	{659}
Spokane	30,266	30,511	30,756	30,756	31,344	(6,269)	[1,505]	{752}	31,910	(6,382)	[1,532]	{766}	32,462	(6,492)	[1,558]	{779}
Thurston	5,664	5,712	5,760	5,760	5,881	(1,176)	[282]	{141}	6,006	(1,201)	[288]	{144}	6,128	(1,226)	[294]	{147}
Whatcom	4,667	4,776	4,885	4,885	5,177	(1,035)	[248]	{124}	5,503	(1,101)	[264]	{132}	5,870	(1,174)	[282]	{141}
Yakima	22,690	22,839	22,988	22,988	23,347	(4,669)	[1,121]	{560}	23,696	(4,739)	[1,137]	{569}	24,035	(4,807)	[1,154]	{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.